SCOPE OF WORK

The Scope of Work for the Phoenix West Extension AA/EIS identifies the project study area and will be used as the basis for the Alternatives Analysis and NEPA process.

PROJECT INITATION PACKAGE SEPTEMBER 2007

This document contains a project status update and provides early project background and information to the Federal Transit Administration for review and comment.

PURPOSE AND NEED NOVEMBER 2008

This document develops the supporting goals and objectives that assist in evaluating solutions to the transportation problems in the study area. The Purpose and Need examines travel patterns, population and employment growth trends, and transportation system capacity.

EVALUATION METHODOLOGY REPORT JULY 2008

This report presents the methodologies that will be used to evaluate each alternative that is part of the Alternatives Analysis process. This document provides an objective and structured approach to screening the wide range of alternatives identified for this project.

TIER 1 ANALYSIS REPORT NOVEMBER 2008

This report presents the evaluation and analysis of the initial set of Tier 1 Alternatives that are under consideration for high-capacity transit improvements in the I-10 Corridor.

Alignments carried forward **10**

TIER 2 EVALUATION REPORT MAY 2009

This report presents the results of the Phoenix West Alternatives Analysis/Environmental Impact Statement Study Tier 2 Evaluation and Screening. These alternatives were recommended for further evaluation based on the Tier 1 fatal flaw analysis. This evaluation will result in a narrowed list of alternatives that will be advanced into the Final Evaluation and Definition of Alternatives phases.

Alignments carried forward **6**

EVALUATION OF ALTERNATIVES REPORT JULY 2010

This report summarizes the LRT and BRT mode and the alignment alternatives carried through from the Tier 1 and Tier 2 evaluations and provides an evaluation of those alternatives. This report also describes the recommendations for the next steps as the project transitions into the NEPA environmental process.

Alignments carried forward **6**

FINAL DEFINITION OF ALTERNATIVES REPORT JUNE 2011

This report describes the proposed No-Build, Build LRT, and Build BRT alternatives for the Phoenix West Extension. Assumed service levels for the existing bus network, including bus route frequency modifications for the proposed HCT alternatives are also included.

Alignments carried forward **3**

MEMORANDUM OF AGREEMENT FALL 2011*

The purpose of this agreement is to establish terms of agreement between METRO, ADOT, MAG, and the City of Phoenix for purposes of developing multimodal transportation improvements projects along the southbound frontage road of Interstate 17 and along Interstate 10.

LOCALLY PREFERRED ALTERNATIVE REPORT SPRING 2012*

This document describes the full planning process that resulted in the identification of the Build Alternative recommended as a result of this study.

*To be provided at a later date.

EXHIBIT A TO CONTRACT

FUTURE EXTENSION – I-10 WEST

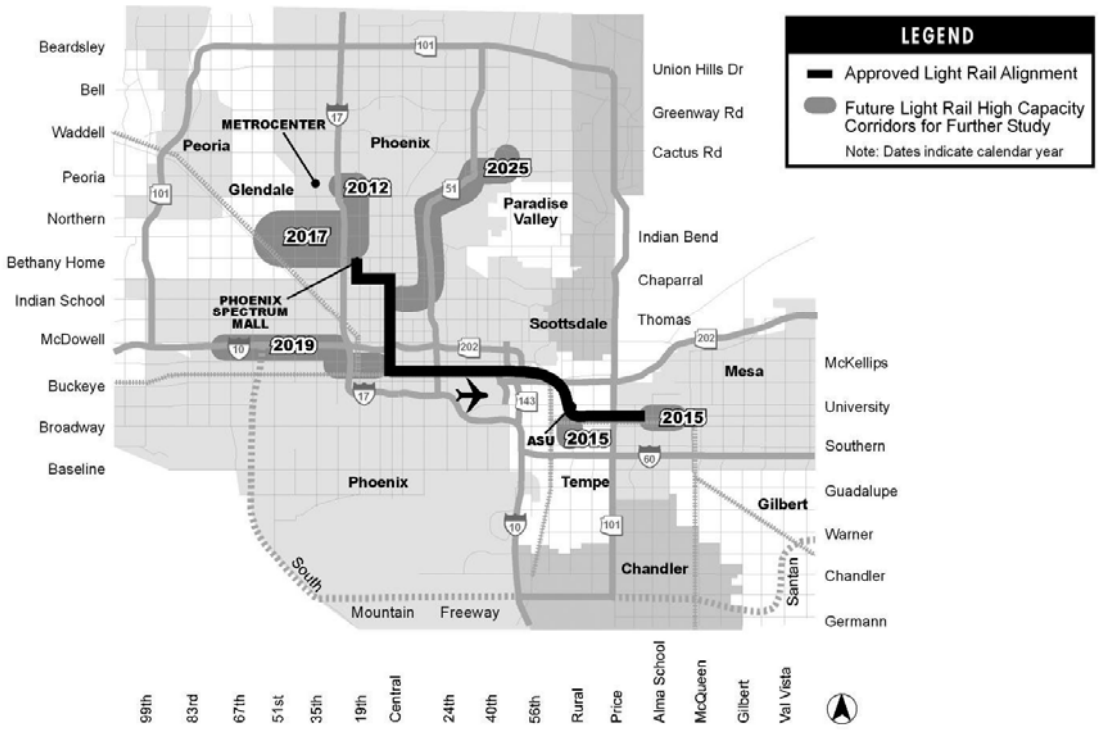
SCOPE OF SERVICES – Revised October 16, 2008

BACKGROUND

The Regional Transportation Plan (RTP), adopted by the Maricopa Association of Governments (MAG) and financed under the one-half cent sales tax extension, identifies 57-miles of major light rail/high capacity transit corridors to be implemented by 2026. Currently, the 20-mile starter segment is under construction and another 5-mile extension to serve the North Mountain Village Core area is in planning. Under the plan, additional service areas are identified: a 2.7-mile east extension into downtown Mesa; a 2-mile extension into south Tempe; a 5-mile extension west into Glendale; an 11-mile extension into west Phoenix; and a 12-mile extension into northeast Phoenix. Valley Metro Rail, Inc. (METRO) is the agency charged with planning, designing, building and operating the light rail transit (LRT) system in the area. This system is identified in Figure 1.

Figure 1

CORRIDOR EXTENSIONS



PURPOSE

This scope-of-work will apply to two future extensions as written in the Maricopa County Association of Government's (MAG's) Regional Transportation Plan (RTP) consisting of the I-10 West extension with a future option on the Glendale extension.

URS Corporation will provide the following services for the I-10 West extension; professional planning, conceptual design, and environmental services in accordance with the scope of services. A future option may be available on the Glendale extensions. Work for each extension will be issued on a "Task Order" basis, but will be in accordance with the following scope-of-services.

Most importantly, as a federally funded project it is a requirement to complete an Alternative Analysis pursuant to FTA 49 USC 5309(e)(1)(A) and DEIS and subsequent FEIS in accordance with the National Environmental Policy Act (NEPA) requirements.

The Consultant will initially provide, for the I-10 West extension, the Federal Transit Administration's (FTA) required Alternatives Analysis (AA), the Draft Environmental Impact Statement (DEIS), New Starts Report and the Economic Development Study / Station Area Market Analysis. The Consultant will be required to provide AA, DEIS and Market Analysis documents for the I-10 West extension according to the following tasks. At METRO's discretion, the Consultant may be asked to participate in further environmental work for their respective project, including the Federal Transit Administration's (FTA) required Final Environmental Impact Statement (FEIS) and Mitigation Monitoring Plan / Assessment / Revisions throughout the construction period.

The Consultant of the I-10 West extension may also be offered an option on the Glendale extension, to perform a similar scope of services including the AA, DEIS and Market Analysis documents with potential future options on the FEIS and Mitigation Monitoring Plan / Assessment / Revisions. The Glendale project will be initiated at different point in time in the future.

SCOPE OF SERVICES OUTLINE

Phase 1: Alternatives Analysis and Definition of Draft Environmental Impact Statement

Task 0: Project Management Plan (PMP)
Task 1: Public Involvement
Task 2: Review Existing Studies
Task 3: Scoping Process
Task 4: Purpose and Need and Evaluation Methodology
Task 5: Identification of Alternatives
Task 6: Evaluation of Alternatives

Phase 2A: Identification and Refinement of Preferred Alternative, Environmental Studies, and FTA Submittals

Task 7: Final Definition of Alternatives
Task 8: Cost Estimating
Task 9: Locally Preferred Alternative Adoption Process
Task 10: Environmental Scoping, Analysis and Evaluation
Task 11: Section 5309 New Starts Report
Task 12: Documentation to Enter New Starts Preliminary Engineering
Task 13: Project Management Plan for Preliminary Engineering
Task 14: Continuing Efforts

Phase 2B: LPA Refinement, Environmental Document and FTA Submittals

Task 15: Refining the Locally Preferred Alternative
Task 16: Update New Starts Report
Task 17: Completion of Draft Environmental Document
Task 18: Economic Development Study / Station Area Market Analysis

Phase 3: Final Environmental Assessment or Environmental Impact Statement

Task 19: Final Environmental Assessment or Impact Statement
Task 20: Record of Decision (or FONSI) Support
Task 21: Update New Starts Report

Phase 4: Mitigation Monitoring Plan Oversight During Final Design

Task 22: Mitigation Monitoring Plan Oversight During Final Design
Task 23: Update New Starts Report

SCOPE OF SERVICES STUDY AREA

The Scope of Services includes a study area map for the I-10 West extension and is defined as the "Project Study Area", as shown. The study area for the scope of services will be used as the basis for the Alternatives Analysis and the NEPA process. Lastly, the study area may be further refined during the project's scoping process and must be approved by the required stakeholders prior to initiating any work.

I-10 West

This extension's study area stretches westward from the Deck Park Tunnel area of Interstate 10 to State Route 101. The project study area would extend westward bounded by Thomas Road on the north, Buckeye Road on the south, State Route 101 (Agua Fria Freeway) on the west and Central Avenue on the east. In addition to the investigation of light rail transit and bus rapid transit, the consultant may be asked to investigate other technologies such as commuter rail transit (CRT).

PHASE 1: ALTERNATIVES ANALYSIS AND DEFINITION OF DRAFT ENVIRONMENTAL IMPACT STATEMENT

TASK 0: PROJECT MANAGEMENT PLAN (PMP)

Task Objective: The Consultant will prepare an internal PMP early in the process to guide the team through the entire AA / DEIS process. The PMP includes a refined scope of work, project schedule and staffing plan.

The PMP will identify internal quality control procedures to provide for excellence in technical analysis, accuracy of published findings, and readability of deliverables. The Consultant shall require quality control checks at several levels in order to produce products that are accurate, complete, and easy to read and understand, and to keep the project on-schedule and within budget. The Task Leader and Project Manager will review all products prepared or reviewed by persons responsible for individual subtasks before they are formally submitted to the Agency. The title page of each deliverable will contain the names of the principal authors and reviewers responsible for producing that report, to ensure that a quality product is prepared by professionals qualified in their respective fields.

TASK 1: PUBLIC INVOLVEMENT

Task Objective: The purpose of this task is to assist in the implementation of a Public Involvement Program (PIP) supportive of the National Environmental Policy Act (NEPA) process and local needs. The Public Involvement Program (PIP) will be prepared by the Consultant with review and comment by the Agency staff. The PIP will be implemented by Agency and Consultant staff and will relate to the alternatives analysis and environmental assessment tasks.

Task 1.1: Draft the Public Involvement Plan (PIP)

The Consultant will prepare the draft PIP with assistance and review by Agency staff. The PIP will relate to the alternatives analysis and environmental assessment tasks

consistent with the guidance contained in SAFETEA-LU. The primary components relate to the alternatives screening steps as follows:

- Project Scoping and initial outreach and involvement;
- Conceptual alternatives assessment and screening;
- Detailed alternatives assessment and screening; and,
- Final alternatives assessment and environmental impact evaluation.

The PIP will conform to the FTA requirements and will provide the framework for the establishment and the conduct of the review committees, agency coordination and general public outreach.

Task 1.2: Meetings and Hearings

The Consultant will be prepared for and attend public, city, agency and committee meetings throughout the three level screening processes in Phase 1. Consultant's activities may include preparation of graphics, maps, boards, preparation of meeting exhibits and handout materials, preparation of electronic graphics for use in PowerPoint presentations, interfacing with Agency Public Involvement staff, and providing additional staff support as needed for project-sponsored meetings and community events. A combination of general public, stakeholder and agency involvement meetings will be used.

In addition to the Public and Agency Scoping meetings, the Consultant will prepare for and attend up to ten (10) Public Meetings in Phase 1. Consistent with the provisions of SAFTEA-LU, the Public Meetings will precede key points in the AA process (scoping, corridor purpose and need, identification of detailed alternatives, identification of preferred alternative). The goal is to disseminate information to a broad audience, provide an opportunity for the public to "be heard," expose the public to others' views, and elicit input on corridor- wide questions of concern to VMR/FTA.

The Consultant will also prepare for and attend planning and progress meetings at the direction of METRO with key stakeholders. This will consist of meetings with the following:

- Village Planning Committees
- Citizen Transit Commission
- City of Phoenix Planning and City Council subcommittees and individual members.
- MAG review committee
- METRO RSWG, RMC and Board

Task 1.3: Communications and Public Outreach

The Consultant will provide graphic support and project information to Agency staff to assist in the preparation of publications, news releases, periodic newsletters, fact sheets and brochures that will be distributed to the public by Agency staff.

Task 1.4: West I-10 Corridor Project Coordination

Consultant will work with other projects that are now or soon will be on-going in the West I-10 Corridor. At the direction of the lead agencies, a coordinated public information and outreach program will be initiated. These projects consist of:

- I-10 West Extension-METRO
- Loop 202/South Mountain – ADOT
- I-10 Widening west of Loop 101 – ADOT
- Commuter Rail Strategic Plan – MAG
- I-10 Widening east of L101 to I-17 - ADOT

TASK 2: REVIEW EXISTING STUDIES

Task Objective: The purpose of this task is to gather and review any applicable existing plans and / or studies relating to the I-10 West extension. The review of these documents should be used as a resource for the completion of an Alternatives Analysis pursuant to FTA 49 USC 5309(e)(1)(A), DEIS and New Starts, in accordance with NEPA requirements. Additional information regarding FTA New Starts and NEPA guidance can be found at the FTA web site www.fta.dot.gov under New Starts. The Consultant should be familiar with the following documents, and others, pertinent to the corridor under evaluation:

- MAG Commuter Rail Study
- MAG Fixed Guideway System Study
- MAG High Capacity Transit Plan
- MAG Long Range Transportation Plan
- MAG Park-and-Ride Study
- ADOT Freeway Expansion Plans: I-10 & Loop 202 (I-10 West)
- Central Phoenix/East Valley DEIS
- Central Phoenix/East Valley FEIS
- Central Phoenix/East Valley New Starts Report
- Central Phoenix/East Valley Project Management Plan
- Phoenix General Plans
- Phoenix Street Classification Map
- Phoenix Transportation Plans

- RPTA Freeway Express Bus/BRT Operating Plan (I-10 West)
- Others, as appropriate and applicable
- METRO Tier 2 Evaluation of I-10 West Alternative Alignments and Final Recommendation
- Papago Intermodal Transfer Station Feasibility Study

The Consultant will rely on the Agency and City of Phoenix to obtain and furnish copies of those studies to be reviewed that the Consultant does not already possess. The Consultant will provide survey control and aerial mapping for the project in this task. Design mapping will be provided in Task 5.1 as an option.

TASK 3: SCOPING PROCESS

Task Objective: The purpose of this task is to develop and shape the scope of the AA / DEIS for each extension by establishing the work that will be done as part of the environmental process, seek input on the local goals and objectives for the project study area, and initiate public participation for the environmental process. The scoping process will also initiate the formal environmental process as required by NEPA.

Project Study Area: The initial Project Study Area for the I-10 West extension is identified in Appendix B.

Task 3.1: Notice of Intent (NOI)

The Consultant will prepare a Notice of Intent (NOI) to prepare an EIS, as required under NEPA, to file for publication in the Federal Register. The NOI should include the following sections:

- Summary of the Project and EIS Process
- Scoping Process
- Description of the Project Area and Need
- Alternatives to be Studied
- Probable Effects and Potential Impacts for Analysis
- FTA / FHWA Procedures

Task 3.2: Scoping Information Booklet

The Consultant will prepare a scoping information booklet in English and Spanish for distribution to the public prior to the scoping meeting(s). The booklet will contain information regarding the background, purpose, and goals and objectives of each of the extensions AA / DEIS. A general discussion of each alternative will be provided with maps and sketches. A schedule of scoping meeting(s) will also be included.

Task 3.3: Scoping Meetings

The Consultant will assist Agency staff in facilitating public scoping meeting(s) for the DEIS. The Consultant will record the scoping meeting(s) and provide a written transcript of all proceedings to the Agency. The Consultant will prepare and distribute public notices for the meeting(s), prepare briefing materials and graphic presentations, prepare and distribute meeting agenda(s) and prepare a summary report of the scoping meeting(s). Spanish translation interpreters should be available as needed. Agency staff will assist with the Scoping Meetings as needed. The Consultant will prepare for and attend two public scoping meetings and one agency scoping meeting.

Task 3.4: Scoping Report

After the NEPA scoping meeting and activities, the Consultant, with Agency staff assistance, will develop a scoping report for FTA review that identifies the range of alternatives and major issues to be addressed throughout the EIS process. The scoping report will also include a discussion of the alternatives that have been proposed and the reasons for retaining and/or eliminating each of the alternatives.

TASK 4: PURPOSE & NEED EVALUATION METHODOLOGY

Task Objective: The purpose of this task is to develop a clear Purpose and Need statement to help guide each of the extension's planning process. Supporting Goals and Objectives should also be developed to assist in developing and evaluating solutions to the transportation problems in the project study area. Finally, clear evaluation criteria and a Methodology Report will be developed to evaluate various alternatives against the Purpose and Need and the Goals and Objectives.

Task 4.1: Develop Purpose and Need

The Consultant will develop the Purpose and Need for the project based on the transportation problems to be addressed in the AA / DEIS. The Purpose and Need will examine travel patterns, population and employment growth trends, transportation system capacity for both roads and transit, and should identify the transportation problem(s) based upon a multi-layered analysis of performance deficiencies in the project study area that resulted in the need to consider transportation alternatives. Travel demand data will be assessed in terms of trip movements, level of service, transit and auto travel times and other key parameters that will be defined. Input received from the scoping process will also be used to develop the Purpose and Need. This will form the basis for the first chapter of the DEIS "Purpose and Need."

Task 4.2: Develop Draft Goals and Objectives

The Consultant will develop quantitative Goals and Objectives for the study process and the various alternatives. The Goals and Objectives should be developed in a manner that permits the comparative evaluation of the alternatives against the Goals and Objectives. Additionally, through input received from the scoping process, local Goals and Objectives should be identified for the study corridor against which to assess the alternatives.

Task 4.3: Develop Evaluation Criteria and Analysis Methodology Report

The Consultant will develop evaluation criteria and an Analysis Methodology Report to be used in evaluating the various alternatives for the study corridor. The evaluation criteria should enable a valid measurement of the alternatives and the determination of a locally preferred alternative. The evaluation criteria may be quantitative and qualitative, yet should contain measures that enable the quantitative assessment of an alternative's ability to address the identified transportation problem in the study area. The Analysis Methodology Report will include applicable input received during the scoping process.

Other evaluation criteria that will be used to evaluate possible alternatives will include, but not be limited to:

- Ridership
- Traffic impact
- Capital costs
- Operating costs
- Cost effectiveness
- Economic development potential
- Environmental impacts (qualitative)
- Speed
- Connectivity
- Compatibility with community plans

To assess capital costs for each alternative/technology, the Consultant will utilize a capital cost spreadsheet that calculates capital costs by mode, based on quantities and technology definition.

The Consultant will include all documentation necessary to fulfill FTA project evaluation requirements pursuant to AA. The Analysis Methodology Report will be submitted to the FTA for review.

Task 4.4: Travel Demand Methodology Report

The Consultant will prepare a Travel Demand Methodology Report that clearly documents the model parameters and assumptions made for coding each alternative into the network, using either the TransCAD or EMME/2 software used by the Maricopa Association of Governments (MAG). The report will include a discussion of the no-build network, the Baseline Alternative, and the build alternative networks and associated feeder bus service, as well as a description of how the model will be used to test the performance of the various alternatives for travel demand, travel time savings, and other characteristics that are used in the evaluation of alternatives. The Travel Demand Methodology Report will be submitted to FTA for review.

The Consultant will work closely with MAG staff to ensure the Travel Demand Methodology Report and subsequent model run is executed correctly, and the network coding is done consistently with the model design. The socioeconomic databases to be used for the study will be identified. A sensitivity analysis will be conducted to review the previous 2030 MAG socioeconomic data and the new MAG accepted 2035 socioeconomic data. Projected changes in land use and socioeconomic data will impact ridership potential. Up to five model runs will be completed by the Consultant.

TASK 5: IDENTIFICATION OF ALTERNATIVES

Task Objective: The purpose of this task is to identify a reasonable set of alternatives within the Project Study Area based upon the Purpose and Need, goals and objectives, and community input from the scoping process. Once these alternatives have been identified, a more detailed definition of each alternative will be developed and evaluated.

Study Area: The study area for this Task and all remaining Tasks is identified in the map for the I-10 West extension.

Task 5.1: Data Collection

The Consultant will collect all appropriate data within the Project Study Area to assist in evaluating realistic alternatives. This may include demographic information, right-of-way, utilities, land use and zoning, traffic, transit ridership, major destinations, projected growth, etc. This task will also include the preparation of appropriate base maps to assist in the alignment identification, definition, and evaluation process and, as an option that METRO may exercise, detailed planimetric mapping once the preferred alignment is better defined.

Task 5.2: Definition of Basic Alternatives Proposed for Evaluation

The Consultant will develop a reasonable set of alternatives to be considered in the AA / DEIS process, to include a no-build alternative, a Baseline Alternative, Express bus in HOV lanes, a fixed guideway bus rapid transit (BRT) alternative and light rail build alternative(s). Only a No Build and one Build alternative will be carried into the DEIS.

The alternatives that will be evaluated in the AA are defined as follows:

1. **No-Build**: Existing transit plans and programmed improvements with the exception of light rail transit extensions to the CP / EV LRT project.
2. **Baseline Alternative**: All reasonable cost-effective transit service improvements within each of the extensions short of an investment in a New Starts project. Pursuant to New Starts requirements, the Baseline Alternative for New Starts reporting requirements.
3. **Bus Rapid Transit (BRT):** Programmed expansion in the level of bus service, and fixed guideway BRT.
4. **Light Rail Transit (LRT At Grade):** Programmed expansion in the level of bus service, and at grade LRT.

5. **Express Bus in HOV lanes:** Programmed expansion in the level of bus service in joint use HOV lanes.
6. **Other Technologies:** Programmed expansion that may include a variety of other technologies such as Commuter Rail Transit (CRT) or up to three other technologies identified in the alternatives analysis and community scoping process.

The Consultant will identify specific fixed guideway BRT and LRT alignment alternatives within the study area for the I-10 extension; the project process may also identify CRT as a technology alternative with the I-10 extension. Alignment and technology alternatives may include:

- I-10 West
  - I-10 West Freeway west of 27th Avenue
  - Plus options to connect to Central Phoenix / East Valley LRT line in CBD
    - I-10 West Freeway into Deck Park tunnel
    - I-10 West Freeway to 17th Avenue/ 15th Avenue
    - Washington/Jefferson and/or Adams options

Additional alignment alternatives or sub-alternatives may result from the alignment identification and/or the public involvement and scoping process.

Task 5.3: Conceptual Definition of Alternatives

The Consultant will prepare a conceptual level definition for each alternative. This definition will include, at a minimum, alignment maps, station locations, park-and-ride locations and capacity, inter-modal transfer stations including an end-of-line station and right-of-way requirements and impacts. Identification of major underground and overhead utilities will be initiated during this task to avoid potential problems later on that may be associated with some alternatives due to the need to relocate major utilities.

Task 5.4: Downtown Phoenix Location Concepts

The Consultant will define an area in Central Phoenix that includes the Downtown Phoenix/Governmental Mall and extends west to 27th Avenue for a more focused alternatives planning process. The objectives of this process consist of:

- Develop alignment/station location alternatives to relate to:
  - Community objectives
  - Trip generators
  - Sensitive resources
  - Physical constraints

- Relate concepts to options to connect to Central Phoenix/East Valley LRT line
- Develop drawings and summaries of conceptual alignment and station locations for public and agency review.

The Consultant will conduct an evaluation of the sub-area to define up to three conceptual alternatives and three sub-alternatives (total of six options) for further study. The alternatives will reflect the "reasonable range" of options to connect to the west location options to include:

- Direct, rapid transit connection
- Direct connection with more frequent access points
- Collection/distribution function before linking west

As part of this analysis, the Consultant will conduct an evaluation of the I-10 Bus Transit Station at the Deck Park. This evaluation will consider suitability of the station for LRT, BRT or other transit use.

The Consultant will prepare a Sub-Area Planning Results technical report for review and distribution. Remaining alternatives will be advanced to the next screening level. The consulting team will prepare for and conduct up to five public meetings/workshops to conduct the sub-area planning study.

Task 5.5: I-10 Freeway Widening Joint Project Feasibility Study

The Consultant will form a sub-area planning team to work with the ADOT I-10 Widening and Loop 202/South Mountain connection projects to assess the feasibility of a joint project and a technical assessment of how transit alternatives fit within the freeway right-of-way with the ADOT improvements. The feasibility assessment will consider:

- Separate implementation
- Joint implementation
- Technical assessment

The Consultant will assess construction costs and savings, time-savings, and coordination items that need to be resolved. Transit alternatives will consider an envelope for LRT/BRT and Express bus in the median.

The Consultant will prepare a technical report to document the comparisons and trade-offs for review by METRO, ADOT and FHWA/FTA. A maximum of five meetings will be conducted.

Task 5.6: Initial Screening of Alternatives

The Consultant will screen the various technology alternatives and alignments identified in this Task. The initial screening should consider how well the various alternatives meet the goals and objectives of the study area and how they compare against evaluation criteria for addressing the purpose and need. The Consultant will work with agencies

and stakeholders to develop recommendations for various alternatives to be carried forward for a more detailed definition and evaluation.

Task 5.7: Funding Feasibility for Conceptual Alternatives

The Consultant will conduct an assessment of FTA funding feasibility for up to three representative conceptual alternatives. The feasibility assessment will consist of:

- Conceptual-level capital and operating costs
- Ridership response range using the MAG forecasts and sketch planning to generate estimates
- Qualitative assessment of land use potentials
- Comparison of the three scenarios to assess feasibility of FTA funding
- Cost Effectiveness

Results will be documented by the Consultant in a Technical Memorandum.

TASK 6: EVALUATION OF ALTERNATIVES

Task Objective: The purpose of this task is to evaluate the various alternatives carried forward from Task 5 and establish a final set of alternative(s) to be carried forward through the NEPA process.

Task 6.1: Definition of Alternatives

The Consultant will define in detail the alternatives and alignments recommended to be carried forward for further analysis. Up to four primary alignment/technology alternatives with up to a total of four sub-alternatives (total of eight options) will be considered.

This definition will include, at a minimum, 1" - 200' alignment plans and cross sections, right-of-way requirements and impacts, station locations, storage and maintenance facility site alternatives and/or expansion/upgrades, park-and-ride locations and capacity, intermodal transfer stations, end-of-line station location and size, feeder bus service, potential minimum operable segments, and operating plans for each alternative.

The operating plans should identify the number of vehicles, headway frequency, fare structure, and line-haul capacity for each alternative, including the no-build and Baseline Alternatives. Capital and operating cost estimates should be provided for each alternative. The detailed definition of alternatives should be sufficient to allow for a comparative analysis of the costs and transportation benefits of the various alternatives as well as the impacts of the alternatives on the human and natural environment.

Task 6.2: Preliminary Environmental Screening

Information from Task 9.2: Environmental Technical Reports will be used to assist with the screening of the alternatives. A matrix of critical environmental considerations and

resource areas will be developed for each of the remaining alternatives. The results will be used to assist with identification of the preferred alternative.

Task 6.3: Definition of Alternatives Report

The Consultant will prepare a Definition of Alternatives Report that will summarize the detailed definition of alternatives provided in Subtask 6.1. FTA will review the Definition of Alternatives Report for the selection of a Baseline Alternative. The intent will be to involve FTA in the selection of the Baseline Alternative.

Task 6.4: Travel Demand Forecasting

The Consultant will provide travel demand forecasting services for each alternative described in the Travel Demand Methodology Report. The Consultant will use either the EMME/2 or TransCAD model used by MAG to perform the model runs. It is imperative that the Consultant understands the travel forecasting system used by MAG.

In order to fulfill the modeling requirements for this project, activities required include, but are not limited to:

- Testing Park-and-Ride location;
- Testing station use activities by land use and mode of access;
- Analyzing park and ride usage;
- Interpreting bus/rail operations for modeling;
- Coding bus/rail networks and associated highway networks;
- Providing travel time analyses;
- Performing select link analysis;
- Sensitivity analysis of model input data;
- Risk Analyses for land use and pricing assumptions
- Special Event Model runs
- Reasonableness of model runs; and
- Use the FTA program ‘SUMMIT”

The Consultant will code and run up to 10 model runs to evaluate the alternatives.

METRO will provide the Bus Book, a copy of the Life Cycle Plan and any operating plans generated by METRO or RPTA use in the transit networks.

Task 6.5: Final Alternative Recommendations

The Consultant will evaluate each alternative based on the Analysis Methodology Report. The top performing alternatives will also be modeled and assessed against the Section 5309 New Starts criteria to help assess the likelihood of securing a “MEDIUM” or higher rating from FTA. The Consultant will run up to 5 model runs to evaluate the

alternatives. Based on the evaluation, the Consultant will provide recommendations on the final set of alternative(s) to carry forward into the final definition of alternatives and the NEPA process. Consultant will strive to eliminate all other alternatives during this task with the exception of the "preferred alternative" with possible design options and a No-Build Alternative.

Task 6.7: Federal Funding Feasibility Assessment

Results of these subtasks will be summarized and the information from Task 5.7 will be updated to assess the feasibility of FTA New Starts funding. Depending upon the outcome of this subtask, additional tasks may not be authorized.

Task 6.8: Response to Federal Transit Administration Comments, Special Requests and Local Community Issues

The Consultant Team will respond to comments, special requests and local community issues that arise that were unforeseen during the development of the scope of work. The unforeseen items will be identified by METRO or the Consultant and a formal scope and estimate will be prepared to address the item. The METRO Project Manager will authorize the unforeseen item prior to any work being undertaken by the Consultant. The Consultant will account for the individual unforeseen items and will keep track of the progress and deliverables to satisfy each separate authorization.

PHASE 1 MAJOR MILESTONE DELIVERABLES

Below is an inclusive list of major milestone deliverables for the Phase 1 Scope of Services. In all cases, except monthly status reports, the Consultant will deliver two draft for each final deliverable listed below. In addition, except where noted, the Consultant will deliver two draft copies and five final copies. In addition, the Consultant will deliver an electronic copy in .pdf format.

- Revised Scope and Schedule (2)
- Status Reports
- Public Involvement Plan (2)
- Notice of Intent to Prepare an EIS (2)
- Scoping Information Booklet (2) (200 final copies)
- Scoping Notices Preparation and Distribution (2)
- Summary of Scoping Meetings Report (2)
- Purpose and Need Statement with Goals and Objectives (2)
- Evaluation Criteria and Analysis Methodology Report (2)
- Travel Demand Methodology Report (2)
- Identification of Alternatives Report (2)
- I-10 Joint Project Feasibility Study and Technical Report (2)

- Federal Funding Feasibility Assessment Report (2)
- Summary Report Technical Analysis and Funding Feasibility (2)
- Public Meeting Preparation and Attendance (10 meetings)
- Aerial mapping for corridor at 1"=400' scale.
- Option: Detailed planimetric mapping for engineering design in AutoCADD and MicroStation.

PHASE 2A: IDENTIFICATION AND REFINEMENT OF PREFERRED ALTERNATIVE, ENVIRONMENTAL STUDIES, AND FTA SUBMITTALS

TASK 7: FINAL DEFINITION OF ALTERNATIVES

Task Objective: The Consultant will provide a detailed definition of the final alternative to evaluate for the AA / DEIS process. The Project Limits will be from First Street/Central Avenue to 99th Avenue at I-10. In accordance with the results in Phase 1 with Phoenix City Council approval, the alignment for all Build alternatives west of I-17 will be within the right-of-way of the I-10 freeway except that alignment extensions from 79th/I-10 west to SR-101 and north to Thomas Road will be considered if these are part of the remaining alternatives from Phase 1.

The work in Phase 1 has included development of a working relationship with ADOT and FHWA to jointly plan and design improvements to I-10 for high capacity transit and for highway elements. The Consultant and METRO have been coordinating with the aggressive expansion program that is being conducted by ADOT to ensure that no transit options are precluded.

The DEA or DEIS will consider up to four (4) Final Alternatives that are produced by the Phase 1 work on the Locally Preferred Alternative. These consist of the No Action, TSM/Baseline, and one Build Alternative (with up to 2 alignment location variations) using either a BRT or LRT technology.

As discussed in Task 10, Consultant's goal is to obtain the Locally Preferred Alternative (LPA) approval prior to completion of preparation of the DEA/DEIS so that a single build alternative can be evaluated during the DEA/DEIS. The Consultant will describe the alternative in sufficient detail to develop accurate capital and operating cost estimates, ridership projections, specific alignments, station or stop locations, future connection opportunities, park-and-ride locations and capacity, inter-modal stations including terminus station location and parking capacity, feeder bus service plans, right-of-way requirements and impacts, traffic impacts, and impacts on the human and natural environment.

Task 7.1: Data Collection

The Consultant will assess the adequacy and findings of the data regarding the final alternative defined in the previous tasks. The Consultant will collect additional data as

necessary to complete a final definition of alternatives. No geotechnical field sampling will be conducted.

Task 7.2: Engineering Data

The Consultant will prepare plan and profile drawings of the proposed alignment for the final alternative. These drawings will be formatted for use in the environmental analyses, evaluation and documentation. The Consultant will provide detailed alignment layouts, utilizing aerial photography. The Consultant will work with METRO to develop a utility modification and coordination approach for use in the different segments of the corridor.

Because of the differences in the two primary sections of the corridor regarding alignment options and ADOT and FHWA involvement, two separate subtasks will be used consisting of the following.

Subtask 7.2.1: Conceptual Engineering Design along I-10 Right of Way

The Consultant will prepare conceptual engineering drawings of 1" = 100' scale to facilitate the assessment of technical feasibility, right-of-way impacts, cost analysis and documentation. The plans will include linear plan drawings, street cross sections, location of power substation sites (if LRT is the final alternative), and future connection opportunities. A list of issues and constraints that would likely affect construction traffic control design for the final alignment alternative will also be provided. To determine structure and soil conditions, grades, curves, and right-of-way and utility impacts, the Consultant will conduct the services necessary to meet NEPA requirements and to provide the data needed to conduct this conceptual level of engineering. The Consultant may use available records, as-builts and reports. No field sampling will be undertaken.

The Consultant will work closely with ADOT to develop conceptual design plans that integrate the transit improvement with the highway improvements. Because the objective in this segment will be to minimize impacts to freeway operations with joint projects, more detailed design work will be conducted by the Consultant in critical areas. These areas will be defined through this coordination process to address issues or develop a plan of action for METRO regarding integration of the two projects In these areas the design plans may require a closer scale of drawings such as 1"=50' scale. Work may include assessment of structures, drainage, cross streets and preparation of cost estimates for design and/or construction as appropriate. Up to eight (8) study areas will be addressed. Categories are shown in the table that follows.

Facility	Recommended Category (see Notes)	Action
STRUCTURES		
System Interchanges		
1. Future South Mountain TI	3	Confirm ADOT project accommodates transit
2. I-10/I-17 TI – includes 19th Ave and Grand Ave	3	Confirm ADOT project accommodates transit
Crossroad Bridges		
1. 39th Ave Underpass	1	Confirm ADOT project accommodates transit
2. One overpass and 9 underpasses	4	To be determined
Transit Station Locations (Preliminary)		
1. 63rd Ave	2	Evaluate station location for potential savings if feature constructed with ADOT
2. 39th Ave	2	Provide station location/design if 39th Ave structure reconstructed by ADOT to accommodate transit stations.
ADOT Sign Structures		
1. 8 structure replacements	1	Determine transit alignment to provide optimum sign locations
DRAINAGE		
Existing Collection System		
1. 61 Catch Basins in median	4	Determine which catch basins need to be relocated by transit
2. 4,200' of pipe culverts in median	2	Confirm ADOT project accommodates transit
3. 650' of pipe culverts under median barrier	2	Confirm ADOT project accommodates transit
Transit Modifications/Additions		
1. 5,300' of undersize existing culverts	2	Determine which culverts need to be increased in size to accommodate transit
2. Additional CBs and pipes	3	Determine additional catch basins required to accommodate transit
Pumping System	3	Confirm no modifications required to pump system
FREEWAY LIGHTING		
1. 21 existing pole locations	1	Confirm ADOT project accommodates transit
2. 2010 project locations	1	Confirm ADOT project accommodates transit
Transit Lighting needs	3	Evaluate transit lighting needs. Confirm ADOT accommodates transit lighting needs. Evaluate potential savings of joint ADOT/METRO lighting

Facility	Recommended Category (see Notes)	Action
UTILITIES		
1. 11 SRP Irrigation Crossings	2	Confirm relocation at 31st Ave accommodates transit. Evaluate clearances and structural integrity of other crossings.
2. Kinder-Morgan Petroleum Crossing	3	Evaluate clearance and structural integrity of crossing.
3. 84 other crossings	3	Evaluate clearance and structural integrity of crossings.
4. Utility feeds for transit stations	2	Confirm location accommodates transit
ADOT FREEWAY MANAGEMENT SYSTEM		
1. Trunk line in median	3	Confirm location accommodates transit
2. Joint METRO/ADOT trench	3	Evaluate potential savings
Median Barrier Walls	3	Confirm barrier height and location built by ADOT accommodates transit
TPSS Feeds	2	Investigate locations of feeds into median for potential savings by construction of freeway crossing by ADOT

NOTES:
1 – Must design/construct with ADOT project
2 – Should design/construct with ADOT project
3 – Should design but not construct with ADOT project
4 – Defer design/construction until Metro project

The Consultant will work with ADOT to resolve up to eight of the issues in Categories 1, 2 and 3 above in this task using small area or alignment/station section design concept studies. Detailed design drawings will not be prepared for use by ADOT in this task. Additional scope and budget will be required to provide these products if required as the specific needs become more clear.

Subtask 7.2.2: Conceptual Engineering Design for Downtown Section

The Consultant will prepare conceptual engineering drawings of 1” = 100’ scale to facilitate the assessment of technical feasibility, right-of-way impacts, cost analysis and documentation. The plans will include linear plan drawings, street cross sections, intersection plans, location of power substation sites (if LRT is the final alternative), and future connection opportunities. A list of issues and constraints that would likely affect construction traffic control design for the final alignment alternative will also be provided. To determine structure and soil conditions, grades, curves, and right-of-way and utility impacts, the Consultant will conduct the services necessary to meet NEPA requirements and to provide the data needed to conduct this conceptual level of engineering. The Consultant may use available records, as-builts and reports. No field sampling will be undertaken.

Task 7.3: Stations, Park-and-Rides and Terminus Stations

The Consultant will prepare conceptual layout drawings of stations, park-and-rides, and the terminus stations. The Consultant will indicate site-specific requirements concerning pedestrian access, bus and other vehicle access, passenger drop off, park-and-ride and joint development opportunities. The Consultant will also identify the demand and parking capacity for each park-and-ride and the terminus stations.

Up to two (2) site concept plans will be developed and assessed at the following station locations on one east/west alignment:

- 5th/7th Avenue
- 15th/17th/19th Avenue
- 19th Avenue at I-10
- 35th/39th Avenue
- 43rd/51st Avenue
- 63rd/67th Avenue
- 79th Avenue
- End-of-Line Terminus if not 79th Avenue

Task 7.4: Operating Plan

The Consultant will develop operating plans for the No-Build, Baseline and up to two (2) build alternatives for detailed evaluation in Task 9 to identify a Locally Preferred Alternative. The operating plans will include, at a minimum, total number of vehicles, headway frequency for peak, off-peak and special events, fare structure, travel time, and line-haul capacity. The operating plans will provide enough detail to develop accurate operating cost estimates. These estimates will be in the format proscribed by FTA for the New Starts evaluation.

Task 7.5: Bus Interface

The Consultant will work with local bus operations staff from the City of Phoenix and RPTA to provide a bus interface plan for the final alternative. This will include modifications/improvements to the existing bus service base, as well as the integration of the bus system into the proposed stations and park-and-rides.

Task 7.6: System Integration

With input and direction from METRO and the Systems Planning Consultant, the Consultant will determine the general adequacy of the existing and/or planned yard and shop facilities (bus and/or light rail facilities) and identify the number of vehicles, track (if LRT is final alternative), guidance, traction power (if LRT is final alternative), ventilation, fire protection, control and communications, yards, shops, and other system elements necessary for further development of the final alternative.

Task 7.7: Travel Demand Forecasting

The Consultant will refine the travel demand forecasting model for the final alternative. The Consultant will build upon the model runs performed in previous tasks and make any necessary revisions to reflect the final definition of alternative. Up to four (4) model runs will be conducted. The model runs will also provide VMT/VHT, and speed data for air quality analysis as well as AM, PM, and daily traffic volumes for traffic impact analysis that will be needed during preparation of the DEA/DEIS (Task 9).

The Consultant will run the special event model for each of the four alternatives. Prior to running the model, the model input assumptions; especially the attendance database will be reviewed and revised as needed.

Task 7.8: Summit Software Reporting

The Consultant will use the "Summit" reporting software to review the travel demand results and conduct winners and losers analysis to identify travel markets with positive and negative impacts as a result of the final alternative. We assume up to five additional model runs will be developed for this task. The Summit reports will also be a useful tool to identify problems in the alternative, or transit network, and make service adjustments to address those issues. The Summit reports will be submitted to FTA to assist in its analysis of the travel demand results.

Task 7.9: Final Travel Demand Results Report

The Consultant will prepare a Final Travel Demand Results Report that will contain the results of the model runs and the travel demand forecasts completed for the final alternative, and document changes made to the network, the model assumptions, or the alternative to account for the performance characteristics.

Task 7.10: Support to Public Involvement

The primary effort in this task will be led by METRO and their consultant team. The Consultant will work with METRO to refine the public involvement program for the I-10 West Corridor that has been conducted to date. We have assumed URS Team participation and support to METRO in conducting the public outreach and involvement process that will consist of:

a. Key stakeholder meetings including Village Planning Committees – up to 15 total
b. Corridor-wide public meetings – up to 4 meetings
c. Internal preparation and de-briefing meetings—up to 10 total
d. Internal monthly meetings with the City of Phoenix—up to 12 total
e. Community Working Groups – up to 6 meetings in each segment, 12 total
f. Support communications using newsletter and web site

Task 7.11: Project Management Plan Update

The Consultant will work with METRO to refine the PMP early in the phase to guide the team through the entire AA / DEIS process. The PMP will be updated and will include a refined scope of work, project schedule and staffing plan.

The FTA requirements for entry into Preliminary Engineering will be incorporated into the PMP as follows:

- Basic Requirements – project sponsor, staffing, budget and schedule.
- Procedures – Document control, change order, material testing, internal reporting, operational testing and QA/QC.
- Plans – Contracting plan for PE, Contingency Management Plan, Real Estate Acquisition Plan, Rail Fleet Management Plan, Bus Fleet Management Plan, Safety and Security Management Plan.
- Third Party Agreements and Permits.

TASK 8: COST ESTIMATING

Task Objective: The purpose of this task is to develop a detailed capital and operating/maintenance cost estimate for the build alternative defined in Task 8 and the no-build and New Starts baseline alternative.

Task 8.1: Capital Cost Estimate

Consultant shall develop a comprehensive capital cost estimate for each alternative to include site preparation, maintenance facility and yard upgrades, trackway (LRT only) or roadway, stations, park-and-rides, equipment, vehicles, structures, traction power supply (LRT only), signaling and train control (LRT only), communications, safety, right-of-way, etc. The Consultant will also identify and provide cost estimates for any off-system costs associated with each alternative, including urban design elements and ancillary roadway and traffic system improvements. LRT costing will incorporate the library of data collected for the CP/EV and Northwest Extension LRT projects. METRO will provide the LRT data as requested.

Because of the duration of this phase, the capital cost estimates will be prepared with increasing levels of detail as more design work is completed. The estimates will be provided at two milestones:

- Conceptual level following Phase 1 results for use in comparisons among remaining alternatives.
- Detailed level at the conclusion of the Final Alternatives for New Starts.

Task 8.2: Operating and Maintenance Cost Estimates

The Consultant will prepare a detailed operating and maintenance cost estimate for the build, no-build, and New Starts baseline alternative, based on the proposed operating

plan, ridership projections, fares, and other required information developed in previous tasks. Costs will be reported using the FTA Standard Cost Categories and input to the New Starts templates.

Task 8.3: Cost Estimate Results Report

The Consultant will prepare a report that presents the results of the cost estimating for each alternative. The report will include total Capital and Operating and Maintenance costs for each alternative, including the corresponding level of equipment needs and system miles. The report will also detail the requirements for maintenance staff, equipment and facilities. Costs will be reported using the FTA Standard Cost Categories (SCC). The New Starts Criteria Templates and Certifications will be prepared.

TASK 9: LOCALLY PREFERRED ALTERNATIVE ADOPTION PROCESS

Task Objective: The purpose of this task is to facilitate the selection of a LPA which can be advanced to the DEIS and Preliminary Engineering / Final Environmental Impact Statement (FEIS) phase of the FTA project development process. The goal is to complete the process prior to submittal of the DEIS and New Starts Report so that a single build alternative can be evaluated during the DEIS.

Task 9.1: LPA System Implementation Plan

With input from the Systems Planning Consultant and METRO, the Consultant will provide an assessment of the preliminary LPA using the METRO proposed system plan. The assessment will identify one (1) development and implementation scenario for the LPA.

Task 9.2: LPA System Benefits and Costs

The Consultant will evaluate and compare the relative benefits and costs of the proposed alternative, including the project's cost effectiveness, in a technical LPA System Benefits and Costs Memorandum.

Task 9.3: LPA Financial Plan

METRO will provide a Financial Plan to the Consultant for use in the documentation that demonstrates how the Agency will be able to operate and maintain the existing transit system during the construction and operation of the proposed major capital investment. The Financial Plan will be developed in a manner consistent with FTA's "Guidance for Transit Financial Plans" and should document the recent financial history of the Agency, describe its current financial health, document project costs and revenues, and demonstrate the reasonableness of key assumptions underlying these projections.

The Financial Plan will follow the previous format used by METRO for the CP/EV project. The format will relate to the METRO ***Transit Lifecycle Program Update 2008*** and will include the following Sections:

1. Introduction
   a. Description of the Project Sponsor and Funding Partners
   b. Description of the Project
   c. Summary of the Financial Plan
2. Capital Plan
   a. Proposed Project Capital Plan
   b. Agency-Wide Capital Plan
3. Operating Plan
   a. Operating Revenues
   b. Operating and Maintenance Costs
   c. Agency-Wide Operating Plan
4. Cash Flow Analysis
   a. Twenty-Year Cash Flow Projection
   b. Financial Evaluation
5. Appendix (Reference Supporting Documentation)

Task 9.4: LPA Adoption Process

The Consultant will assist Agency staff in the adoption process for the LPA. This includes obtaining approval from the appropriate committees, commissions and councils at each municipality and the METRO Board of Directors, as well as amending the Maricopa Association of Government's Long Range Transportation Plan and Transportation Improvement Program, as necessary. All of these actions will occur prior to completion of the DEIS. Approval of Project Definition by Phoenix City Council will occur prior to completion of Phase 2.

Task 9.5: Prepare LPA Report & Conceptual Design Drawings

The Consultant will prepare a Locally Preferred Alternative Report that summarizes the overall process and steps leading to the LPA. Additionally, a set of conceptual design drawings will be developed concurrently with the Locally Preferred Alternative. A Conceptual Design Report will be prepared to summarize results of alignment and station design, utility, drainage and right-of-way requirements and capital cost estimates. A portion of the report will describe the process to coordinate work within the I-10 right-of-way with ADOT. The conceptual design drawings will be included in this report.

TASK 10: ENVIRONMENTAL SCOPING, ANALYSIS AND EVALUATION

Task Objective: The purpose of this task is to prepare the initial environmental analyses for use in evaluation and of the alternatives. This work will be used to begin preparation of the Draft Environmental Assessment (DEA) or a Draft Environmental Impact Statement (DEIS), based on the final alternatives, in compliance with the National Environmental Policy Act (NEPA) of 1969, along with compliance with all requirements under the Safe, Accountable, Flexible, Efficient

Transportation Equity Act (SAFETEA – LU). The DEA/DEIS will be submitted for FTA approval. The DEA/DEIS will assess the impacts of the No-Build and LPA Alternatives. As noted in Task 9, the goal is to obtain LPA approval prior to completion of preparation of the DEA/DEIS and include only one alternative in the DEA/DEIS. One review/revision cycle per deliverable is expected for each submittal. If multiple reviewers are used, the comments will be consolidated and provided to the Consultant for incorporation.

Task 10.1: Notice of Intent and Scoping Process

The Consultant will prepare a Notice of Intent (NOI) to prepare an EIS, as required under NEPA, to file for publication in the Federal Register. The NOI should include the following sections:

- Summary of the Project and EIS Process
- Scoping Process
- Description of the Project Area and Need
- Alternatives to be Studied
- Probable Effects and Potential Impacts for Analysis
- FTA / FHWA Procedures

The Consultant will assist Agency staff in facilitating public scoping meeting(s) for the DEA/DEIS. With assistance from the Consultant, METRO will prepare and distribute public notices for the meeting(s), prepare briefing materials and graphic presentations, prepare and distribute meeting agenda(s) and prepare a summary report of the scoping meeting(s). Spanish translation interpreters should be available as needed. Agency staff will assist with the Scoping Meetings as needed. The Consultant will prepare for and attend two public scoping meetings and one agency scoping meeting.

Task 10.2: Environmental Review and Technical Reports

Documentation in the DEIS will be organized for each resource area that is affected. The format for these sections will consist of Methods, Existing Conditions, Environmental Consequences, and Proposed Mitigation Treatments. To provide the background material necessary for the DEIS analysis, Consultant will prepare technical reports for each of the following major disciplines that will be studied in the DEIS.

Some of the technical areas may be combined if related to a single area of potential impact (such as demographics, social factors, economic impacts, neighborhoods, and environmental justice):

- Methodology
- Existing Conditions
- Initial Conceptual Alternatives Evaluation

- Environmental Consequences of Final Alternatives
- Transportation (including transit, streets and highways, parking, and pedestrian & bicycles)
- Demographics and socioeconomic factors - The Consultant will utilize available data and documented sources to assess this category. No additional field work will be conducted
- Economic impacts of employment changes – The Consultant will utilize available data and documented sources to assess this category. No additional field work will be conducted
- Equity and environmental justice considerations
- Community facilities and services - The Consultant will utilize available data and documented sources to assess this category. No additional field work will be conducted.
- Neighborhoods, Land use and economic development – This section will be assessed from a general viewpoint without detailed calculation of economic benefit from the land use change.
- Parklands and recreational resources
- Displacements/relocations – Total numbers of properties and input to right-of-way estimates.
- Environmental Justice assessment
- Noise and vibration – consistent with FTA requirements and will include up to 15 locations where noise monitoring will be conducted to establish the background noise levels; either the BRT or LRT modes will be considered depending upon the LPA..
- Air quality– consistent with FTA requirements and will utilize available data and documented sources to assess this category. No additional field work will be conducted; either the BRT or LRT modes will be considered depending upon the LPA...
- Historic, archaeological, and traditional cultural resources and places - It is assumed that the technical cultural resource reports prepared during the alternatives analysis phase will not need to be revised. It is assumed that an additional cultural resources technical report will be prepared to provide a basis for making determinations of eligibility for cultural resources within the area of potential effects for the l preferred alternative, as well as a determination of effect. The report would address mitigation concepts but would not include a detailed treatment plan. It assumed that two drafts and one final would be prepared. It assumed that Section 106 consultation assistance would be provided by drafting a programmatic agreement, and participating in two joint meetings with the State Historic Preservation Officer, Phoenix City Historic Preservation Office, and Phoenix City Archaeologist, as well as one meeting with interested tribes. Depending on which route and mode are selected for the locally preferred alternative, we assume that approximately 2 historic districts, 75 historical

buildings, 1 historic streetscape would need to inventoried and evaluated for eligibility for the National Register of Historic Places. It is assumed that no archaeological survey would need to be conducted during the DEIS phase because of the extent of disturbance and modern development. If there are impacts to areas in the study corridor not previously surveyed, a survey may be required that is not currently assumed in this scope of work. It is assumed that the cultural resource team will contribute to the Section 4(f) Evaluation and no more than 5 properties will assessed. The Consultant will prepare a separate Section 4(f) Evaluation to include applicable historic properties consistent with USDOT requirements.

- Visual quality and aesthetic characteristics – The Consultant will generate daytime (11" x 17") color simulations for the proposed project from up to five (5) key observation points (KOPs) illustrating the exiting and proposed viewing conditions. To the extent that base information and materials are readily available, METRO will provide detailed locations for all proposed project facilities (digital), and from previous standardized products for a unified image of the system If available, METRO will provide digital scaled drawings and descriptions of the proposed project facilities, proposed surface treatment, colors, materials, signage, lighting, train cars, and landscaping plans. If available, METRO will provide AutoCAD or 3D Studio Max compatible 3D digital models of all proposed project facilities, and rail cars. Up to five (5) simulations would be developed of the project from proposed KOPs. Additional simulations from points other than the KOPs inventoried in the initial field visit are not included in this SOW. The field inventory of existing conditions and photography for simulations would be conducted in one trip. Additional field days are not included in this scope of work. Animated simulations are not included in this SOW, but can be provided and would require a separate SOW.
- Hazardous materials – The Consultant will utilize available data and documented sources to assess this category. Field work will be conducted to visually assess primary station sites for obvious hazardous materials presence. Information will be organized in a format similar to that used for Phase 1 site evaluations but since the corridor is a linear feature, all sites will be included in the overall assessment.
- Section 4(f) and Section 6(f) Evaluation – The Consultant will prepare a separate Section 4(f)/6(f) Evaluation consistent with USDOT and other regulatory requirements. The Consultant will develop and conduct the consultation process with local jurisdictions to address project uses of affected parcels.

The following resources will be evaluated for purposes of the DEIS, however a separate technical report is not assumed:

- Water resources – The Consultant will utilize available data and documented sources to assess this category. No additional field work will be conducted.
- Energy – Calculations will be completed using travel demand forecasts in a manner consistent with regional planning techniques for the Phoenix area.

- Geology and soils – The Consultant will utilize available data and documented sources to assess this category. No additional field work will be conducted.
- Ecosystems and natural resources – The Consultant will utilize available data and documented sources to assess this category. A Biological Assessment and consultation to develop a Biological Opinion is not included in this work because of the lack of threatened and endangered species in the corridor. No additional field work will be conducted.

Sufficient work will be completed in each of the environmental resource areas to support planning work in other Tasks of Phase 2. In particular, work will focus on assessment of existing conditions, environmental resource agency coordination, and conceptual-level assessment of potential impacts. Results will be used in the evaluation and screening of alternatives.

TASK 11: SECTION 5309 NEW STARTS REPORT

Task Objective: The purpose of this task is to prepare the FTA required Section 5309 New Starts Report. This report is required annually as part of the Federal funding process. A part of this work will include preparation of a "Making the Case" submittal for METRO. The Consultant may be asked to prepare the original submittal and one (1) update through the completion of Phase 2.

Task 11.1: Section 5309 New Starts Report

The Consultant will prepare a New Starts Report for submittal to FTA. The Report will be coordinated with the previous LRT reports to ensure consistency of applicable information. The report should have the following sections:

- General Project Information
- Mobility Improvements
- Environmental Benefits
- Operating Efficiencies
- Cost Effectiveness
- Existing Land Use, Transit Supportive Land Use Policies, and Future Patterns
- Local Financial Commitment
- Other Factors
- Appendices

To save time, the Consultant will begin assembling existing data (e.g., project information, land use, etc.) about the project early in the process as it becomes available.

FTA will review a draft of the Section 5309 New Starts Project Justification Criteria, the Financial Plan, and the Summit Reports and user benefits summaries before a final

version of the New Starts Report is completed for a request to initiate Preliminary Engineering.

Task 11.2: FTA Technical Methodology Certification

The Consultant will certify that the technical approaches and assumptions used in the analysis were in accordance with FTA guidance and best professional practices.

TASK 12: DOCUMENTATION TO ENTER NEW STARTS PRELIMINARY ENGINEERING

Task Objective: The purpose of this task is to develop a program to identify the financial, jurisdictional, environmental, and administrative procedures which must be implemented after the AA / DEIS process in order to advance the project to the New Starts Preliminary Engineering (PE) phase of the FTA project development process.

Task 12.1: Documentation for Before and After Study and Making the Case Document

The Consultant will prepare an outline and scope of work and data collection plan to support a future Before and After Study. This should include, at a minimum, information regarding Project Scope, Service Levels, Capital Costs, Operating and Maintenance Costs, and Ridership Patterns. Although a formal plan for the Before and After Study is not required until final design, the “before” element of the study relating to predicting impacts requires that assumptions and resulting information for each of the five characteristics listed above must be documented at the conclusion of the AA and submitted to FTA at the time of application to begin preliminary engineering.

The Consultant will also prepare the Making the Case Document for submittal to FTA. This document provides a detailed assessment of the benefits of the transit investment and the return on that investment to the public and affected agencies.

Task 12.2: FTA Request to Enter PE Phase

The Consultant will prepare all appropriate Support Documentation and required readiness items necessary to enter PE and will prepare a Draft Letter Request to the FTA Administrator to allow the Agency to enter the PE phase.

Task 12.3: Other Readiness Items for PE

The Consultant may be requested to prepare additional readiness documents, such as agreements and technical plans, needed to demonstrate project readiness for PE to the FTA.

TASK 13: PROJECT MANAGEMENT PLAN FOR PRELIMINARY ENGINEERING

Task Objective: The Consultant will assist METRO with preparation of the project PMP for Preliminary Engineering by providing input toward the end of Phase 2. This work will build upon the standard Program Management Plan that METRO has developed with specific elements detailed for the I-10 West project.

The PMP will include information sufficient to fulfill the requirements of the Federal Transit Administration regarding project management oversight. METRO has developed a Program Management Plan which provides an overview of the Agency's management requirements and systems used to implement an efficient and effective rail transit system. The PMP supplements the Program Management Plan and will provide unique management considerations for each specific project. The PMP will include a project overview, project organization and staffing information, a schedule and budget, and other special management considerations for the project.

The PMP is a required deliverable to the Federal Transit Administration to demonstrate readiness to enter into Preliminary Engineering.

TASK 14: CONTINUING EFFORTS

Task Objective: An allowance will be set aside by METRO to be allocated to additional continuing effort tasks as they arise during the course of this phase. The continuing efforts will be identified jointly by METRO and the Consultant who will prepare a separate request for each item. The Consultant will include the scope, cost and schedule for each request. METRO will review the request and negotiate the continuing efforts to be undertaken with the Consultant. METRO will authorize the use of the continuing efforts budget in writing to the Consultant before any work is initiated. A separate Notice to Proceed with the continuing efforts will be issued by METRO.

PHASE 2B: LPA REFINEMENT, ENVIRONMENTAL STUDIES, AND DOCUMENT AND FTA SUBMITTALS

TASK 15: REFINING THE LOCALLY PREFERRED ALTERNATIVE

Task Objective: The purpose of this activity is to refine the Locally Preferred Alternative design concept for inclusion in the Draft Environmental Document. This task will seek to identify the major issues associated with the LPA and to confirm he footprint of the project and concept design of mitigation treatments.

Task 15.1: Identification of Major Issues & Preliminary Assessment of Risks

Key elements of this identification task are to develop parameters for determining significance of impacts, perform a concept-level risk in a generalized FTA format.

Task 15.2: Preferred Alternative Refinement

The purpose of this task is to provide design refinements to confirm and finalize the various design elements of the LPA following the results of the environmental studies. An allowance will be assumed to cover this portion of the work that will be subject to authorization by METRO for each assignment. The focus of this work will be to clearly define the project limits and extent (the environmental footprint), and the mitigation treatments that are proposed.

Task 15.3: Cost Estimate Update for LPA

The Consultant will use the refinement information and the list of mitigation treatments to update the cost estimate for the LPA. The updated estimates will be used in the New Starts evaluation in Task 16 and in the DEA/DEIS.

TASK 16: UPDATE NEW STARTS REPORT

Task Objective: The Consultant will provide the update to the New Starts Report as called for in Task 11.

Task 16.1: Update New Starts Report

The Consultant will provide one update to the initial New Starts Report during this phase of the project. The report should contain the following sections:

- General Project Information
- Mobility Improvements
- Environmental Benefits
- Operating Efficiencies
- Cost Effectiveness
- Existing Land Use, Transit Supportive Land Use Policies, and Future Patterns
- Local Financial Commitment
- Other Factors
- Appendices

TASK 17: COMPLETION OF DRAFT ENVIRONMENTAL DOCUMENT

Task Objective: The purpose of this task is to prepare a complete Draft Environmental Assessment or Draft Environmental Impact Statement (DEA or DEIS), based on the final alternatives and direction from FTA, in compliance with the National Environmental Policy Act (NEPA) of 1969, along with complying with all requirements under the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA – LU). The DEA or DEIS will be submitted for FTA approval. The DEA or DEIS will assess the impacts of the No-Build and LPA Alternatives. As noted in Task 9, the goal is to obtain FTA approval to enter Preliminary Engineering prior to completion of preparation of the DEA or DEIS to include only one alternative in the DEA or DEIS. One review/revision cycle per deliverable is expected for each submittal. If multiple reviewers are used, the comments will be consolidated and provided to the Consultant for incorporation.

Task 17.1: DEA or DEIS and Section 4(f)/6(f) Report Format

The DEA or DEIS and Section 4(f)/6(f) Report will include the following primary elements in an outline that is developed early in the process to be submitted to and approved by METRO and FTA:

- Executive Summary
- Purpose and Need
- Alternatives Considered
- Affected Environment
- Transportation Systems
- Environmental Consequences (including potential construction impacts)
- Section 4(f) and Section 6(f) Evaluation
- Secondary and Cumulative Impacts
- Evaluation of Alternatives
- Public Comment and Agency Coordination
- All Applicable References and Appendices

The following sections will also be incorporated into the DEIS document:

a. Permits and Approvals
b. Construction Management Plan
c. Secondary and Cumulative Impacts
d. Relationship between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity.
e. Irreversible and Irretrievable Commitment of Resources that Would be Involved in the Proposed Project
f. Bibliography

The DEIS will also include a Section 4(f)/6(f) Evaluation as a separate chapter in the DEIS.

Consultation with affected agencies will also be included in the subtask level of effort. This effort will include coordination of agency reviews and responses to comments as the resource area analyses are completed. It is expected that up to two (2) consultation meetings for any individual resource area will be sufficient for the DEIS effort.

Task 17.2: Support to Public Involvement

The primary effort in this task will be led by METRO and their consultant team. The Consultant will work with METRO to refine the public involvement program for the I-10 West Corridor that has been conducted to date. We have assumed URS Team participation and support to METRO in conducting the public outreach and involvement process that will consist of:

a. Key stakeholder meetings including Village Planning Committees – up to 10 total
b. Corridor-wide public meetings – up to 4 meetings

c. Internal preparation and de-briefing meetings—up to 10 total
d. Internal monthly meetings with the City of Phoenix—up to 12 total
e. DEIS Public Hearing – up to 2 hearings
f. Community Working Groups – up to 6 meetings total for both segments
g. Support communications using newsletter and web site

Task 17.3: First Administrative Draft DEA/DEIS Report

The Consultant will prepare an Administrative Draft DEIS report for review by METRO and City of Phoenix staff if needed. Agency staff will review the draft to determine conformance with study goals and objectives and the NEPA requirements in one combined cycle. Comments will be reconciled by METRO and provided to the Consultant. The Consultant will make all necessary revisions to the First Administrative Draft DEIS and will submit a revised draft for review by Agency staff to ensure all revisions were made according to comments received. Comment tracking and response sheets will be used to manage this process.

Task 17.4: Second Administrative Draft DEA/DEIS Report

The Consultant will prepare a second administrative draft DEA/DEIS report for review. The DEA/DEIS for the I-10 West extension shall be reviewed by the FTA in one combined cycle. Comments will be reconciled by METRO and provided to the Consultant. The Consultant will make all necessary revisions to the second administrative draft before preparing a final DEA/DEIS for final submittal. Comment tracking and response sheets will be used.

Task 17.5: Prepare and Submit Final DEA/DEIS Report

After making final revisions, the Consultant will prepare and submit a final DEA/DEIS report to METRO for approval and signature by the Agency and FTA. The finished product shall include a title and signature page for responsible officials from the Agency and FTA.

The Consultant will prepare the Administrative Record, technical reports and other memoranda, and comment tracking and response tables. The Consultant will submit these items to METRO Document Management System for recordation and filing.

Task 17.6: Prepare and File Notice of Availability

The Consultant will prepare a Notice of Availability for the DEA/DEIS, as required under NEPA. The Consultant will also prepare a list of agencies and individuals to be provided with copies of the final DEA/DEIS document. The Consultant will make and distribute copies of the final DEA/DEIS document to the list of local agencies and individuals.

Task 17.7: DEA/DEIS Public Hearing

The Consultant will assist Agency staff in preparing a Notice of Public Hearing for the DEIS to be held during the 45-day review period. The Consultant will also assist Agency staff in conducting the public hearing.

Task 17.8: Identify Issues and Impact Areas Requiring Additional Environmental Analysis

The Consultant will review comments received from the DEIS to determine environmental-related comments that may require additional environmental analysis. The Consultant will prepare a memorandum identifying the comments that must be addressed, and the level of detail of the required analysis. Meetings will be held with Agency staff and other agencies, as necessary, to clarify comments and identify potential impacts that must be addressed in the FEIS. We assume that less than 1,500 comments will be received on the DEIS for response by the Consultant.

TASK 18: ECONOMIC DEVELOPMENT STUDY / STATION AREA MARKET ANALYSIS

Task Objective: The objective of this task is to identify and evaluate market-based development opportunities along the I-10 West, extension and its respective station areas. For the corridor segment west of I-17, it would be appropriate to- start the Economic Development Study once final station sites were defined to help identify potential park-and-ride sites for inclusion in transit project submittals to FTA.

Task 18.1: Market Overview Analysis

The Consultant will review the regional economic and market conditions by collecting data on demographics, employment and real estate, including development trends. This data will be derived primarily through Census data, regional and local agencies, commercial data sources, academic studies and personal interviews with real estate and economic development officials.

Task 18.2: Market & Jurisdictional Conditions Analysis

The Consultant will also need to collect qualitative data regarding each of the municipalities and jurisdictions such as relevant policies, competitive position and detailed development activity information. From this information, the Consultant can develop development priorities and programs for each of the extensions. Furthermore, this information can be utilized to develop station specific analysis and develop programs for residential, office, retail, industrial and/or flex-space, hotels and mixed-use. These uses will be determined by weighing demand variables vs. supply variables ensuring the maximum market potential is identified for each extension and site.

Task 18.3: Financial Feasibility Analysis

The Consultant will then use the information from the market and jurisdictional conditions analysis to develop estimates of financial feasibility of each of the development programs. The feasibility analysis should employ “static” pro forma models for each of the opportunity sites to ensure.

Task 18.4: Identify Station Area Opportunities Summary

The Consultant will incorporate the data collected and analyzed in the first 3 tasks into comprehensive development programs identifying general uses, building prototypes / densities and parking solutions based on market-driven forces. These development programs should identify recommended and secondary development possibilities, special conditions, parcel assembly, property disposition, phasing, financing and planning and/or other efforts.

PHASES 2A and 2B MAJOR MILESTONE DELIVERABLES

Below is an inclusive list of major milestone deliverables for the Phase 2 Scope of Services. In all cases, except monthly status reports, the Consultant will deliver two draft for each final deliverable listed below. In addition, except where noted, the Consultant will deliver two draft copies and five final copies. In addition, the Consultant will deliver an electronic copy in .pdf format.

- Evaluation of Alternatives Report (2)
- Conceptual Design Report to include Plan and Profile Drawings suitable for use in the development of the environmental analyses and documentation (2)
- Final Definition of Alternatives Report (2)
- Travel Demand Results Report (2)
- Cost Estimate Report at two levels:
    - Concept level
    - Detailed LPA level(2)
- Preliminary FTA New Starts Assessment Technical Memorandum (2)
- Annual New Starts Report (2) (25 final copies)
- Draft Financial Plan prepared by METRO (2)
- Notice of Intent to prepare NEPA documents and scoping process
- DEIS Environmental Technical Reports (2) – affected resource reports only
- Locally Preferred Alternative Report (2) (25 final copies) (50 executive summaries).
- Documentation of Request to FTA to enter New Starts Preliminary Engineering
- Updated Project Management Plan (2)
- Updated Public Involvement Plan input to Metro
- Public Involvement meeting participation as listed in Task 7.10
- LPA Design Refinement Design Technical Memorandum (2)
- LPA Cost Estimate Refinement and Technical Memorandum (2)
- Financial Plan by METRO (2)
- Update to Annual New Starts Report (25 final copies)

- Before and After Study Outline and Work Plan (2)
- DEA or DEIS Outline (2)
- 1st Administrative Draft DEA or DEIS
- 2nd Administrative Draft DEA or DEIS
- Draft EA or EIS (100 final copies)
- Section 4(f) Evaluation Technical Report (2)
- Comment Tracking and Response system
- Notice of DEA or DEIS Availability (2)
- Notice of Public Hearing (2)
- Public involvement in accordance with Task 7.10
- EA or EIS Issues and Impacts Memo (2)
- Market Analysis Report – Phase I: Market Overview, Market & Jurisdictional Conditions Analysis (2)
- Market Analysis Report – Phase II: Financial Feasibility, Station Area Opportunities Summary (2)

PHASE 3: FINAL ENVIRONMENTAL ASSESSMENT OR ENVIRONMENTAL IMPACT STATEMENT

As stated in the RFQ, Phases 3 and 4 will be negotiated subsequent to Phase 2 authorization and appropriate milestones.

TASK 19: FINAL ENVIRONMENTAL ASSESSMENT OR IMPACT STATEMENT

Task Objective: The purpose of this task is to prepare a FEA/FEIS for the Locally Preferred Alternative that is in compliance with NEPA and FTA requirements in order to obtain the Finding of No Significant Impact (FONSI) or Record of Decision (ROD) from FTA.

Task 19.1: Identify Issues and Impact Areas Requiring Additional Environmental Analysis

The Consultant will review comments received from the DEA/DEIS to determine environmental-related comments that may require additional environmental analysis. The Consultant will prepare a memorandum identifying the comments that must be addressed and the level of detail of the required analysis. Meetings will be held with Agency staff and other agencies, as necessary, to clarify comments and identify potential impacts that must be addressed in the FEA/FEIS.

Task 19.2: Conduct Social, Economic, and Environmental Impact Analyses

As necessary, the Consultant will refine the social, transportation, economic, and environmental impact analyses conducted for the DEA/DEIS, within the FEA/FEIS. Any changes to the LPA during the preliminary engineering phase will require a reassessment of the potential impacts identified in the DEA/DEIS.

The environmental analyses will include a description of impacts under each specific environmental area, as required under NEPA and applicable FTA guidance. Baseline conditions for each of the impact areas will have been documented and included in the DEA/DEIS. To the extent practical, this baseline will be used for the reassessment of the impacts of the LPA. If appropriate, additional data will be collected from existing sources maintained by federal, state and local agencies, and augmented by field studies and measurements, as appropriate.

The Consultant will identify, verify, and describe all project impacts. Impacts on existing and future conditions will be assessed in terms of beneficial and adverse impacts. Direct (primary), indirect (secondary), and cumulative impacts will be considered. Impacts will be classified and their significance addressed in terms of short-term and long-term consequences.

Consultant will conduct the analysis of impacts in accordance with the methodology used in preparation of the DEA/DEIS, including a description of the approach used in developing the baseline and assessing impacts as required under NEPA. The results of this task, incorporating the impacts of the LPA, will be documented in the FEA/FEIS.

Task 19.3: Identify Design Mitigation Measures and Monitoring Program

The Consultant will identify and evaluate reasonable and practical measures for avoiding impacts and minimizing harm during both construction and operation of the proposed system.

The Consultant will develop draft and final mitigation plans and monitoring programs for all adverse impacts resulting from the project. The plans will identify mitigation measures for each adverse impact, noting where authority and responsibility for carrying out these measures reside. The report will discuss monitoring requirements mandated by federal, state and local jurisdictions to ensure that the measures are enforced. Memoranda of Agreement will be developed between the parties responsible for implementing and monitoring the measures. The mitigation measures and MOA's will be incorporated into the FEIS.

Task 19.4: Identify Required Environmental Permits

The construction of the project will be regulated by environmental rules and regulations administered by federal, state, county and local agencies. Many of these agencies have established environmental permit programs to ensure careful use of air, land, and water resources. The Consultant will identify all federal, state, county, and local agencies requiring environmental permits and prepare a schedule for obtaining the permits.

The Consultant will prepare a Permit Coordination Package to share with all involved regulatory and permit review agencies. This package will provide information on the project to facilitate discussions with the regulatory agencies and identify ways in which the project could be made more acceptable from a permitting perspective. The package will also summarize proposed mitigation measures.

Task 19.5: Prepare Final EA or EIS Document and Provide Procedural Support

The Consultant will prepare the FEA/FEIS document and provide the procedural support necessary to complete the federal environmental process. This will include submitting the FEA/FEIS to FTA, supporting the review and updates necessary to obtain the Finding of No Significant Impact (FONSI) or Record of Decision (ROD) and clearing the way for FTA to approve Final Design and initiate a Full Funding Grant Agreement for the project.

The FEA/FEIS document will be prepared and processed in accordance with the FTA and NEPA guidelines. The preparation of the FEA/FEIS document will include preparation of Draft FEA/FEIS chapters by incorporating the LPA, environmental impacts and mitigation, and responses to comments received on the DEA/DEIS. *The Final EA or EIS will present the New Starts evaluation and rating criteria of the preferred alternative in addition to the NEPA evaluation of alternatives.* The Draft chapters will be prepared by utilizing the DEA/DEIS document and closely coordinating with Agency staff, Preliminary Engineering Consultants, and FTA.

An outline of the FEA/FEIS will be prepared following the standard FTA EIS format. The FEA/FEIS will include the following chapters:

- Executive Summary
- Purpose and Need
- Alternatives Considered
- Affected Environment and Environmental Consequences
- Transportation Systems
- Evaluation of Alternatives
- Public Comment, Responses, and Agency Coordination
- All Applicable References and Appendices

The FEA/FEIS chapters will be prepared by revising the DEIS document to add sections that review and summarize responses and comments.

The Consultant will prepare and submit a Preliminary Draft FEA or FEIS to Agency staff for review and comment. Once all comments have been incorporated, Consultant will prepare a Revised Preliminary Draft FEA or FEIS for submission to FTA. The Consultant and Agency staff will meet with FTA to receive and discuss comments on the Revised Preliminary Draft FEA or FEIS. Once all final comments are incorporated, the Consultant will prepare, print and submit the Final FEA or FEIS document to the Agency for transmittal to the FTA.

Task 19.6: Notice of Availability

A Notice of Availability of the FEA or FEIS for public review will be prepared and submitted to the Agency for publication in local newspapers.

TASK 20: RECORD OF DECISION (OR FONSI) SUPPORT

Task Objective: The Consultant will provide support as necessary to obtain the Record of Decision by FTA.

Task 20.1: Mitigation Monitoring Plan

The Consultant will prepare a final Mitigation Monitoring Plan (MMP) based on the finding of the FEIS. The MMP should, at a minimum, identify each potential impact, the mitigation measure(s) to be taken, monitoring action and conditions for approval, identification of party(ies) responsible for implementing the mitigation, and the enforcement agency for each measure. The MMP will be attached to the draft Record of Decision.

Task 20.2: Draft Record of Decision (or FONSI)

The Consultant will prepare a draft Record of Decision to be submitted to FTA. The Draft Record of Decision should include all necessary attachments required for FTA approval.

Task 20.3: New Starts Rating Assistance

The Consultant may provide additional assistance required in the preparation and submission of information to FTA for rating of the project in accordance with its Section 5309 New Starts Criteria.

TASK 21: UPDATE NEW STARTS REPORT

Task Objective: The Consultant will annually update the New Starts Report for the duration of this Phase of the contract.

Task 20.1: Update New Starts Report

The Consultant will update the annual New Starts Report during this phase of the project. The report should contain the following sections:

- General Project Information
- Mobility Improvements
- Environmental Benefits
- Operating Efficiencies
- Cost Effectiveness
- Existing Land Use, Transit Supportive Land Use Policies, and Future Patterns

- Local Financial Commitment
- Other Factors
- Appendices

PHASE 3 MAJOR MILESTONE DELIVERABLES

Below is a non-inclusive list of major milestone deliverables for the Phase 3 Scope of Services. Please note that this is not a comprehensive list of deliverables, but a list of key milestone deliverables.

- FEIS Issues and Impacts Memorandum
- Environmental Impacts Documentation for FEIS
- Mitigation Monitoring Plan
- Permit Coordination Package
- Administrative Final Environmental Impact Statement
- Final Environmental Impact Statement
- Notice of Availability for FEIS Review
- Draft Record of Decision Letter
- New Starts Report

PHASE 4: MITIGATION MONITORING PLAN OVERSIGHT DURING FINAL DESIGN

As stated in the RFQ, Phase 4 will be negotiated subsequent to Phases 2 and 3 authorization and appropriate milestones.

TASK 22: MITIGATION MONITORING PLAN OVERSIGHT DURING FINAL DESIGN

Task Objective: The Consultant will provide on-going monitoring, assessment, revision and oversight of the approved MMP during final design. This task will consist of review of engineering and design efforts to ensure compliance with mitigation commitments established in the FEIS, ROD and MMP.

Task 22.1: Plan Review

The Consultant will attend various design review meetings during final design to ensure compliance with the MMP. The Consultant will also review all design plans, including but not limited to, 30%, 60%, 90%, 100% Complete design plans for compliance with the MMP. Consultant will provide a written report of key review meetings, and all formal design reviews, that identifies deviations, updates or revisions required to the MMP.

Task 22.2: Review Proposed Design Changes/Amend MMP

The Consultant will review all proposed design changes and amend the MMP as necessary to address mitigation measures necessary for each change to the plans, as defined in the FEIS.

Task 22.3: Environmental Permits

The Consultant will assist in securing all necessary environmental permits, such as air quality and water quality permits, for construction of the project.

TASK 23: UPDATE NEW STARTS REPORT

Task Objective: The Consultant will update the New Starts Report during this Phase of the contract.

Task 23.1: Update New Starts Report

The Consultant will update the annual New Starts Report during this phase of the project. The report should contain the following sections:

- General Project Information
- Mobility Improvements
- Environmental Benefits
- Operating Efficiencies
- Cost Effectiveness
- Existing Land Use, Transit Supportive Land Use Policies, and Future Patterns
- Local Financial Commitment
- Other Factors
- Appendices

PHASE 4 MAJOR MILESTONE DELIVERABLES

Below is a non-inclusive list of major milestone deliverables for the Phase 4 Scope of Services. Please note that this is not a comprehensive list, but a list of key milestone deliverables.

- Review of Key Design Meetings and Formal Design Reviews
- MMP Updates as Necessary
- Acquire All Necessary Environmental Permits
- New Starts Report

I-10 WEST

ALTERNATIVES ANALYSIS/ ENVIRONMENTAL IMPACT STATEMENT

DRAFT
PROJECT INITIATION PACKAGE

September 12, 2007

METRO

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1.0 OVERVIEW

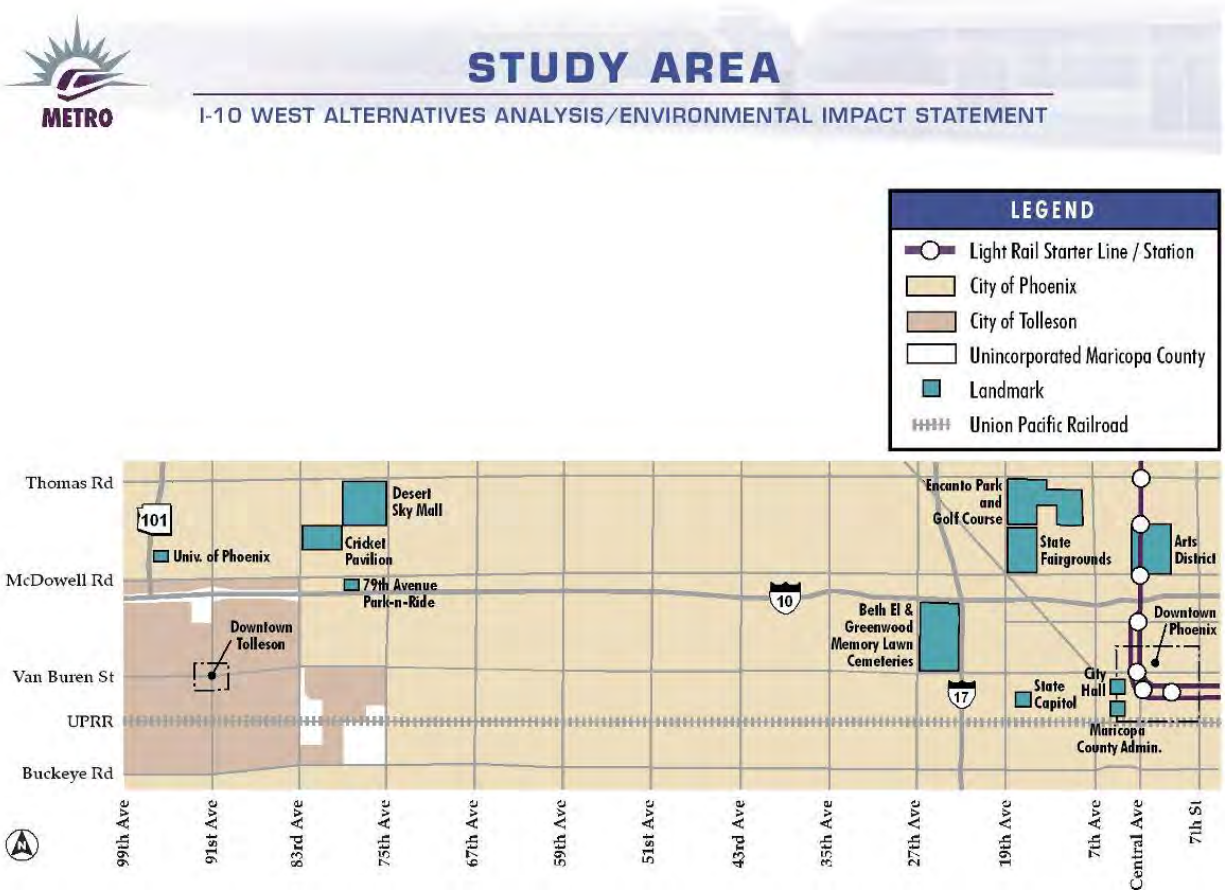
1.1 INTRODUCTION

This Project Initiation Package contains an overview and status update of the Interstate 10 (I-10) West Alternatives Analysis (AA)/Environmental Impact Statement (EIS). This document also provides early project information to the Federal Transit Administration (FTA) for review and comment. It is the intent of Valley Metro Light Rail (METRO) to partner with FTA to develop a major transit capital investment within the I-10 West Corridor, as identified in the voter approved Regional Transportation Plan (RTP), and funded through Proposition 400.

1.2 PROJECT BACKGROUND

The study consists of an AA/EIS to evaluate potential high capacity transit (HCT) improvements in the western Phoenix and the northern Tolleson city limits (Figure 1). This project will also require a Section 4(f) Evaluation in compliance with the U.S. Department of Transportation Act of 1966.

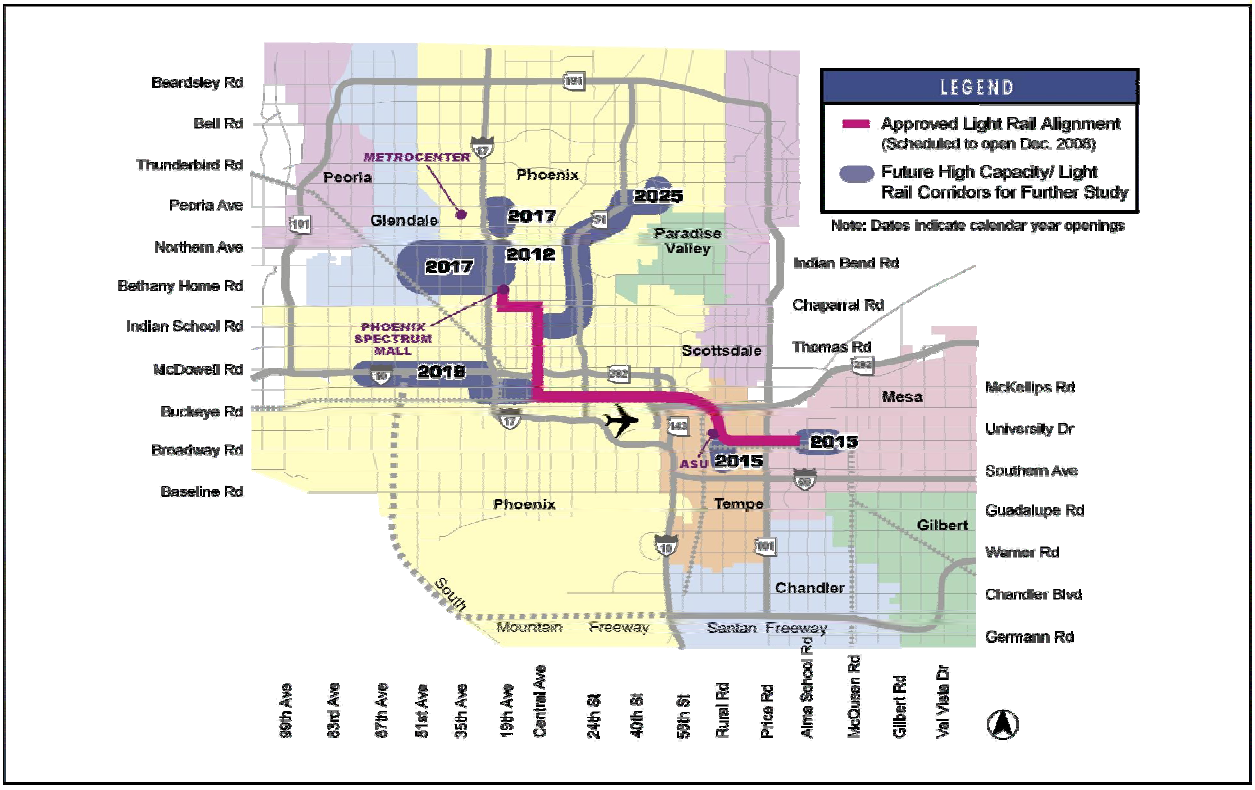
Figure 1 – I-10 West Study Area



The I-10 West AA/EIS is funded by the Proposition 400 half-cent transportation sales tax extension approved by Maricopa County voters in 2004, and is contained in the RTP as a component of the 57 miles of light rail / HCT network to be implemented by 2026 (Figure 2). Construction of the 20-mile light rail starter line through Phoenix, Tempe, and Mesa will open for passenger service in December 2008.

The established schedule for HCT implementation in the Phoenix area provides regional context for the I-10 West AA/EIS. METRO's 20-mile starter line will extend through the Cities of Phoenix, Tempe and West Mesa. The I-10 West light rail is anticipated to open in 2019. Other high capacity or light rail corridors are planned to be implemented as follows: Northwest Phase I opens in 2012; Phase II opens in 2017; Tempe South opens in 2015; Central Mesa opens in 2015; Glendale opens in 2017; and Northeast opens in 2025.

Figure 2 – High Capacity/Light Rail Transit Corridors



1.3 STUDY AREA DESCRIPTION

The project study area is bounded by State Route 101 (Loop 101) to the west, 7th Street to the east, Thomas Avenue to the north, and Buckeye Road to the south. Located immediately west of the Phoenix central business district (CBD), this corridor is diversely developed with a wide range of land uses including residential, industrial, commercial, public/government and agriculture. The immediate project corridor is centered along I-10 in western Phoenix, extending from the light rail starter line currently under construction through downtown Phoenix.

I-10 serves as both a nationally and regionally significant transportation corridor. Regionally, the corridor is supported by a network of parallel arterial streets that provide local access and circulation, but also provide additional east-west transportation capacity. Overall, non-freight transportation capacity within the I-10 corridor is further enhanced by the relatively high level of public transit service provided on the adjacent parallel arterial streets.

1.4 PROJECT PURPOSE

The draft statement of the project purpose is currently under review by METRO and the City of Phoenix and will be refined further. In its current state, the purpose is defined as follows:

1. Identify a transit alternative that increases efficient access to employment opportunities throughout the Central Phoenix/West Valley region.
2. Identify an improvement that provides effective transit options to relieve peak period congestion.
3. Identify a transit improvement alternative, with a recommended alignment and technology, to connect the LRT system currently under construction with the West Valley.
4. Identify a transit improvement alternative that would facilitate continued development of a comprehensive and inter-connected regional transit network that is multi-modal, that offers a range of effective mobility choices for current and future transit riders, and that attracts new transit riders to use the growing regional system.
5. Identify an alternative that improves the efficiency of transit operations.
6. Identify an alternative that provides cost-effective transit improvements and expands access to corridor destinations.
7. Identify a transit alternative that supports economic development (including transit-oriented development), and ensures enhanced connectivity among existing and planned regional and local activity center and attractions.

1.5 COORDINATION

A draft Public Involvement Plan, which includes a Project Coordination Plan and a list of participating agencies, was developed in cooperation with METRO and the City of Phoenix to guide the public involvement process. Preliminary lists of project stakeholders and elected officials, Technical Advisory Committee members, along with a schedule of initial stakeholder meetings have been developed, and are under review by METRO, the City of Phoenix, the Maricopa Association of Governments (MAG), and the Regional Public Transportation Authority (RPTA). A Project Fact Sheet will be distributed over the next 2 months and coordinated along with notification of the scoping meetings.

2.0 PROBLEM STATEMENT UPDATE

The I-10 West Corridor is one of the most heavily traveled in the Phoenix metropolitan area. The rapid growth of West Valley communities has generated significant travel demands for trips to and from the central part of the region.

At the same time, no new major capacity additions to east/west travel have been added to the system since the construction of I-10 through central Phoenix in the mid 1980's. As part of the Final Environmental Impact Statement for the construction of I-10, reservation of a 50-feet wide right-of-way was planned in the median of the highway for future transit options.

Current travel on I-10 is extremely congested during the morning and evening peak periods. Coupled with the increasing volumes and associated congestion on parallel arterials such as Buckeye Road, Van Buren Avenue, McDowell Avenue and Thomas Road, the transportation system is failing to meet existing demands. Continued growth will only contribute to congestion.

Transit services in the project study area are limited at the current time. One of the highest volume bus routes in the Phoenix system is the West Thomas Road Green Line running between Central Avenue and the Loop 101. New bus rapid transit service on the I-10 West RAPID has been successful, carrying over 900 daily riders.

Additional travel options are needed in the corridor. The Arizona Department of Transportation (ADOT) is starting projects to widen I-10 west of Interstate 17 (I-17) to the west. The widening projects were authorized by voters in 2004. Construction completion is scheduled for 2012. The I-10 West Corridor Alternatives Analysis will need to coordinate with ADOT to determine the best use of the reserved right-of-way.

2.1 OVERVIEW OF POPULATION, LAND USE AND ECONOMIC DEVELOPMENT TRENDS

The City of Phoenix, which spans approximately 515 square miles, is the largest city in Arizona, and the fifth largest in the nation. The Arizona Department of Commerce estimates the 2006 population of the City of Phoenix at approximately 1.5 million. The Maricopa Association of Governments (MAG) estimates the population of the City of Phoenix to grow to approximately 2.2 million by 2030.

By comparison, MAG estimates that the metropolitan region had a population of 3.7 million in 2006, increasing to 6.1 million by 2030. Population is expected to increase at the rate of 2.1 percent per year, adding over 2.5 million people over the period. Employment is projected to increase from 1.7 million in 2006 to 3.3 million in 2030, an increase of 1.6 million or 2.6 percent per year.

The West Valley, including the cities of Goodyear, Buckeye, Tolleson, Avondale, Litchfield Park, Surprise, El Mirage, Youngtown and portions of unincorporated Maricopa County (including Sun City), encompass the area influencing travel to and from the I-10 West Corridor corridor. As shown in Table 1, population in the West Valley is expected to more than double and employment is expected to be four times higher by 2030.

Table 1 – I-10 West Corridor Influence Area Population and Employment Growth

	Population	Employment
2005	338,422	92,371
2030	1,109,464	463,140
Change	+ 771,042	+ 370,769
Percent Change	228%	401%
Annual Growth Rate	4.9%	6.6%

Source: MAG; May 2007

It is interesting to note that the West Valley cities in the influence area will be responsible for over 30 percent of the population growth in the region and more than 23 percent of the employment growth in the region over the next 25 years.

Population density is expected to be highest north of I-10 between I-17 and Loop 101 by 2030. 2030 employment density appears to be concentrated south of I-10 and along the Loop 101. Figures 3 and 4 show the percent of households with zero autos (as compared to the total number of households) by Traffic Analysis Zone (TAZ) for both 2004 and 2030.

Concentrations of zero-auto households, an indicator for potential transit dependent populations, are located north and immediately adjacent to the I-10 corridor in 2030. Percentages appear to be growing west of I-17 between 2004 and 2030. Overall, within the study corridor area, zero auto households are expected to increase nearly 15 percent by 2030.

Figure 3 – 2030 Zero Auto Households

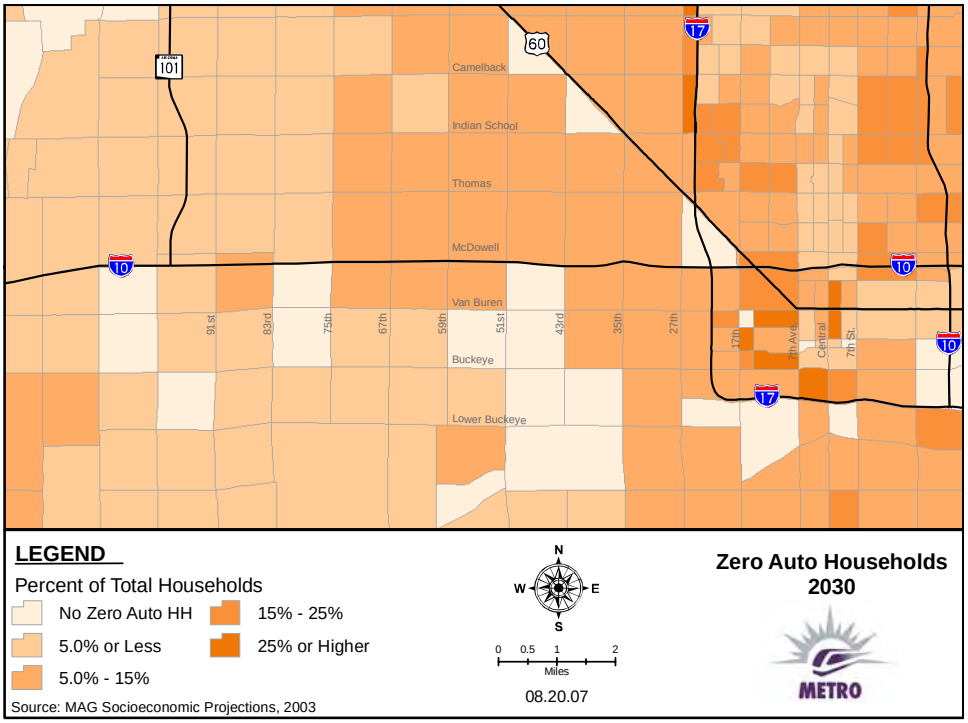


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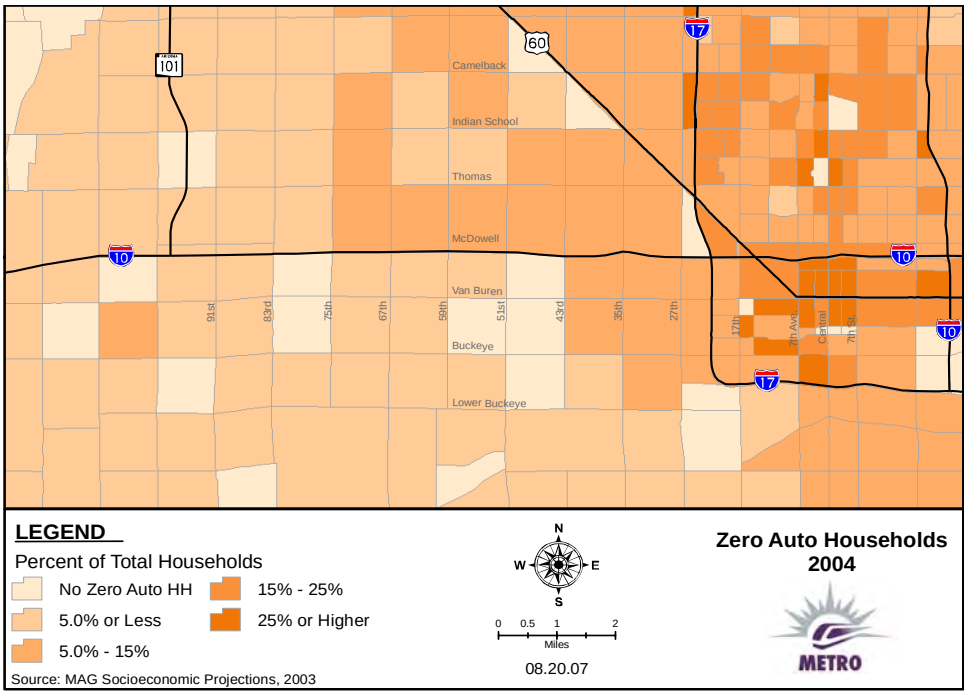
Figure 4 – 2004 Zero Auto Households



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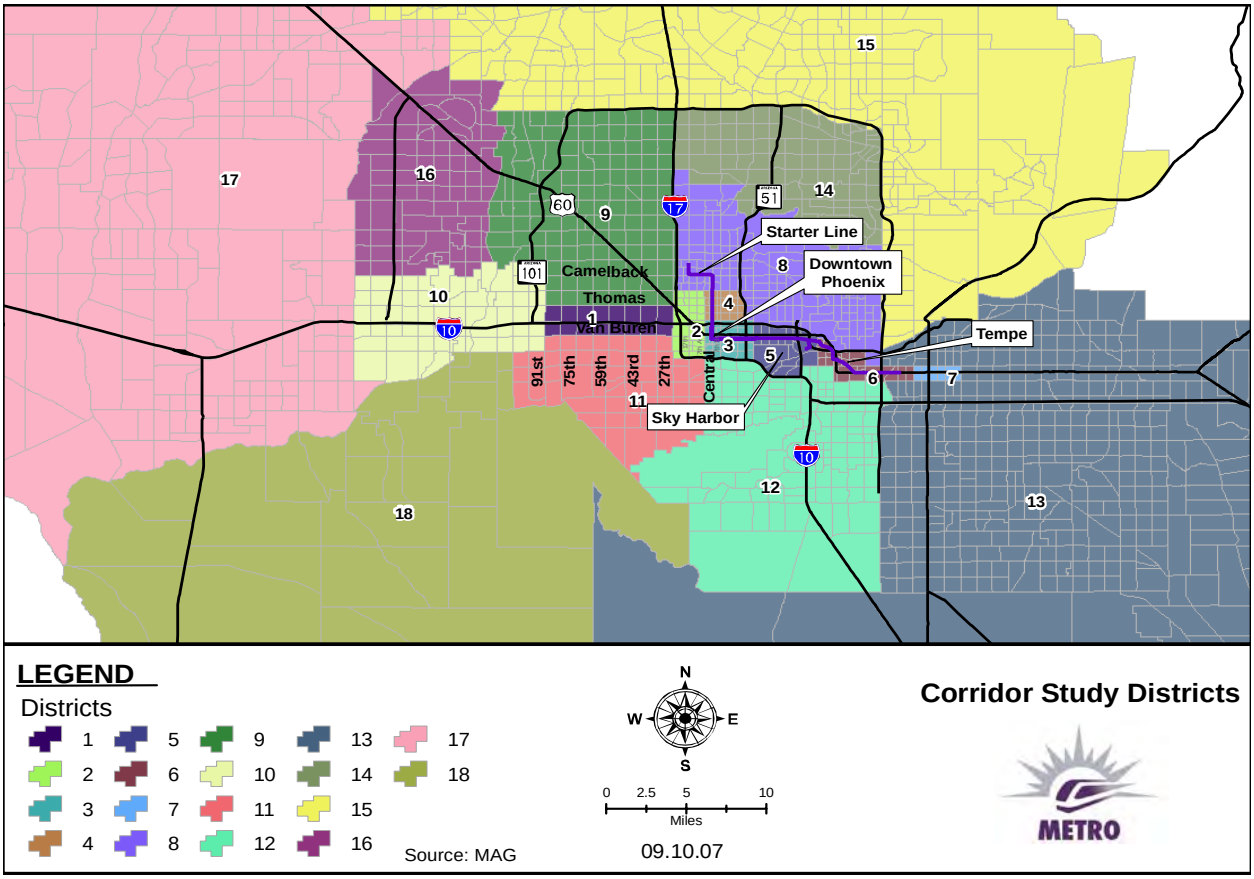
2.2 TRAVEL PATTERNS

Potential district-to-district travel demand travel was identified by reviewing 2030 person trips to and from Districts 1, 2 and 3. These three districts encompass the project corridor (Figure 5). Person trips from Districts 9, 10 and 11 provide insight into the primary 2030 travel patterns for the I-10 West corridor. District 9 covers areas north of the I-10 West corridor, between I-17 and the Agua Fria River. District 10 covers I-10 as it continues west of the Loop 101 into the fast growing Buckeye area. District 11 covers areas south of the 1-10 west study corridor.

Figure 5 – I-10 West Corridor Districts



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Preliminary analysis shows substantial person trips coming from outlying districts (9, 10, and 11) to study corridor districts (1, 2, and 3). Person trips are highest to District 1 and District 3 from all three outlying districts. District 1 has the highest number of person trips both coming and going, in relation to Districts 9, 10 and 11. District 9, which represents a substantial part of the West Valley, is expect to produce over 130,000 person trips to the study corridor and attract nearly 80,000 person trips by 2030. These patterns are summarized in Table 2.

Table 2 shows the estimated number of 2030 person trips to and from study area districts (1, 2 and 3) and influence area districts (9,10 and 11). This provides an understanding of trip patterns between districts. District 3, which includes downtown Phoenix, attracts a significant amount of trips from the other two study corridor districts. Person trips from District 1 are almost equally split between District 2 and 3.

Table 2 – 2030 Person Trips for Study Area and Influence Area Districts

	To District					
From District	**1**	**2**	**3**	**9**	**10**	**11**
1	**128,806**	**11,252**	**12,533**	**55,092**	**22,726**	**33,845**
2	**6,369**	**25,095**	**23,175**	**12,721**	**1,715**	**8,980**
3	**6,929**	**19,520**	**123,787**	**12,156**	**3,318**	**12,870**
9	**73,370**	**25,883**	**31,862**	**1,487,340**	**72,924**	**52,311**
10	**28,135**	**3,730**	**8,188**	**62,590**	**465,873**	**35,524**

2.3 TRAVEL OPERATIONS

I-10 West Operations

The portion of I-10 through the study area corridor carries some of the highest volumes by segment for any highway in the region. The segment between I-17 and Loop 101 shows volumes in the top five in the region on a daily and peak-period basis according to the MAG report, "Freeway Traffic Conditions and Trends in the Phoenix Region, 2004". This report assembled actual count data from 58 different Traffic Management System (TMS) sites around the region used by ADOT.

This segment of I-10 carried between 175,000 and almost 200,000 vehicles per day in both directions in 2004. Typically the segment has four general-purpose lanes and a High Occupancy Vehicle (HOV) lane in each direction. The HOV lane terminates west of 83rd Avenue. An exclusive bus-only ramp leads to and from the 79th Avenue overpass for access to the park-and-ride at that location. Of the total daily volume, the HOV lane carried between 11,000 and 12,500 vehicles in each direction.

Traffic counts and speed information is collected at the stations in the corridor. Data from the TMS reports is presented in Table 3.

Table 3 – Key Operating Statistics for I-10 between I-17 and Loop 101

Segment/Direction and Peak-Period	Total Volume	General-Purpose per Lane Volume	HOV Lane Volume	Level of Service	Hours of Congestion (Speed less than 50 MPH)	Percent Weekdays with Congested Speeds
Eastbound – AM Peak Hour						
79th Avenue	5,490	1,130	970	E	0.8	50%
55th Avenue	5,410	1,105	990	E	1.5	61%
33rd Avenue	7,100	1,480	1,190	F	1.1	69%
Westbound – PM Peak Hour						
79th Avenue	5,540	1,110	1,140	E	0.0	0%
55th Avenue	7,510	1,580	1,200	E	0.1	0%
33rd Avenue	7,860	1,520	1,780	E	0.0	0%

Source: Freeway Traffic Conditions and Trends in the Phoenix Region, 2004; MAG

Traffic operations on I-10 in 2004 showed significant congestion in the eastbound direction in the morning peak period. Volumes build in the eastbound direction as the freeway nears the central portion of the region. At least half of the weekdays experienced congested speeds, with frequent incidents such as accidents reducing operations to poor levels of service. Traffic operations in the westbound direction are more uniform as traffic leaves the central area and is distributed on the way west. The HOV lane volumes are highest in the westbound direction during the evening peak period compared to the morning peak period.

Interstate10 is also a major truck route between Phoenix and California. ADOT counters obtain vehicle type information at the TMS stations. In this segment, trucks constitute between 12% and 13% of all vehicles. Truck volumes are between 11,000 and 12,500 per day.

Existing Fixed Route Transit Service

Fixed route transit service within the study area is provided in a hierarchy of sub-modes including circulators, local bus, express bus and RAPID bus. Compared to fixed route service provided throughout the region, the study area has a relatively high level of service.

Local bus routes provide main-line transit service on the study area's one-mile grid network of streets. Seven of the nineteen local bus routes operate at a peak frequency of fifteen minutes or better. Local bus service is provided seven days per week (except Avondale connections) with

most local routes operating from approximately 5:00 AM to 10:00 PM; however, more than half the local bus routes operate expanded service hours on weekdays.

The express and RAPID routes provide weekday peak period commuter service between the western portion of the study area and the Phoenix CBD/State Capitol. RAPID service is similar to express but differentiated by providing a higher number of trips and fewer passenger stops. Currently one express route and one RAPID route serve commuters originating from within the study area. Other express and RAPID routes serve the Phoenix CBD and State Capitol area, but do not directly serve the study area commuter market.

Circulators are operated on a free fare basis to provide local circulation and access to the other fixed route transit modes operating in the study area. The Downtown Area Shuttle (DASH) operates as a high frequency weekday shuttle connecting businesses, parking facilities and entertainment venues in the Phoenix CBD/State Capitol area. Finally, service is provided in the Maryvale and Desert Sky neighborhoods through Maryville Area Ride for You (MARY) that circulates through designated neighborhoods approximately every thirty minutes, seven days a week. Existing fixed route service is depicted in Figure 6.

Figure 6 – Existing Fixed Route Transit Service

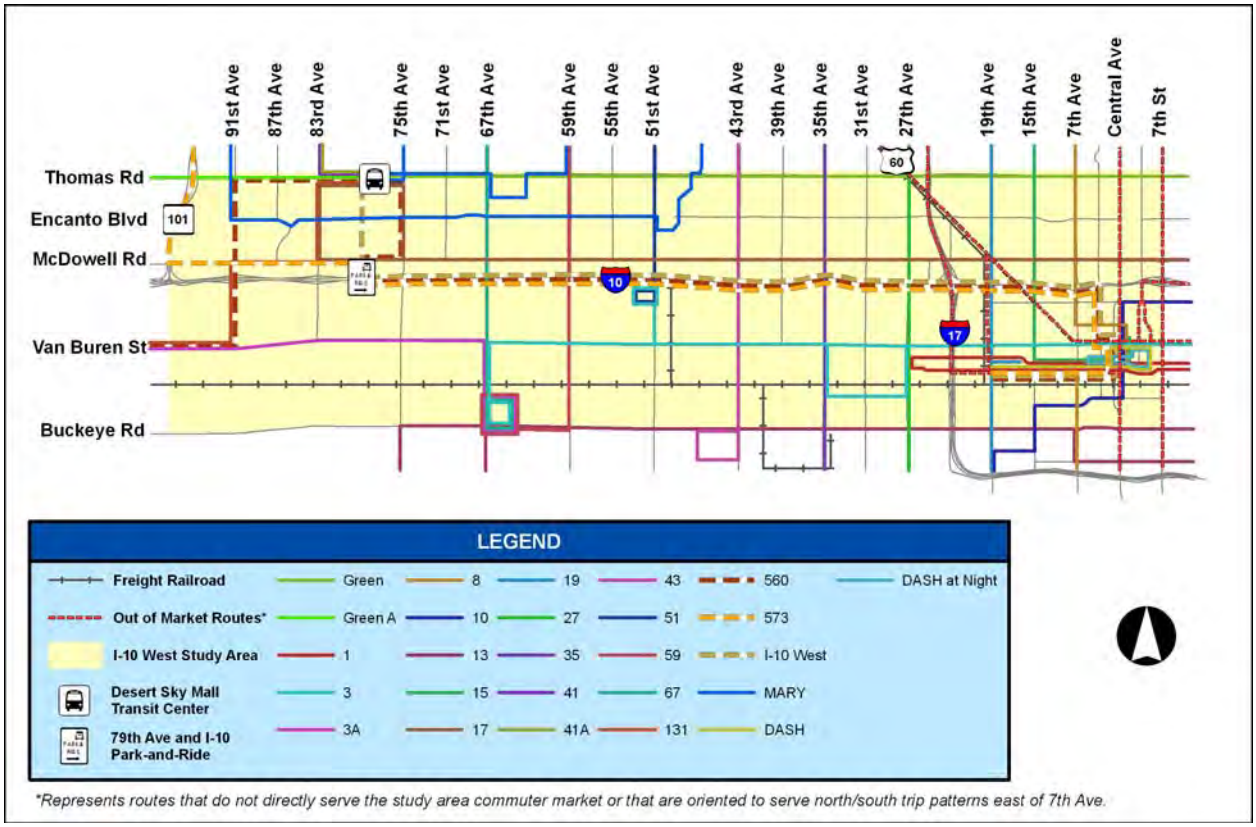

Table 4 identifies the existing fixed route transit services operating in the study area and average weekday boardings. Routes designated with an “A” are Avondale connection routes (i.e. Green A). Avondale connection routes do not operate on Sundays.

Table 4 – I-10 West Existing Transit Operations

Mode	Total Routes[1]	Total Daily Trips	Average Weekday Boardings		Percent Change
			1999	2006	
Local	20	1,543	57,333	79,309	38.3%
Circulator	3	176	273	1,679	515.0%
Express	2	16	247	118	-52.2%
RAPID	1	25	0	922	100.0%
Total	**26**	**1,760**	**57,853**	**82,028**	41.8%

[1] *Statistics do not include routes that primarily serve commuter markets outside of the study area or that are oriented to serve north/south trip patterns east of 7th Ave.*

Planned Fixed Route Transit Service

Significant investments in fixed route transit operations within the study area have already been implemented through the City of Phoenix Transit 2000 Plan; however, the RTP identifies extensions of existing study area routes to destinations outside of the study area. In addition, one new express route and two new local routes are identified in the RTP. The new express route (Loop 303 Express) will provide a link between Desert Sky Mall and the cities of Surprise, Peoria and Glendale via I-10 and Arizona Loop 303. The two new local bus routes on 99th Avenue and 83rd/75th Avenues fill in gaps in the arterial street grid system in the western portion of the study area.

Ridership Trends

Regional transit patronage has had significant gains since the City of Phoenix voters approved a 0.40 percent sales tax in 2000 to fund city-wide transit improvements. The regional impact of Phoenix's sales tax measure is significant as nearly 72 percent of all passenger boardings in 2000 occurred within the city's boundaries. Regional transit ridership increased 35.9 percent between 1999 and 2006. The year 1999 is significant as it is the year before any sales tax related transit improvements were funded in the City of Phoenix. During the same time period, ridership increased even more sharply (41.8 percent) on the routes serving the study area. A 41.8 percent increase in ridership represents 24,175 additional passenger boardings each weekday, bringing the total daily ridership on the routes serving the study area to 82,028. Table 4 identifies ridership changes between Fiscal Year 1999 and 2006.

In addition to having positive ridership gains over the last seven years, six of the bus routes in the study area are ranked in the top seven of all routes in the region for productivity (average daily ridership). With 11,485 average passenger boardings each weekday, the Green Line on Thomas Rd transports more passengers than any other bus route in the region during Fiscal Year 2006. During this same fiscal year, average daily ridership on the Green Line surpassed 12,750 passenger boardings during the month of September.

The other five routes operating in the study area that are ranked among the top six routes in the region are Route 41 (Indian School Rd), Route 19 (19th Ave), Route 17 (McDowell Rd), Route 3 (Van Buren St) and Route 35 (35th Ave). The only other route included in the top six routes in the region is the Red Line, which operates in generally the same alignment as the light rail transit minimum operating segment (MOS) scheduled to open for revenue service in late 2008.

A closer look at the ridership data for the routes directly serving I-10 and operating in the same directional flow (east/west) up to a mile on either side of the interstate reveals a significant demand pattern. Three local bus routes, a RAPID route and an express route operate within this two-mile wide corridor Between Van Burn Street and Thomas Road. These routes include the Green Line (Thomas Road), Route 3 (Van Buren Street), Route17 (McDowell Road), I-10 West RAPID and Route 560 Express (Avondale). Combined, more than 29,300 passengers boarded these routes each weekday during Fiscal Year 2006, representing approximately 14.7 percent of all fixed route boardings within the region (ridership data includes all boardings for each route inside and outside of the study area).

Transit Capacity

Based on the available ridership data, bus routes with an east/west orientation within the study area generally have the highest passenger activity. Isolating the five east/west routes that operate within the corridor between Van Buren Street and Thomas Road, an average of approximately 68 passenger boardings per trip were documented in Fiscal Year 2006; however, the Green Line (Thomas Road) has the highest level of passengers per trip, with 83. These routes are typically operated with a standard 40-foot transit coach (35 seats) or a 60-foot articulated coach that can accommodate 55-seated passengers. The average passengers per seat on the Green Line are 2.4 and 1.5 for 40-foot and 60-foot coaches respectively. A high ratio of passengers per seat is an indicator of either high seat turnover (short passenger trips) or overcrowding.

A review of trip checks conducted by City of Phoenix Public Transit Department contract staff indicate that the Green Line, Route 3 and Route 17 are experiencing overcrowding within the study area boundaries. The highest number recorded on board a bus at any location within the study area was 89 passengers. On a 55-seat coach, this represents a passenger per seat ratio of 1.61. Finally, of the 263 trip checks reviewed, 11.0 percent showed passengers in excess of seated capacity within the study area. Table 5 identifies the sample population size and characteristics.

Table 5 – Trip Check Samples

Route	Total Trip Checks Sampled	Trip Checks with Passengers Exceeding Seats in Study Area	Percent Samples Exceed Seated Capacity	Maximum Boardings	Study Area Maximum Boarding Location
Green	61	15	24.6%	89	Thomas & 19th Ave
3	78	11	14.1%	58	Van Buren & 7th Ave
13	87	0	0%	29	Buckeye & 75th Ave
17	37	3	8.1%	42	McDowell & 11th Ave
Total	**263**	**29**	**11.0%**	**NA**	**NA**

Source: Veolia Transportation, 2007

2.4 TRANSIT FACILITIES

Existing Transit Facilities

The study area includes a diverse range of fixed route transit facilities including a park-and-ride, transit center, and a new fixed route bus maintenance operations facility scheduled to open in late 2007. In addition to the major passenger and operations facilities, the study area contains a network of bus stops ranging in classification from a simple signpost bus stop to a RAPID

station compete with custom passenger shelter and seating and electronic real-time passenger information signs. Generally, bus stops are located every one-eighth to one-quarter of a mile depending upon nearby land uses, activities and other considerations.

The 79th Avenue Park-and-Ride serves Routes 17 and 560 as well as the I-10 West RAPID. Facility amenities include covered parking, staffed security, “next-bus” variable information sign supporting the I-10 West RAPID service and a direct access on/off ramp connecting the facility with I-10.

Passenger transfers are accommodated at the Desert Sky Transit Center. This publicly owned facility is located in the parking lot of Desert Sky Mall near Thomas Road and 75th Avenue. The facility serves the following routes: Green Line, Green Line A, Route 17, Route 41, Route 41A, Route 131, Route 560 and the I-10 West RAPID.

A new fixed route bus maintenance facility, known as the Phoenix West Division, is scheduled to open in late 2007. This publicly owned facility will serve as a maintenance and operations base for up to 250 fixed route vehicles. The new facility will replace an existing facility that is currently located in Glendale, but leased by a City of Phoenix Public Transit Department maintenance and operations contractor.

Planned Transit Facilities

Based upon the RTP and Phoenix 2000 Transit Plan, there are no major fixed route transit facilities planned for the study area.

2.5 TRAVEL TIME SAVINGS

Travel times for both automobile and transit will be reviewed in the AA to assess to what extent high capacity transit could improve travel time in comparison to automobiles. The MAG 2006 Freeway Level of Service Study found persistent congestion during both the morning and evening peak hour periods throughout the study corridor.

Initial results from the MAG 2030 travel demand model indicate Levels of Service E and F for the I-10 West corridor, which will have a direct impact on travel time within the corridor in the future.

3.0 TRAVEL DEMAND METHODOLOGY FORECAST

In January of 2007 MAG, METRO and RPTA developed an action plan to collect data for use in transit travel forecasting. The need for additional data collection was identified and highlighted in the recommendations of the 2006 MAG Model Peer Review Panel.

Data collection efforts include the following:

1. A survey of Arizona State University student and employee travel patterns related to long range master planning for satellite campuses has been completed by ASU. MAG is working with METRO staff to incorporate survey results into the MAG Travel Forecasting modeling system.

2. Results on information about premium transit service in the Phoenix Metropolitan area as represented by a survey of RAPID Bus Riders was completed in February 2007. These results are currently being used to update the MAG Mode Choice model for the premium and drive to transit markets. This task is expected to be complete by November 2007.
3. RPTA is in the process of conducting a region-wide 2007 On Board Bus Survey. A draft survey questionnaire has been developed and will be tested in August of 2007 with the full survey to take place in October of 2007.

Once these stand-alone models or model updates to the MAG regional forecasting model have been completed, a travel methodology report will be prepared. The report will incorporate this latest information into the methodology report for FTA, consistent with long-range forecasting in the Phoenix region.

4.0 EVALUATION CRITERIA

Evaluation criteria will be developed during the scoping process and tied to the project goals and objectives that will also be developed. The criteria will be refined at the initiation of the Tier 1 analysis of the conceptual alternatives. For purposes of the Tier 1 analysis, evaluation criteria will be primarily based on a refined statement of project needs. The criteria will be oriented to a logical and reasonable assessment of the conceptual alternatives, combining qualitative and quantitative measures for the evaluation.

At the beginning of the Tier 2 analysis of the detailed alternatives, evaluation criteria will be revised and refined and will incorporate agency and community comments including information received during scoping. The criteria will be quantitative in nature with a focus on transportation performance, impacts, costs and operations improvements. Criteria will also be developed to provide an early comparison for the FTA New Starts evaluation.

5.0 DESCRIPTION OF CONCEPTUAL ALTERNATIVES

5.1 NO-BUILD

The No-Build Alternative will incorporate only those changes in the transportation network which are already approved or programmed by the Year 2030. The No-Build Alternative would consist of a modified plan of existing and committed highway and transit improvements as defined by the RTP. The No-Build Alternative definition will be coordinated with the cities of Phoenix and Tolleson. METRO and MAG have begun coordination to establish the list of highway and arterial roadway projects that will be included in the No-Build Alternative.

5.2 TRANSPORTATION SYSTEM MANAGEMENT (TSM)

The TSM Alternative would include relatively low-cost safety, operational and capacity enhancements to the existing transportation system. This alternative would not include a major investment and would represent a less-capital intensive improvement strategy to address

identified project needs in the I-10 West corridor. The TSM Alternative would be focused on increased bus services and selected facility improvements and would implement all of the projects in the No-Build Alternative. Improvements to the RAPID service will be the key component of this alternative.

5.3 BUILD ALTERNATIVES

A range of modal and alignment alternatives will be evaluated for the project corridor. Modal alternatives would include both LRT and Bus Rapid Transit (BRT) technologies operating in exclusive guideway. Project alternatives will also include the consideration of Express Bus operating in HOV lanes on I-10 and alternatives that are developed through the project scoping process.

The primary set of alignment alternatives will be oriented along the I-10 right-of-way. Alignment alternatives along the major east-west arterials such as Buckeye Road, Van Buren Avenue, McDowell Avenue and Thomas Road will also be considered. East of I-17, alignment alternatives will need to follow city streets to make connections to the downtown Phoenix transit facilities including the Downtown Phoenix Transit Center and the Central Phoenix/East Valley LRT line. All build alternatives will be inclusive of those projects contained in the No-Build Alternative and the highway element of the TSM alternative.

6.0 SCHEDULE

The preliminary schedule for the I-10 West Alternatives Analysis phase is attached to this document. The initial phase of the transit project is focused on the alternatives analysis to respond to the needs for ADOT in determining the preferred location and configuration of the transit element relative to the highway widening projects. Concentrating on the alternatives analysis will help METRO and project participants to make decisions to reduce the number of modal and location alternatives within the National Environmental Policy Act process but prior to beginning the detailed environmental studies.

Currently, scoping is anticipated in Fall 2007, adoption of the Locally Preferred Alternative in Fall 2008, and preparation of the Draft EIS is expected to occur between Summer 2008 and Spring 2009.Submittal of the Draft EIS to FTA would be tentatively scheduled for May 2009. Application to enter Preliminary Engineering is anticipated in the Fall of 2009.

I-10 WEST

ALTERNATIVES ANALYSIS/ ENVIRONMENTAL IMPACT STATEMENT

DRAFT
PURPOSE AND NEED

November 2008

METRO

METRO I-10 West Corridor Alternatives Analysis
Draft Purpose and Need

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1.0 INTRODUCTION

This chapter presents the statement of purpose and need for the Interstate 10 (I-10) West Corridor Alternatives Analysis (AA) study. The chapter begins with an introduction of the proposed project, followed by a summary of pertinent background information. The project purpose and need are outlined for the corridor and outlying region based on existing conditions and information contained in current planning documents.

1.1 PROJECT BACKGROUND AND DESCRIPTION

Valley Metro Rail, Inc. (METRO), in cooperation with the Federal Transit Administration (FTA), is conducting a study to analyze potential high capacity transit improvements in the I-10 West Study Area, which extends along the I-10 freeway west of Downtown Phoenix in Maricopa County, Arizona to State Route 101 (Loop 101) (Figure 1). The Study Area is bounded by Thomas and Buckeye Roads to the north and south, respectively. When discussed as the "I-10 West Corridor," the document is referring to the select portion of the Study Area identified in the 2003 Maricopa Association of Governments (MAG) *Regional Transportation Plan* (RTP) that is centered along I-10, as illustrated in Figure 2.

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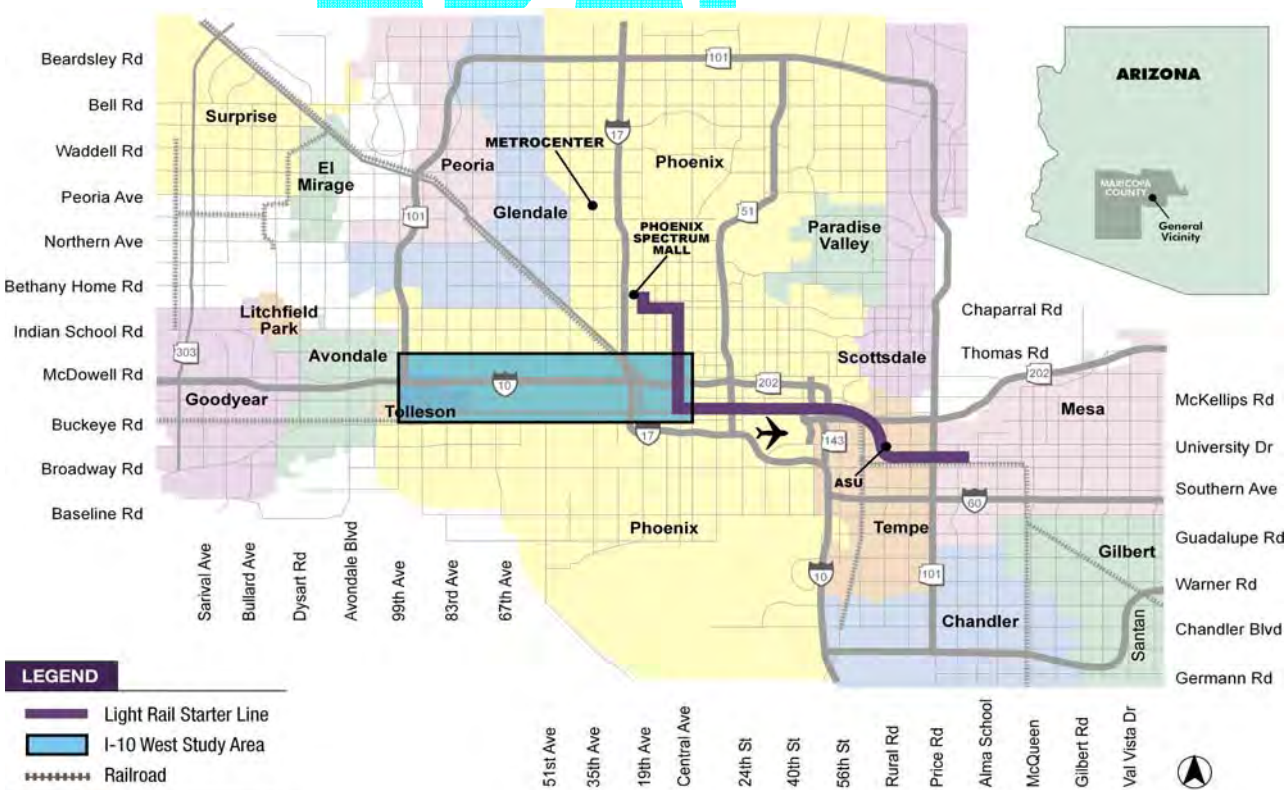
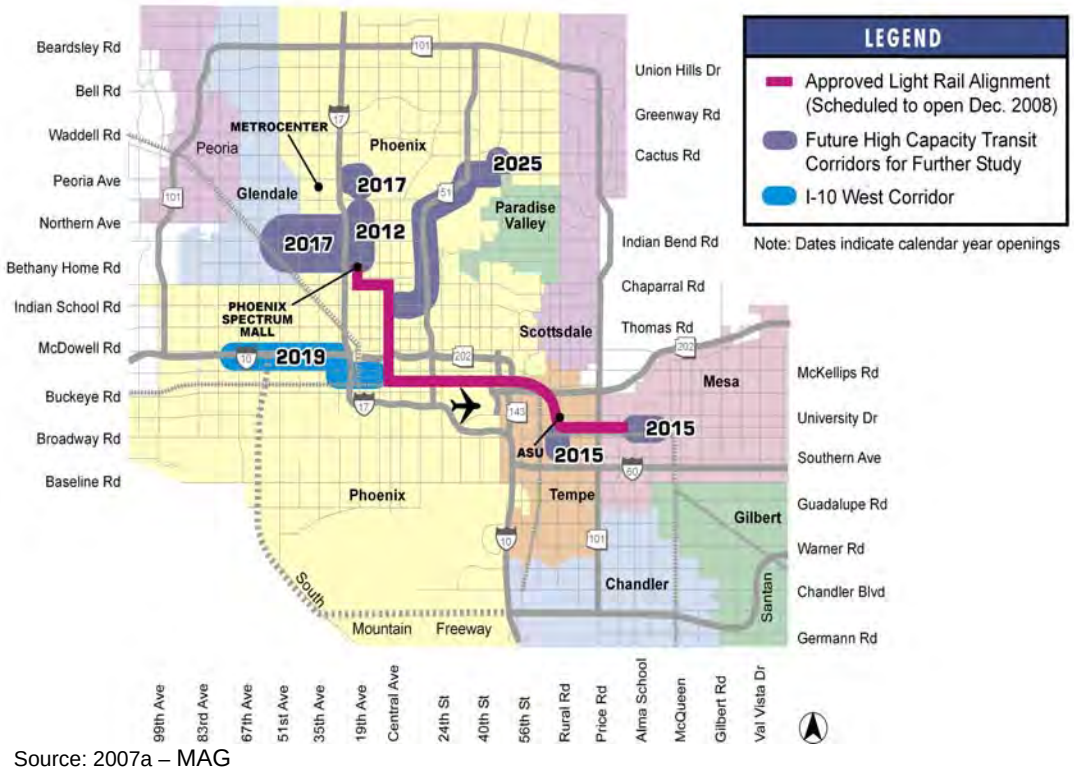
Figure 1 Vicinity Map



Source: 2007 – METRO

High capacity transit improvements under consideration include light rail transit (LRT), bus rapid transit (BRT) in high-occupancy vehicle (HOV) lanes, and BRT in an exclusive guideway. An alternative to expand express bus service in HOV lanes is also under consideration. The proposed project would serve existing and projected travel demand through the design year 2030 along this east-west corridor centered along a section of I-10. This corridor serves as the primary transportation corridor between downtown Phoenix and the cities of Avondale, Tolleson, Litchfield Park, and Goodyear. To a greater extent, the portion of I-10 through the Study Area also serves communities further west including the cities of Buckeye, El Mirage, Youngtown, and portions of unincorporated Maricopa County.

Figure 2 High Capacity Transit Corridor Extensions



Source: 2007a – MAG

The proposed high capacity transit improvements along the I-10 West Corridor would provide essential transportation capacity within the Study Area and outlying region that are currently experiencing a substantial amount of growth, as indicated in Section 1.1.1. As population increases and development expands throughout the Southwest Valley and outlying areas, I-10 and arterial streets will continue to experience intense peak-period congestion.

The passage of Proposition 400 by Maricopa County voters in November of 2004 signified a substantial increase in the amount of funding for public transit. Over the 20-year life of the half-cent sales tax, it is anticipated that about $4.7 billion will be raised for public transit projects (MAG 2007a). Proposition 400 also represented the public's interest to provide a transportation system that could accommodate regional growth.

Funds from the Proposition 400 half-cent transportation sales tax extension were allocated toward the 57.7-mile LRT system identified in the 2003 MAG RTP. The 20-mile Central Phoenix/East Valley (CP/EV) LRT Starter Line is scheduled to open for service through the cities of Phoenix, Tempe, and Mesa beginning in December of 2008. The 2003 RTP identified an 11-mile extension along I-10, from the CP/EV LRT Starter Line west to the vicinity of 79th Avenue, as one of six additional light rail/high capacity transit corridors within Maricopa County (MAG 2003a), illustrated in Figure 2. This segment of I-10, defined as the I-10 West Corridor, is scheduled to be in operation by 2019, with the remaining system to be operational by 2025.

The section of freeway through the I-10 West Study Area was not completed until the mid-1980's. A 15-mile section of highway from approximately 91st Avenue to 20th Street in Downtown Phoenix was considered the "missing link" as traffic utilized Buckeye Road (US 80) as the primary access route from the west to central Phoenix and the metropolitan region (Federal Highway Administration [FHWA] 1978). When this segment along I-10 was originally designed, a 50-foot median was preserved from the eastern intersection of I-10 and I-17 near 24th Street west to 91st Avenue with the potential for future transit options (FHWA 1978). The 50-foot median is described in the *Interstate 10 – 91st Avenue to Junction I-10 Final Environmental Impact Statement and Section 4(f) Statement* (1978).

As an additional improvement along I-10 in anticipation of future transit use, in 1988 the Arizona Department of Transportation (ADOT) began construction of an express bus facility located within the I-10 freeway median between 3rd Street and 3rd Avenue. This facility was designed to allow express buses to access the facility from exclusive bus-only entrance and exit (at 3rd Street and 3rd Avenue) lanes from the HOV lanes. During the construction of this facility, the station "shell" was completed and includes a partially completed station platform directly below Central Avenue, as well as three currently blocked off access points at the top of the structure to allow vertical circulation to Central Avenue. The *Papago Intermodal Transfer Station Feasibility Study*, completed by the Regional Public Transportation Authority in 2004, examined the feasibility of completing the station as a bus transfer center or converting the facility into a light rail transit station. The study concluded that use of the facility for either transit option is feasible with major structural improvements to the freeway and transit facility. Today, Margaret T. Hance Park, a passive-use recreational facility, sits on top of the unfinished station facility.

1.1.1 Population and Employment

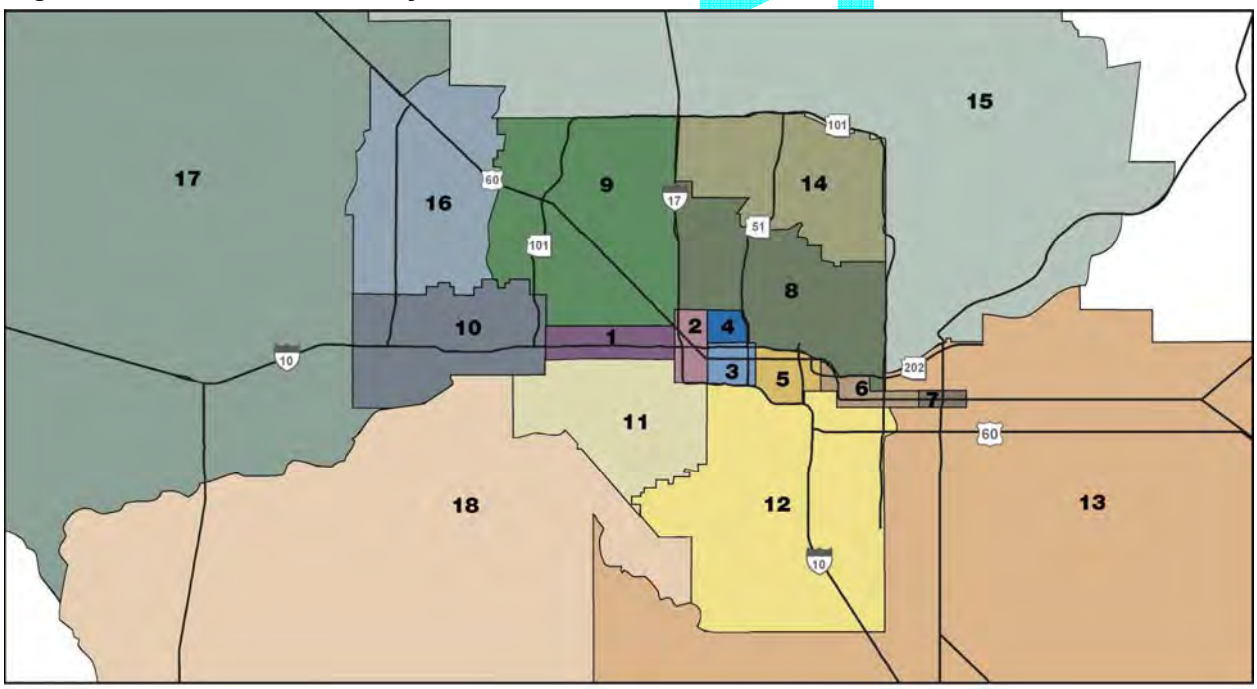
The *I-10 West AA/EIS Transportation Assessment* (METRO 2008) presents an analysis of population and employment characteristics and projections in the Study Area for the year 2030, the planning horizon year. For purposes of the analysis presented in the *Transportation Assessment*, the MAG region was organized into 18 distinct travel districts that are aggregations of Traffic Analysis Zones (TAZs) as shown in Figure 3. TAZs are areas delineated by transportation officials for tabulating traffic-related data and usually consist of one or more census tracts, census blocks, or block groups.

Several travel districts are directly related to the I-10 West Corridor and comprise the "Southwest Valley" for purposes of this document, including:

- District 1 – Along I-10 between 27th Avenue and 91st Avenue within the study area
- District 2 – District along the I-17 portion of the study area, includes portions of downtown
- District 10 – West of the Study Area and Loop 101
- District 11 – District south and adjacent to the Study Area
- District 17 – West of District 10 includes the far West Valley
- District 18 – District southwest of the Study Area

For purposes of population and employment analysis, the Southwest Valley area includes the cities of Goodyear, Avondale, Tolleson, Buckeye, Litchfield Park, El Mirage, and portions of Phoenix (far western area), Surprise (far western area), and unincorporated Maricopa County. This area is a combination of travel districts (Districts 1, 10, 11, 17, and 18) as illustrated in Figure 3. Further, Districts 1 and 2 comprise the I-10 West Study Area for purposes of analysis presented in this section.

Figure 3 I-10 West Study Area Travel Districts



Source: 2008 – METRO

1.1.1.1 Population

The City of Phoenix, which spans 517.4 square miles, is the largest city in Arizona and the fifth largest in the nation in terms of population with 1.5 million inhabitants. In 2004 the Arizona Department of Commerce estimated the population of the City of Phoenix at approximately 1.4 million. MAG projects that the population of the City of Phoenix to grow to approximately 2.2 million by 2030.

By comparison, MAG estimates that the metropolitan region had a population of 3.7 million in 2004, increasing to 6.1 million by 2030. Population is expected to increase at the rate of 1.9 percent per year, adding over 2.4 million people over the period. As shown in Figure 4 and illustrated in Table 1, population in the Southwest Valley is expected to nearly triple by 2030 which will account for over 45 percent of the population growth in the region.

Table 1 Population Growth

	Population			
	2004	**2030**	**Change**	**Percent Change**
Region	3,681,025	6,135,000	2,453,975	67%
Southwest Valley	400,600	1,572,300	1,171,700	292%
I-10 West Study Area	160,616	222,678	62,062	39%

Source: 2008 – METRO

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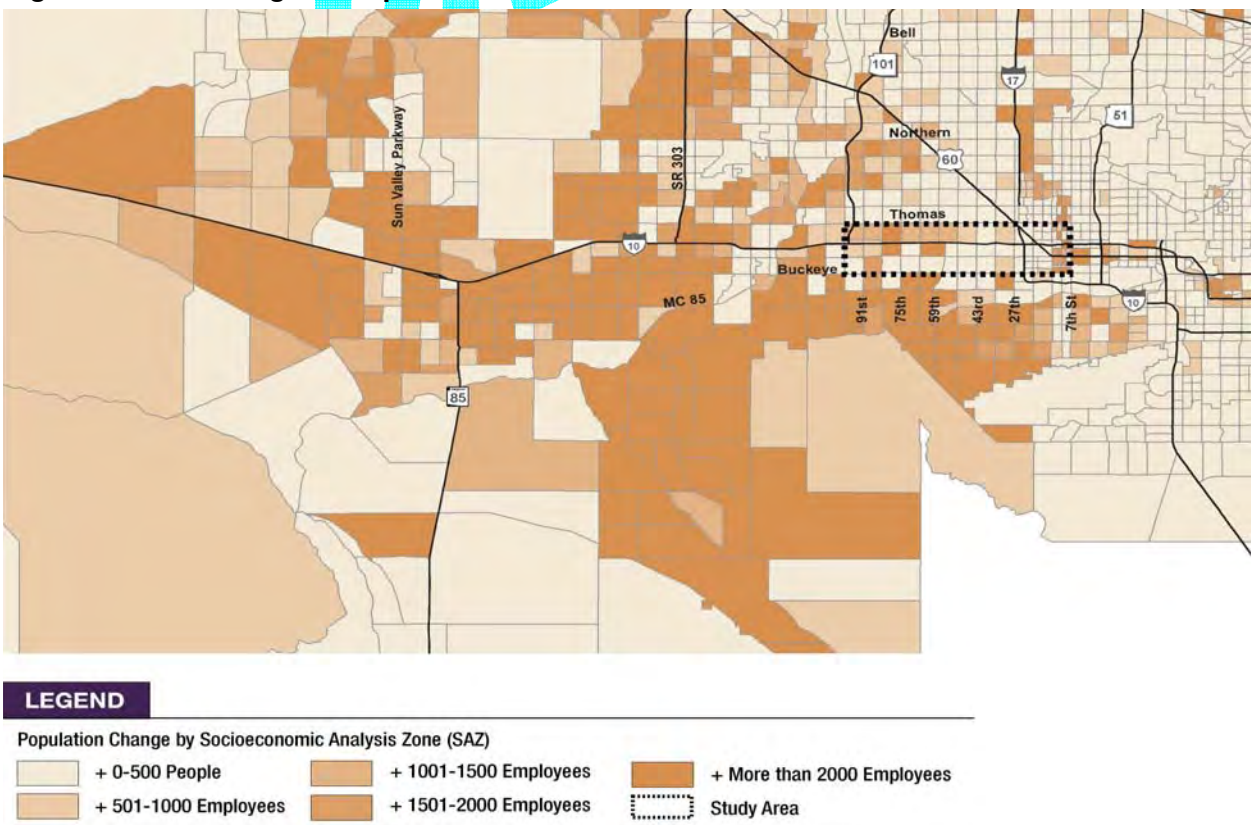
Figure 4 Change in Population 2004-2030



Source: 2008 – METRO

1.1.1.2 Employment

Employment for the entire MAG region is projected to increase from 1.7 million in 2004 to 3.3 million in 2030, an increase of 1.6 million at a growth rate of 2.6 percent per year. Employment in the Southwest Valley alone will grow by 371 percent at a rate of 6.1 percent per year over that same timeframe. Overall the Southwest Valley will account for more than 32 percent of the regional employment growth over the next 25 years. Employment in the Study Area will increase by 41 percent, increasing at a rate of 1.4 percent per year with the majority of the growth occurring west of 59th Avenue (see Table 2 and Figure 5).

Table 2 Employment Growth

	Employment			
	2004	**2030**	**Change**	**Percent Change**
Region	1,747,532	3,378,800	1,631,268	93%
Southwest Valley	139,500	656,900	517,400	371%
I-10 West Study Area	151,022	213,225	62,203	41%

Source: 2008 – METRO

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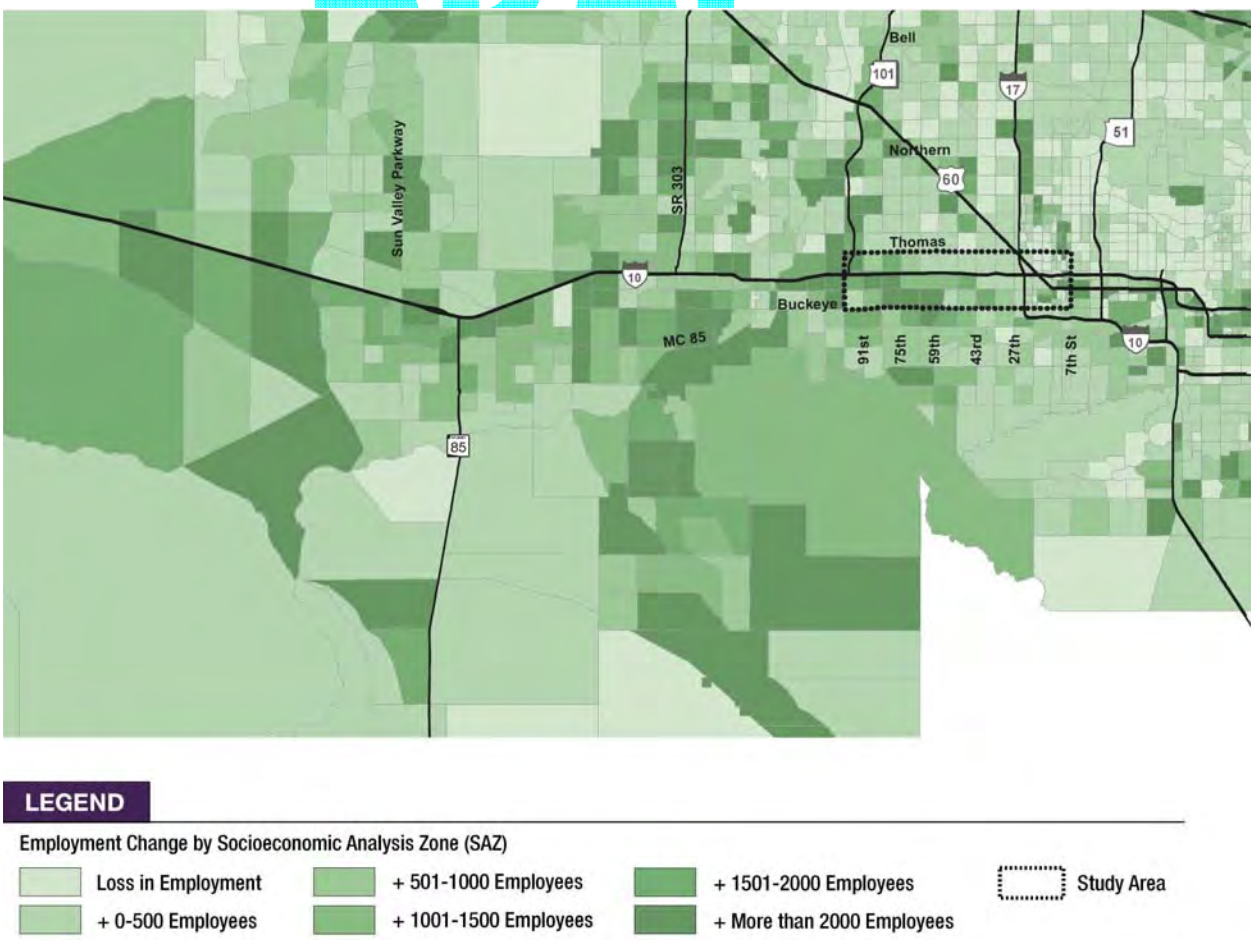
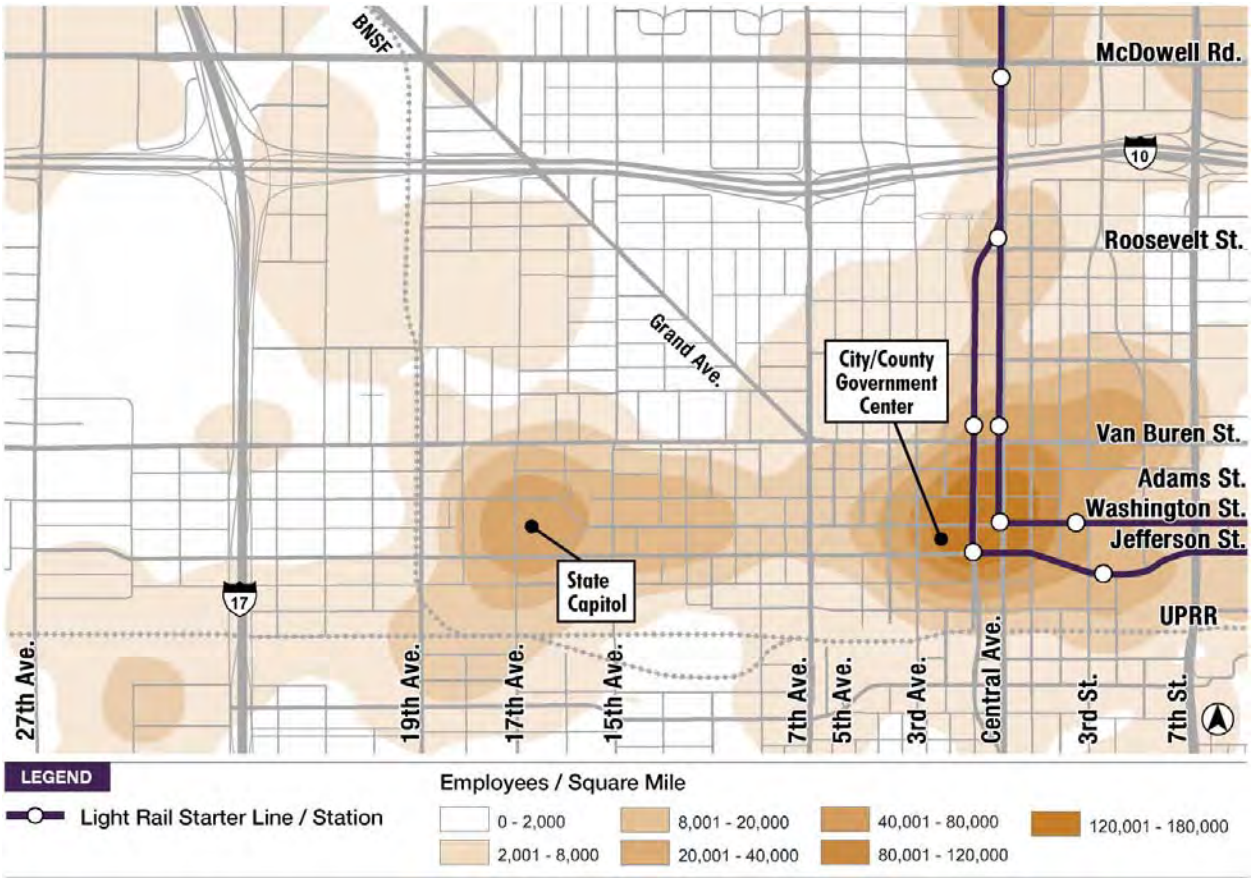
Figure 5 Change in Employment 2004-2030



Source: 2008 – METRO

Within the I-10 West Study Area, employment in Downtown Phoenix is mostly concentrated at the State Capitol and City/County Government Center as shown below in Figure 6. Approximately 120,000 to 180,000 employees per square mile work at the City/County Government Center, which is the largest concentration of employment within the study area. The CP/EV LRT Starter Line will serve this employment center in December 2008 once it is in operation. With approximately 20,000 to 40,000 employees per square mile, the State Capitol represents the second greatest concentration of employment within the Study Area. As illustrated in Figure 6 below, this employment density would not be directly served by the CP/EV LRT Starter Line.

Figure 6 Downtown Phoenix Employment Concentrations



Source: 2005 – MAG

1.1.2 Land Use Patterns

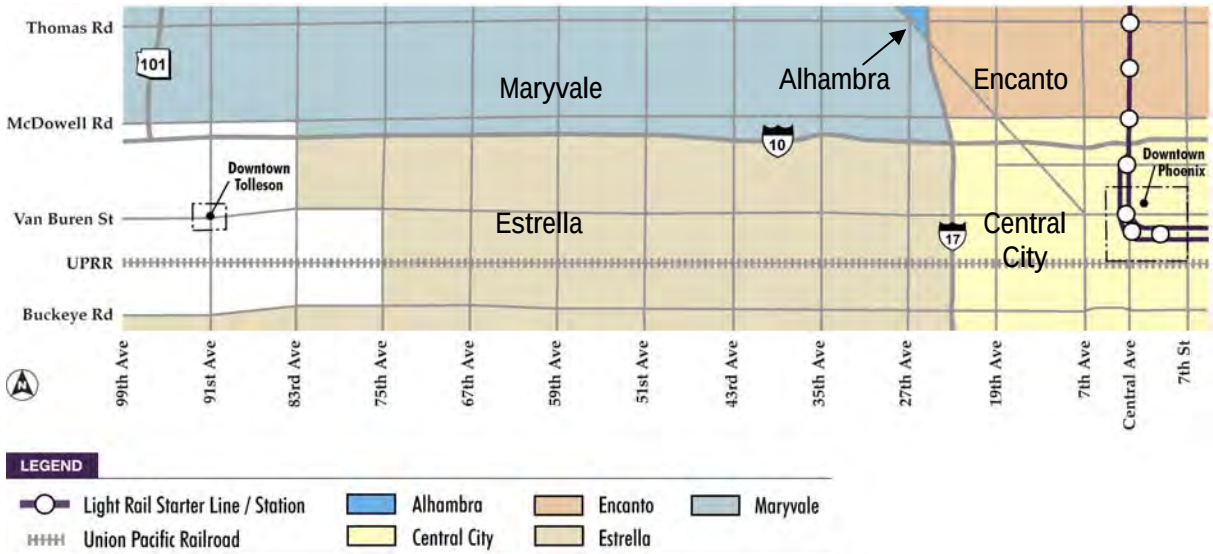
The Study Area contains a diverse range of land use including residential, industrial, commercial, public/government and agricultural uses that extends through western Phoenix and along the northern boundary of Tolleson. I-17 provides a physical barrier that separates the Study Area into two distinct planning areas. Downtown Phoenix, located east of I-17, includes a mix of residential, commercial, and government uses. Although the downtown portion of the Study Area is mostly built-out, several redevelopment projects are proposed including large-scale mixed-use developments, renovation of the State Capitol, and construction of new

government buildings. There is also a significant amount of surface parking and vacant lots located within downtown. Conversely, the area west of I-17 includes primarily residential and commercial uses, with industrial developments located along the south side of I-10. Several large vacant parcels exist in the western portion of the Study Area.

The City of Phoenix has adopted what is known as the "urban village model" by establishing 15 separate urban villages throughout the city. The intent of this model is to encourage village-serving uses to be concentrated in one or two places, thereby fostering local interaction and reducing travel times and trips. The urban village model also facilitates mass transit by providing a major destination specific to each village. Essentially, the urban village model promotes a sense of community and identity within the Phoenix metropolitan area (City of Phoenix 2001). Each village also has an established planning committee that plays a key role in local project development. These villages are referred to in this document as they relate to the I-10 West Study Area.

The I-10 West Corridor passes through a portion of five separate Phoenix urban villages: Central City, Encanto, Maryvale, Estrella, and a very small portion of Alhambra as shown on Figure 7. The Central City Urban Village is considered the urban center for the City of Phoenix. Downtown Phoenix, with its many government, business, cultural, and educational facilities is the focal point of the expanding metropolitan region. The Central City Urban Village is also home to several of the original Phoenix residential neighborhoods and subsequent historic districts. The Encanto Urban Village, located directly north of Central City, includes several key destination locations including museums and a theater associated with the Phoenix Arts District and the Arizona State Fairgrounds. The Maryvale and Estrella Urban Villages generally consist of residential and industrial land uses, respectively.

Figure 7 City of Phoenix Urban Village Boundaries



Source: 2001 – City of Phoenix

The City of Tolleson, which occupies the far southwest portion of the I-10 West Study Area, includes several unincorporated parcels of land owned by Maricopa County. Tolleson occupies approximately 6 square miles and borders the cities of Phoenix and Avondale. The I-10 highway, located along Tolleson's northern border, provides a direct link to the Greater Phoenix Region.

With a population of 6,520 in 2006, the Tolleson portion of the Study Area includes a mix of single-family residential, agricultural, industrial, commercial, government service uses, and vacant parcels (Arizona Department of Commerce 2007). An important area identified in the Tolleson General Plan (2005) is the Downtown/91st Avenue-Gateway/Growth Area, which is a linear corridor that serves as Tolleson's main entry street (91st Avenue) from I-10.

1.1.3 Study Area Transportation Deficiencies

Following the preparation of the *I-10 West Transportation Assessment* (January 2008), METRO has identified several transportation deficiencies within the I-10 West Study Area, mostly consisting of deficiencies within the I-10 freeway including:

- In the Southwest Valley, vehicle-miles and vehicle-hours traveled are predicted to increase approximately 144 percent and 257 percent by the year 2030, respectively. This is nearly twice as much as projected for the region overall, which is expected to experience an increase by 99 percent in vehicle-miles traveled and 180 percent in vehicle-hours traveled by the year 2030.
- By 2030, system average speeds are predicted to decrease by approximately 32 percent on the freeway system in the Southwest Valley.
- Traffic volumes are expected to have the most dramatic increase on the far west end of the corridor near the Loop 101.
- HOV volumes will more than double by 2030 at the west end of the I-10 West Corridor.
- I-10 is currently operating at highly congested levels (Levels of Service [LOS] E-F) in both the AM and PM peak periods for the primary travel movement (eastbound in the AM and westbound in the PM) and are expected to become much worse by 2030, with congestion for several hours in both the AM and PM peak periods in both directions.
- Travel times throughout the corridor are projected to increase substantially by 2030, including transit related trips which will see the largest increase in travel time.
- Existing transit ridership is growing within the Study Area, which is being served by some of the highest ranked routes in terms of ridership in the region. Consequently, overcrowding on various routes indicates additional transit capacity is needed.
- Unrestrained 2030 model runs, which assign traffic to the shortest path for each trip without any capacity constraints, indicate that a large amount of unmet travel demand is expected within the I-10 West Corridor. In that timeframe, projections show that travel demands will more than double from current levels.
- High-capacity transit options that serve major downtown Phoenix government employment centers, such as the State Capitol, in the I-10 West Corridor are limited.

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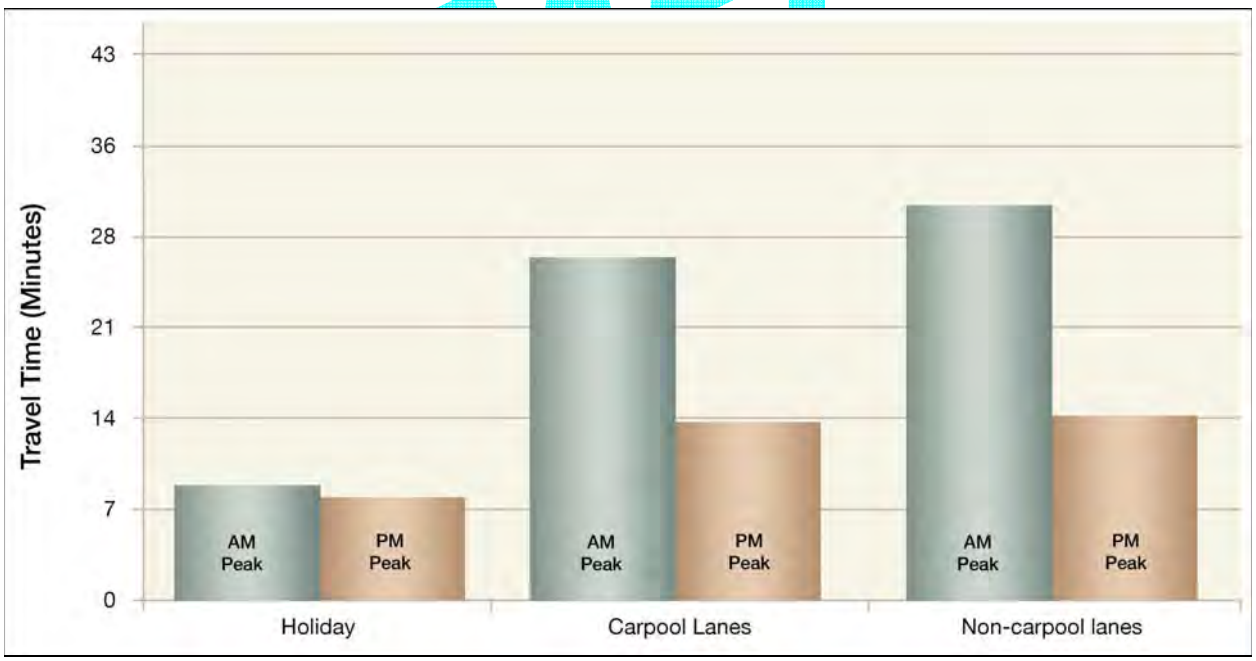
Conversely, CP/EV LRT Starter Line scheduled for operation in December 2008 will directly serve the city and county downtown offices.

- Between the months of January and March of 2008, a "floating car" survey was performed during various AM and PM peak periods from Loop 101 to 7th Avenue along I-10. The intent of the survey was to have a passenger vehicle document travel times along the freeway while traveling the average speed of traffic. Survey results indicated that travel time substantially increased during AM and PM travel compared to baseline, or unimpeded, travel times that were documented during holidays when fewer vehicles were present. Figure 8 demonstrates that travel along the approximately 11-mile stretch from Loop 101 to 7th Avenue averages 9 to 10 minutes without traffic congestion. Conversely, the AM peak hour is approximately 30 minutes in both HOV and general purpose lane travel. PM peak period travel improves to about 15 minutes for both HOV and general purpose lane travel, or approximately 5 to 6 minutes increased travel time compared to uncongested travel.

Figure 8 I-10 West Study Area Floating Car Survey Results



2008 - URS

1.1.4 Project Goals

Project goals identified to meet transportation deficiencies noted in Section 1.1.3 include;

1. Improve regional mobility along the I-10 West Corridor.
2. Connect the local and express bus system and the CP/EV LRT system with the West Valley.
3. Provide cost-effective transit improvements.

4. Serve major employment centers, including the State Capitol, and support economic development.
5. Minimize environmental impacts.

1.2 STATEMENT OF PROJECT PURPOSE

The purpose of the proposed I-10 West Corridor high capacity transit project is to:

- Offer a viable transportation alternative that will facilitate the safe and efficient movements of people, particularly commuters, through and within the project corridor;
- Provide efficient high capacity transit service within the project corridor;
- Provide additional capacity as part of a "shared solution" incorporating transit, highway improvements, and existing service such as HOV lanes and bus service along I-10 in the Southwest Valley that are currently operating at LOS E-F and are anticipated to steadily deteriorate;
- Enhance economic development potential within the corridor by improving access to existing and planned employment and activity centers in both the Southwest Valley and Downtown Phoenix;
- Support regional plans and policies that support an efficient transit system; and
- Support regional air quality goals.

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High capacity transit improvements associated with the I-10 West Corridor would provide more dependable transit access to employment centers, educational facilities, housing, and recreation in central Phoenix and the Southwest Valley. With connections to bus and light rail, the proposed project would serve staff, faculty, and students at two universities consisting of the Arizona State University campus in Downtown Phoenix and the University of Phoenix campus at the western terminus of the project corridor. High capacity transit improvements would also serve Downtown Phoenix, considered the major employment center of the region that includes government buildings associated with the State Capitol Mall, Phoenix Governmental Mall, and numerous other businesses. By helping to alleviate congestion by offering an alternative to commuting by automobile, the project would support orderly economic development within the Study Area. For these reasons, transit improvements along the I-10 West Corridor enjoy widespread support.

In summary, the purpose of the proposed high capacity transit improvements in the I-10 West Study Area is to provide a dependable and efficient cost-effective high capacity transportation option that connects central Phoenix, Southwest Valley, and outlying communities.

1.3 STATEMENT OF PROJECT NEEDS

The I-10 West AA/EIS study would provide a high capacity transit option that addresses regional growth, increased travel demand, changes in land use patterns, lack of access to activity centers, air quality problems, inadequate transit service, and regional planning goals. The project would help to satisfy the four following primary needs:

1) **A need for added peak period travel capacity as part of a balanced transportation system.** According to the *I-10 West Transportation Assessment* (January 2008), travel demands are expected to more than double by 2030. Cost effective transit improvements are needed to address the future demands as part of a "shared solution" to facilitate the safe and efficient movement of people and goods within the project Study Area, specifically along the I-10 corridor.
2) **A need for increased transit system connectivity.** Transit service coverage in the Study Area is limited, especially for longer peak period commute trips. Improved services and connections are needed between and among the destinations within and connected to the Study Area.
3) **A need for improved access to corridor destinations.** Improved transit service should be implemented to provide safe and efficient access to numerous local and regional destinations within and adjacent to the I-10 West Study Area including the State Capitol, the City of Phoenix and Maricopa County Government Center, and entertainment destinations including Downtown Phoenix sports and arts venues and Cricket Pavilion located in the Southwest Valley.
4) **A need to reinforce economic development opportunities.** Investments in high capacity transit should be leveraged to encourage more intensive transit oriented development in the Study Area consistent with prior planning studies and future development.

As noted in this section, these needs are the result of several factors. Each factor contributing to these needs is outlined in the following sections.

1.3.1 Peak Period Travel Capacity as part of a Balanced Transportation System

1.3.1.1 Travel Demand

This section summarizes the current transportation conditions within the Southwest Valley. The following analysis also provides forecasted statistics in the region for the year 2030 to provide a general sense of future conditions if the current transportation system remains unimproved.

1.3.1.2 District-to-District Travel Patterns

Potential district-to-district travel demand was identified by reviewing 2030 daily (24 hour) person trips to and from Districts 1, 2 and 3. These three districts encompass the project corridor and represent Downtown Phoenix. Daily person trips from Districts 9, 10 and 11 provide insight into the primary 2030 travel patterns for the I-10 West study corridor. District 9 covers

areas north of the I-10 West study corridor, between I-17 and the Agua Fria River. District 10 covers I-10 as it continues west of the Loop 101 into the fast growing Buckeye area. District 11 covers areas south of the I-10 west study corridor.

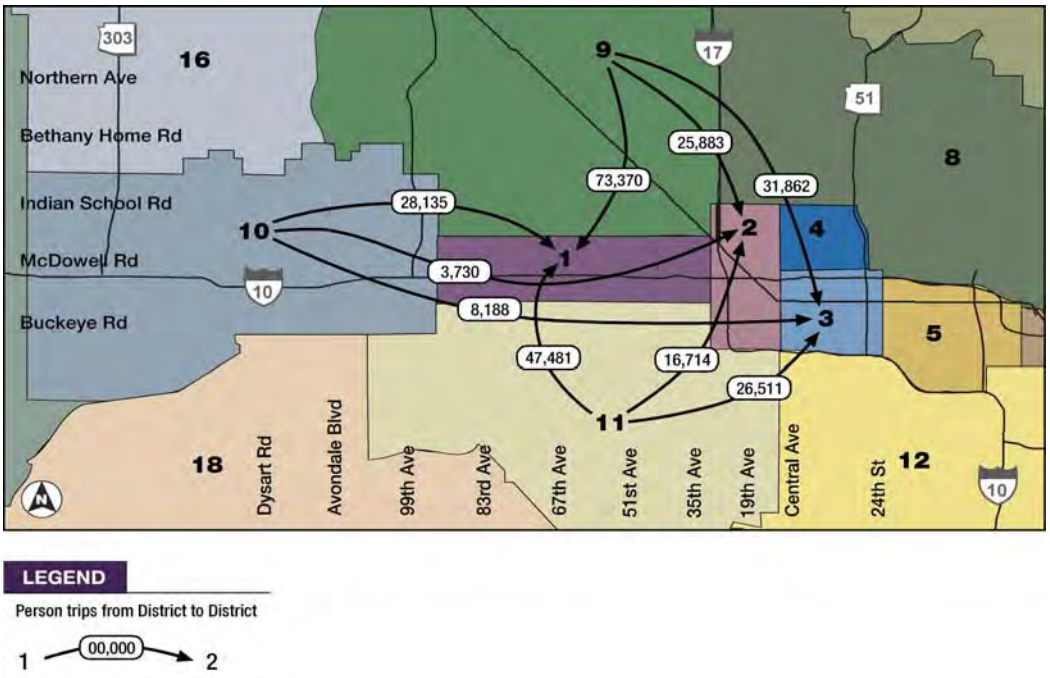
Table 3 shows travel patterns between districts 1, 2, 3, 9, 10 and 11 in terms of the number of daily person trips between each district. For example, there are 28,135 daily person trips between District 10 and 1 that originate from District 10, whereas 22,726 trips between the same two districts originate from District 1. District 2 includes the State Capitol and other government offices while district 3 includes the Phoenix Central Business District. District 1 includes the rest of the I-10 West study area. The analysis shows substantial daily person-trips coming from outlying districts (9, 10, and 11) to Study Area districts (1, 2, and 3), identified on Figure 9 and Figure 10. Daily person-trips are highest to District 1 and District 3 from all three outlying districts. District 9, located north of the Study Area, is expected to produce over 130,000 daily person-trips from the study area to the study corridor and attract nearly 80,000 daily person-trips by 2030, as depicted in Table 3.

Table 3 2030 Daily Person Trips for Study Area and Influence Area Districts

	To District					
From District	**1**	**2**	**3**	**9**	**10**	**11**
1	128,806*	11,252	12,533	55,092	22,726	33,845
2	6,369	25,095*	23,175	12,721	1,715	8,980
3	6,929	19,520	123,787*	12,156	3,318	12,870
9	73,370	25,883	31,862	1,487,340*	72,924	52,311
10	28,135	3,730	8,188	62,590	465,873*	35,524
11	47,491	16,714	26,511	36,141	34,931	315,346*

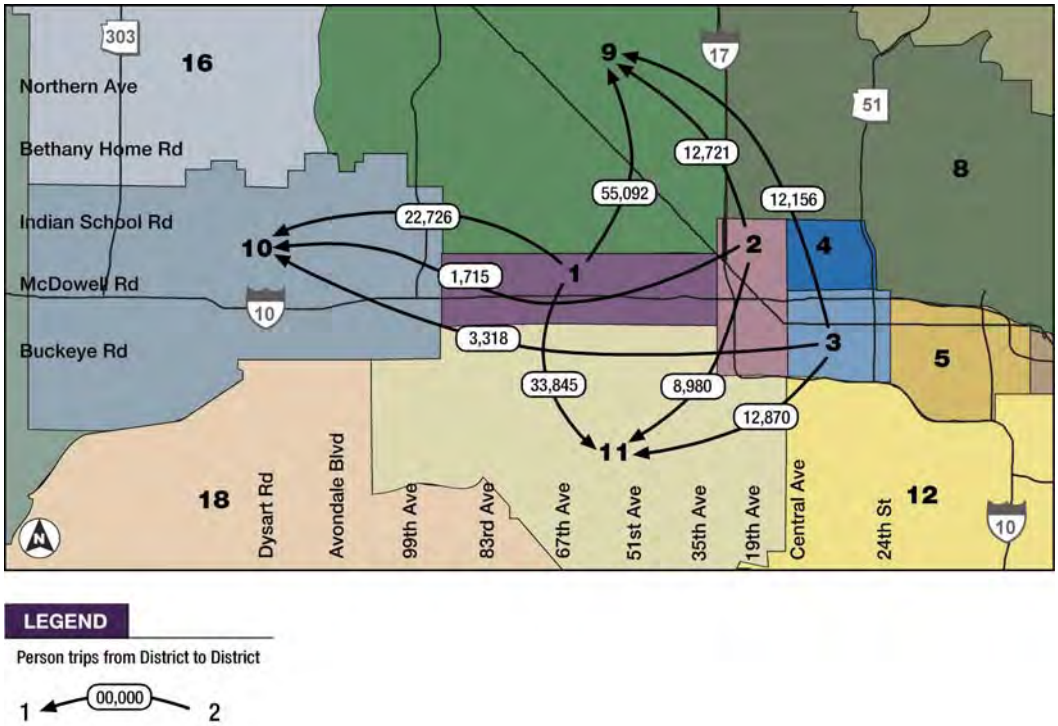
* Denotes Daily Person Trips within the same district
Source: 2008 – METRO

Figure 9 2030 Daily Person Trips from Districts 9, 10, 11 to Districts 1, 2, 3



Source: 2008 – METRO

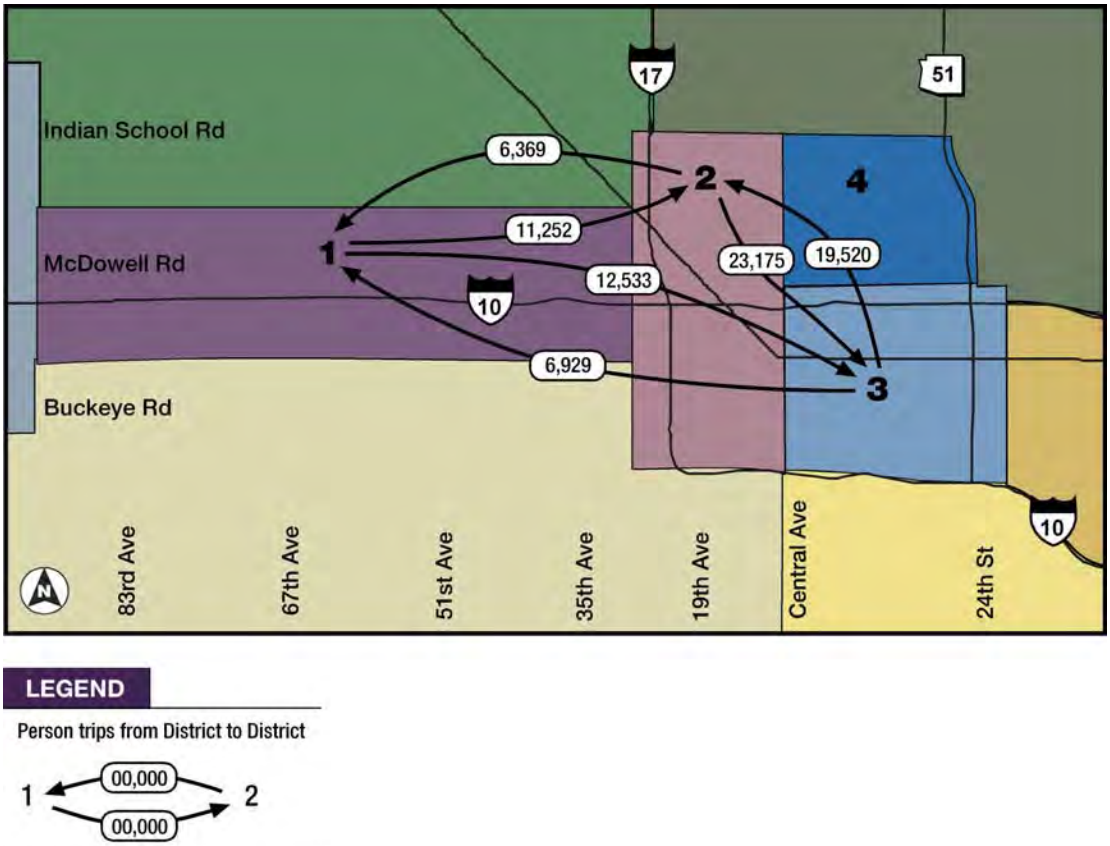
Figure 10 2030 Daily Person Trips from Districts 1, 2, 3 to Districts 9, 10, 11



Source: 2008 – METRO

Trip exchange between the study corridor Districts 1, 2 and 3 is shown in Figure 11. District 3, which includes downtown Phoenix, attracts a significant amount of trips from the other two study corridor districts. Daily person trips from District 1 are almost equally split between Districts 2 and 3.

Figure 11 2030 Daily Person Trips to and from Districts 1, 2, 3



Source: 2008 – METRO

The analysis of these trip patterns includes the following observations:

- Nearly 17,000 daily person trips are coming to and from District 10, located west of the Study Area (District 1), to the central area (Districts 2 and 3) which is served by the CP/EV LRT Starter Line.
- Over 50,000 daily person trips are coming to and from areas west of the Study Area (District 10) and from District 1 of the Study Area.
- Over 37,000 daily person trips are coming to and from the Study Area (District 1) to the central area, which is served by the CP/EV LRT Starter Line.
- There are demand levels of over 195,000 daily person trips per day, coming from districts (9, 10, and 11) outside of the corridor to the corridor districts (1 and 2), of which a substantial portion could be served by transit.

1.3.1.3 Vehicle-Miles Traveled and Vehicle-Hours Traveled/System Performance Analysis

The following transportation system performance analysis is based on the 2030 No-Build model network and model run conducted by MAG in September 2007. Daily Vehicle-Miles Traveled (VMT) and daily Vehicle-Hours Traveled (VHT) for the Region, Southwest Valley, and the I-10 West Corridor are shown in Table 4 and Table 5. The VMT on freeways increases by 99 percent, whereas the VHT for freeways shows an increase of 180 percent. Similarly for the Southwest Valley the increase in the freeway VMT is 144 percent but the VHT increases by 257 percent. The freeway VMT increase for the Study Area is shown as 38 percent but the VHT shows an increase of 153 percent. The higher increase in the VHT as compared to the corresponding VMT is an indication of the extremely congested conditions on the freeways for the year 2030 that is reflected by changes in system speed.

Table 4 Daily Vehicle-Miles Traveled

Region	2004	2030	Change	% Change
Region Total[1]	81,500,000	183,000,000	101,000,000	124%
On Freeways	30,700,000	61,000,000	30,300,000	99%
On Arterials	43,000,000	104,000,000	60,900,000	142%
Southwest Valley Districts*	**2004**	**2030**	**Change**	**% Change**
Southwest Valley Total	8,960,000	38,000,000	29,100,000	325%
On Freeways	4,510,000	11,000,000	6,490,000	144%
On Arterials	3,520,000	23,100,000	19,500,000	554%
I-10 West Study Area**	**2004**	**2030**	**Change**	**% Change**
Study Area Total	4,290,000	6,480,000	2,180,000	51%
On Freeways	2,720,000	3,760,000	1,040,000	38%
On Arterials	993,000	1,780,000	784,000	79%

Source: 2008 – METRO
*Districts 1, 10, 11, 17, and 18 as shown in Figure 3 **Districts 1and 2 as shown in Figure 3

Table 5 Daily Vehicle-Hours Traveled

Region	2004	2030	Change	% Change
Region Total[1]	2,520,000	6,920,000	4,400,000	175%
On Freeways	577,000	1,610,000	1,040,000	180%
On Arterials	1,620,000	4,470,000	2,850,000	176%
Southwest Valley Districts*	**2004**	**2030**	**Change**	**% Change**
Southwest Valley Total	201,000	1,320,000	1,120,000	557%
On Freeways	75,600	270,000	194,000	257%
On Arterials	102,000	869,000	768,000	753%
I-10 West Study Area**	**2004**	**2030**	**Change**	**% Change**
Study Area Total	112,000	264,000	152,000	136%
On Freeways	56,600	143,000	86,500	153%
On Arterials	33,400	84,700	51,300	154%

Source: 2008 – METRO
Note: 1. Regional total includes all roadway link types except centroid connectors.
*Districts 1, 10, 11, 17, and 18 as shown in Figure 3 **Districts 1and 2 as shown in Figure 3

Table 6 shows the system average speeds for the region, the Southwest Valley and the Study Area. These are calculated by dividing the VMT by the VHT (from Table 4 and Table 5 above) to calculate miles per hour. Average speeds are expected to decrease substantially from 2004 to 2030, because VHT is increasing faster than VMT. Freeways are projected to have the largest decrease in average speeds, in the range of minus 29 percent to minus 45 percent, depending on location. The table below depicts the average speed per 24-hour periods. Peak periods would have slower average speeds than those outlined below.

Table 6 System Average Speed (Miles Per Hour)

Region	2004	2030	Change	% Change
All Roadways in Region	32	26	-6	-18%
On Freeways	53	38	-15	-29%
On Arterials	26	23	-3	-11%
Southwest Valley Districts*	**2004**	**2030**	**Change**	**% Change**
All Roadways in Southwest Valley	45	29	-16	-35%
On Freeways	60	41	-19	-32%
On Arterials	35	27	-8	-23%
I-10 West Study Area**	**2004**	**2030**	**Change**	**% Change**
All Roadways in Study Area	38	25	-14	-36%
On Freeways	48	26	-22	-45%
On Arterials	30	21	-9	-29%

Source: 2008 – METRO
*Districts 1, 10, 11, 17, and 18 as shown in Figure 3 **Districts 1and 2 as shown in Figure 3

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1.3.1.4 I-10 West Current Operations

The portion of I-10 through the I-10 West Corridor carries some of the highest volumes by segment for any highway in the region (Texas Transportation Institute for MAG 2005). The segment between I-17 and Loop 101 shows volumes in the top five in the region on a daily and peak-period basis according to the MAG report, "Freeway Traffic Conditions and Trends in the Phoenix Region, 2004." This report assembled actual count data from 58 different Traffic Management System (TMS) stations around the region used by the Arizona Department of Transportation (ADOT).

This segment of I-10 carried between 175,000 and 200,000 vehicles per day in both directions in 2004. Typically the segment has four general-purpose lanes and a HOV lane (2+ carpool) in each direction. The HOV lane terminates west of 83rd Avenue. An exclusive bus-only ramp leads to and from the 79th Avenue overpass for access to a park-and-ride at that location. The 79th Avenue ramp will also allow access to the future West Operating Facility and the potential Regional Heavy Maintenance Facility. Of the total daily volume, the HOV lane carried between 11,000 and 12,500 vehicles in each direction.

Levels range from LOS A, which indicates free-flow traffic conditions with little or no delay, to LOS F, which describes congested conditions where traffic flows exceed design capacity, resulting in long delays. LOS A, B, and C are generally considered to be satisfactory service levels, while the influence of congestion becomes more noticeable at LOS D. LOS E is undesirable and is considered by most agencies to be the limit of acceptable delay, and LOS F conditions are considered to be unacceptable to most drivers. Traffic counts and speed

information is collected at three stations along the corridor. Data from the TMS reports presented in Table 7 demonstrate peak period LOS operates between E and F.

Table 7 Operating Statistics for I-10 between I-17 and Loop 101 – 2004

Segment/ Direction and Peak-Period	Total Volume	General-Purpose per Lane Volume	HOV Lane Volume	Level of Service
Eastbound – AM Peak Hour				
79th Avenue	5,490	1,130	970	E
55th Avenue	5,410	1,105	990	E
33rd Avenue	7,100	1,480	1,190	F
Westbound – PM Peak Hour				
79th Avenue	5,540	1,110	1,140	E
55th Avenue	7,510	1,580	1,200	E
33rd Avenue	7,860	1,520	1,780	E

Source: 2004 – MAG

Traffic operations on I-10 in 2004 showed congestion in the eastbound direction in the morning peak period. Volumes build in the eastbound direction as the freeway nears the central portion of the region. At least half of the weekdays experienced speeds consistent with congested conditions, with frequent incidents such as accidents reducing operations to poor levels of service. Traffic operations in the westbound direction in the morning peak period are more uniform as traffic leaves the central area and is distributed west. The HOV lane volumes are highest in the westbound direction during the evening peak period compared to the morning peak period.

Serving as a freight thoroughfare for the Port of Long Beach in California, I-10 is also a major truck route between Phoenix and California. ADOT counters obtain vehicle type information at the TMS stations. According to the Arizona Multimodal Freight Analysis Study, Technical Memorandum #2 *Assessment of Arizona's Existing Freight Infrastructure,* trucks constitute between approximately 7 to 13 percent of all vehicles in the study area.

The Park-and-Ride located at 79th Avenue serves multiple routes, including local, express, and RAPID services. Facility amenities include covered parking, staffed security, "next-bus" variable information sign supporting the I-10 West RAPID service and a direct access on\off ramp connecting the facility with I-10. The 79th Avenue Park-and-Ride has 607 parking spaces and is currently at capacity.

1.3.1.5 Unrestrained Demand Assessment

The *I-10 West Transportation Assessment* (METRO 2008) summarizes the results of an unrestrained demand model that assigns traffic to the shortest path for each trip without any capacity constraints. The results may then be used to provide a theoretical understanding of how much potential travel demand exists for any given facility. Conclusions drawn from the results show that the I-10 West Corridor capacity is inadequate to meet growing travel demands. Relief is needed for the growing levels of congestion along the I-10 West Corridor; the 2030 capacity available in this corridor will not be adequate to meet projected travel demand unless substantial improvements are made (METRO 2008).

ADOT is currently preparing a Draft Environmental Impact Statement (DEIS) for the Loop 202 (South Mountain Freeway) project that would connect the Southeast Valley with I-10 near 55th Avenue. As part of a "Shared Solution" with the METRO I-10 West project, the Loop 202 project would act as a bypass that would divert through trips currently on I-10 to the south, thereby avoiding Central Phoenix and reducing traffic along I-10.

Table 8 compares the estimated unrestrained travel demand in 2030 for both existing and future highway and transit capacities during the peak period on I-10. Comparisons are made at four separate locations within the I-10 West Corridor, with peak period trips accommodated by either general-purpose (GP) lanes (4 lanes currently, 5 lanes proposed by ADOT in the future), HOV lanes, or by proposed high capacity transit within the I-10 West Corridor (LRT was used for the purpose of the METRO analysis, which would displace any anticipated BRT service). Auxiliary lanes include entrance ramps and acceleration lanes along I-10. Table 8 also shows that the combined capacity of all these modes does not fully accommodate the total number of potential person-trips that would be taken. The difference between the demand and the capacity is unmet demand.

Figure 12 (current number of lanes on I-10) and Figure 13 (future number of lanes proposed on I-10) illustrate the total travel demand and the role each mode plays in accommodating this demand at the four locations identified in Table 8.

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Table 8 Unrestrained Demand Capacity Analysis

Comparison Locations on I-10		Peak Period Person Trip Capacity Distribution (Thousands)			
Existing Configuration (GP/Aux/HOV)	**Peak Period, Peak Direction Person-Trips (Thousands) (1)**	**General Purpose Lane (2)**	**HOV Lane (3)**	**High Capacity Transit (4)**	**Remaining Unmet Demand**
81st Avenue (4/1/1)	**23.0**	8.0	4.6	6.1	**4.3**
47th Avenue (4/1/1)	**28.2**	8.0	4.6	6.1	**9.5**
33rd Avenue (5/1/1)	**26.0**	10.0	4.6	6.1	**5.3**
20th Avenue (4/1/1)	**24.3**	8.0	4.6	6.1	**5.6**
RTP Configuration (GP/Aux/HOV) (5)					
81st Avenue (5/1/1)	**23.0**	10.0	4.6	6.1	**2.3**
47th Avenue (5/1/1)	**28.2**	10.0	4.6	6.1	**7.5**
33rd Avenue (5/1/1)	**26.0**	10.0	4.6	6.1	**5.3**
20th Avenue (5/1/1)	**24.3**	10.0	4.6	6.1	**3.6**

Source: 2007b – MAG

Notes: (1) Peak Period Factor from ADOT TMS - 8.0% on West I-10, with 50/50 directional split.

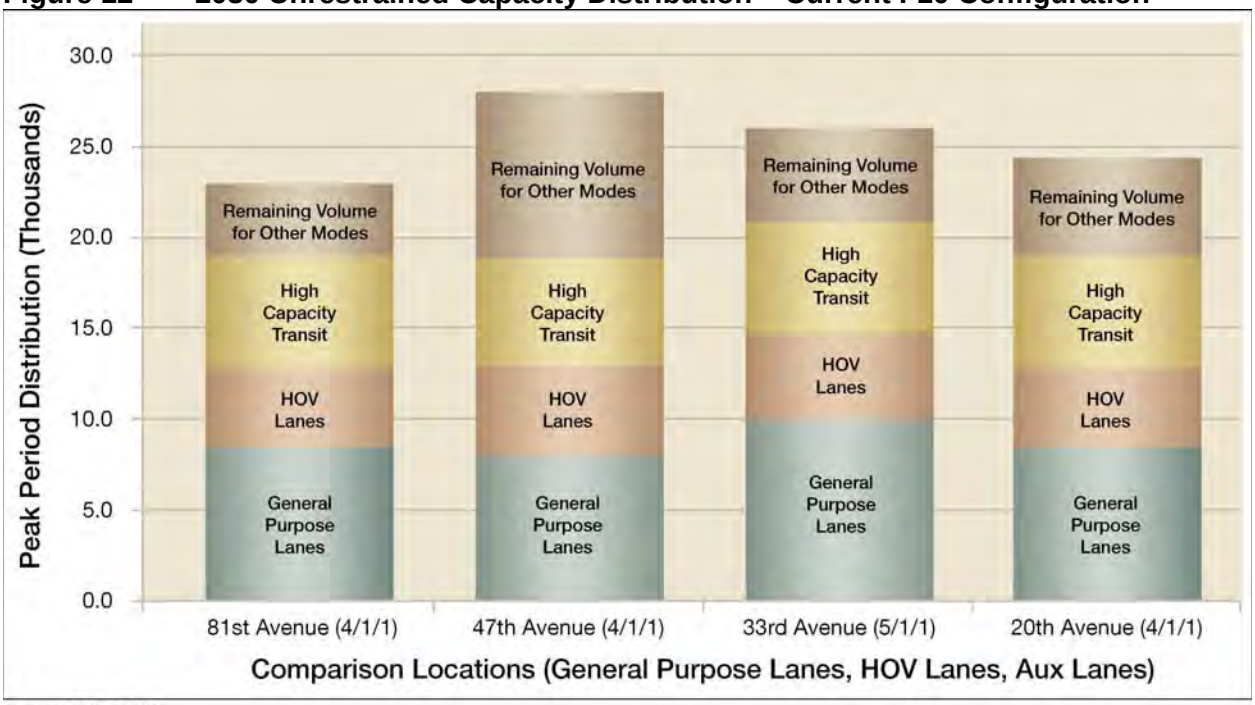
(2) General-Purpose Lane capacity 1,900 vehicles/hour at 1.05 persons/vehicle.

(3) HOV Lane capacity 1,900 vehicles/hour at 2.2 persons/vehicle plus 8 BRT/Express buses at 50 riders each.

(4) High capacity transit example assumes a capacity of 170 patrons/vehicle, 3-vehicle trains, 12 trains per peak hour per direction.

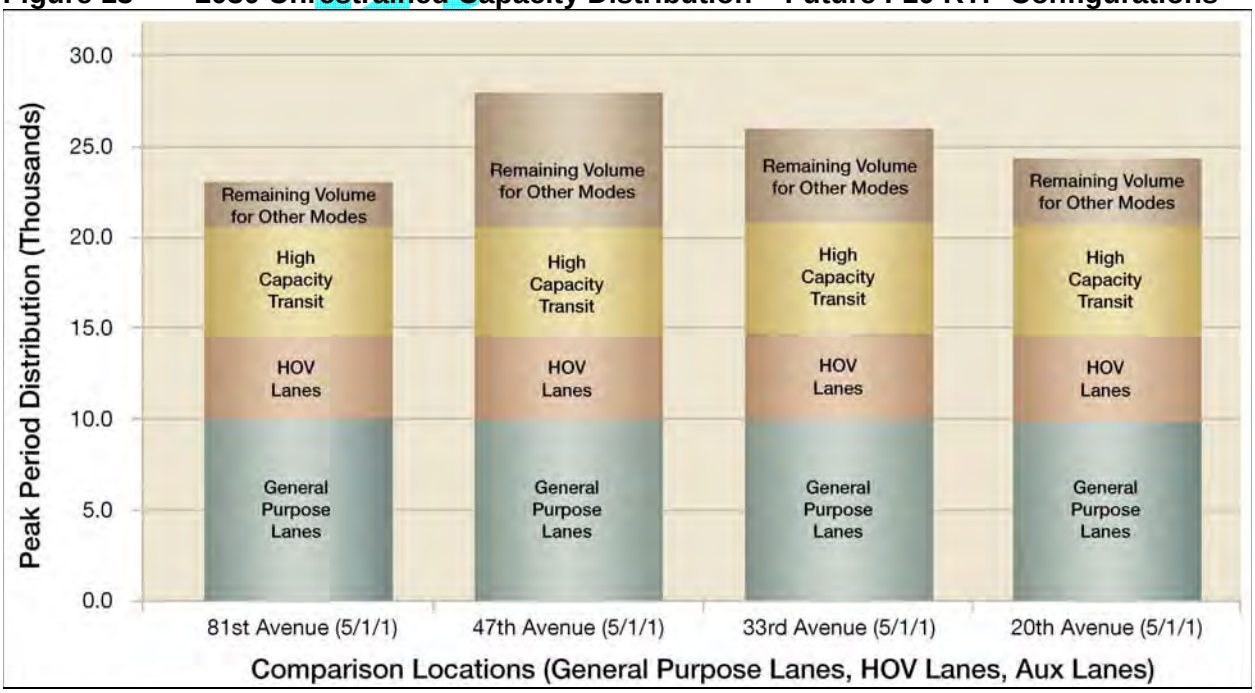
(5) Network includes South Mountain Freeway connection at 59th Avenue.

Figure 12 2030 Unrestrained Capacity Distribution – Current I-10 Configuration



Source: 2007b – MAG

Figure 13 2030 Unrestrained Capacity Distribution – Future I-10 RTP Configurations

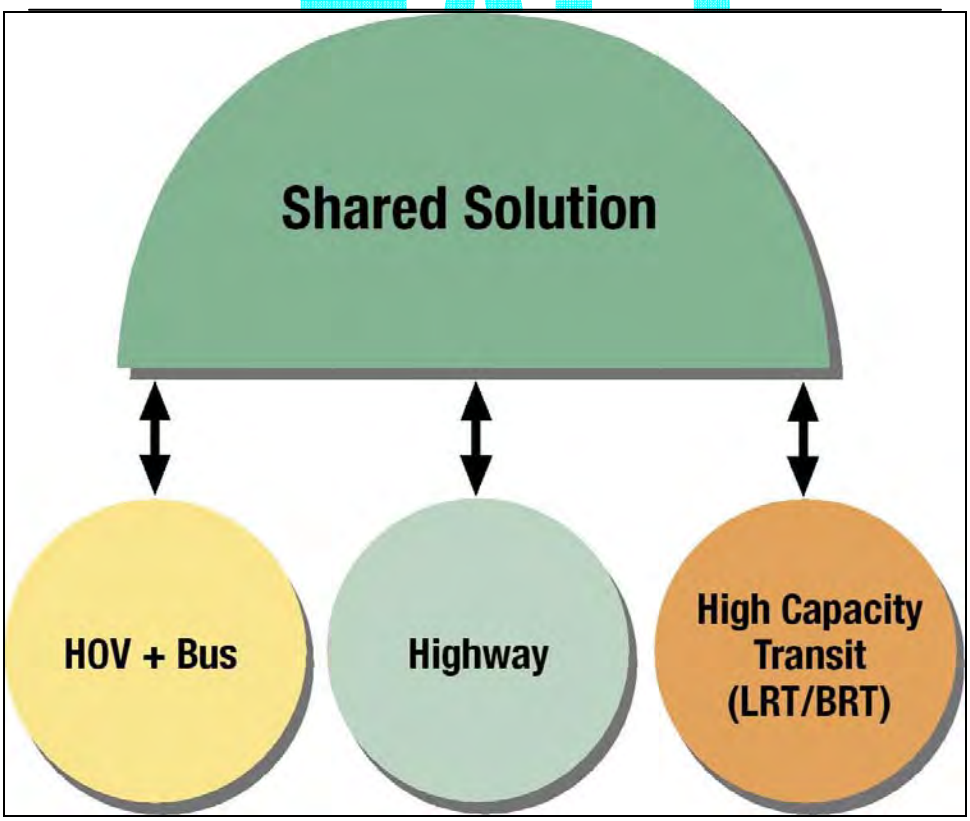


Source: 2007b – MAG

Observations concerning the results of these comparisons include:

- Travel demand in the I-10 West Corridor is expected to more than double between 2004 and 2030.
- Some additional transportation capacity will be provided with an additional lane in each direction on I-10 by Summer of 2012, consistent with the RTP (ADOT 2008).
- A high capacity transit addition to the corridor such as light rail or bus rapid transit could accommodate a substantial portion of the unmet demand in the corridor.
- Substantial unmet demand in 2030 is expected to remain even with highway improvements and the addition of high capacity transit.
- A "shared solution" concept should be examined to resolve transportation issues in the corridor including unmet demand levels. Highway, transit and Transportation Demand Management/ Transportation Systems Management (TDM/TSM) Rideshare improvements are all needed, as shown in Figure 14 and discussed in Section 1.3.1.6.

Figure 14 I-10 West Shared Solution Concept

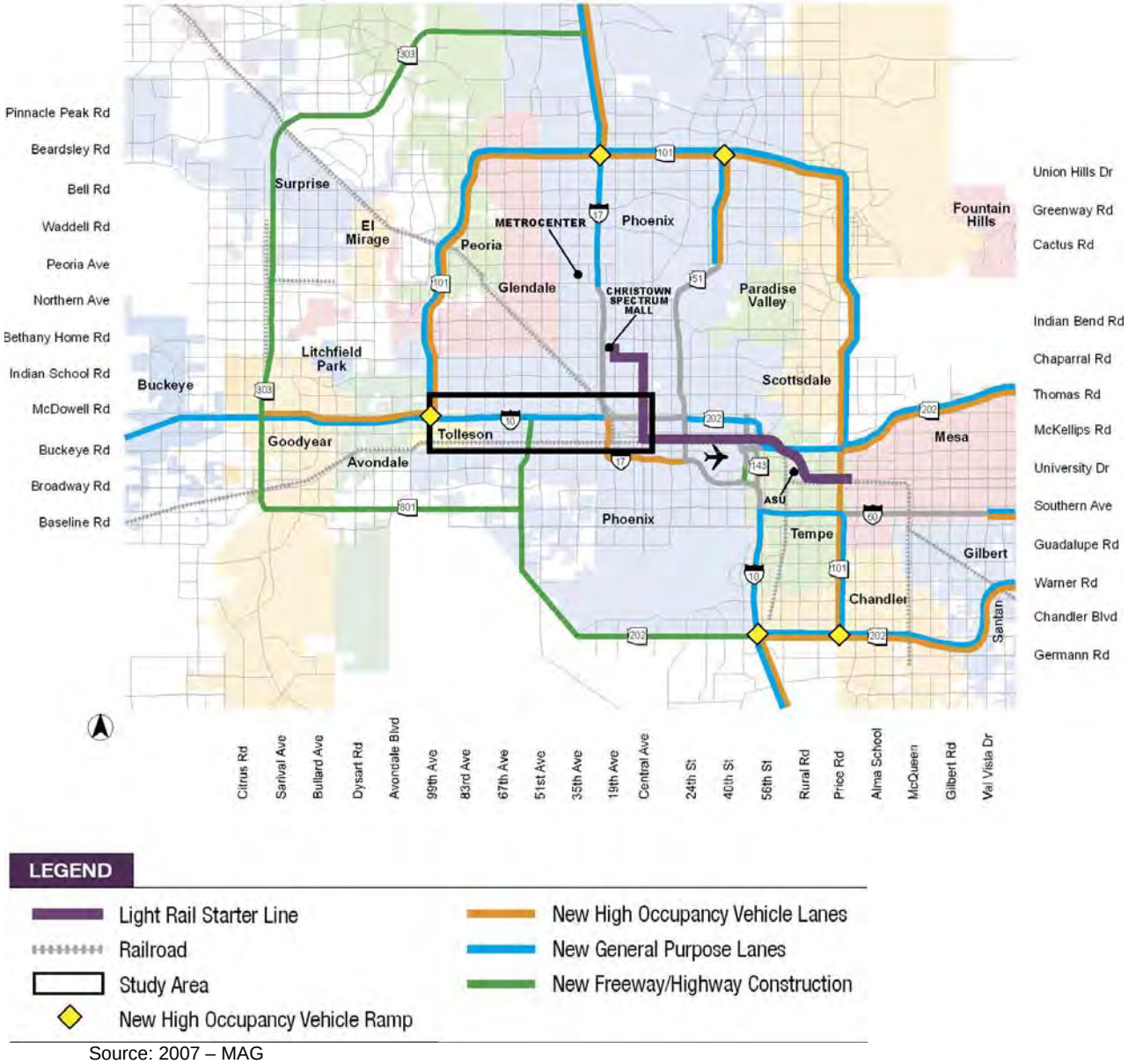


Source: 2008 – METRO

1.3.1.6 The "Shared Solution" Roadway Projects

In anticipation of projected population and employment growth, ADOT is planning several large-scale highway improvement projects that either fall within the I-10 West Corridor or will directly impact traffic conditions within the Study Area. Throughout the planning process, METRO will coordinate with ADOT on proposed projects including the following and illustrated on Figure 15.

Figure 15 Proposed Highway Improvements in the MAG Region



Source: 2007 – MAG

- ADOT I-10 Freeway Expansion – A Design Concept Study commenced in August 2007 for the proposed addition of general purpose lanes in each direction along I-10 between Loop 101 and I-17. This study will evaluate the build-out scenario for I-10, but will also scope a

project for ADOT's fiscal year (FY) 2010, where $68 million is budgeted for improvements in the RTP. This FY 2010 project is expected to be complete in 2012.

- ADOT Loop 202 (South Mountain Freeway) – The Loop 202 Freeway will be designed to connect I-10 in the Southeast Valley with I-10 in the West Valley, thereby diverting through trips along I-10 around South Mountain rather than Central Phoenix. As currently designed, ADOT's Preliminary Preferred Build Alternative would link the new Loop 202 Freeway with I-10 near 55th Avenue. Construction funding for this project is not anticipated until 2009-2015.

- ADOT Loop 101 to I-10 HOV Direct Connector – A project scheduled for ADOT FY 2025 that adds an HOV direct connector ramp at the Loop 101/I-10 interchange and would include the south-to-east and west-to-north HOV ramp movements. Preliminary study is currently under way to determine how the interchange could be modified to accept this ramp, since it was not originally designed to accommodate it.

- ADOT SR 801 – SR 801 is a east/west freeway proposed in western Maricopa County that would connect the existing SR 85 to the proposed Loop 202 (South Mountain Freeway), with a connection to the proposed SR 303 (Loop 303). Design and construction of SR 801 are anticipated to occur from 2021 to 2025. Although located south of the I-10 West Study Area, the SR 801 project will be considered throughout the AA/EIS phase of the I-10 project.

The 2007 MAG *FY 2008 – 2012 Transportation Improvement Program* identifies several transportation improvement projects within the I-10 West Study Area. However, improvement projects identified with in the I-10 West Study Area are limited to intersection widening and general improvement projects that would not affect high-capacity transit improvements proposed within the Study Area.

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1.3.2 Increased Transit System Connectivity

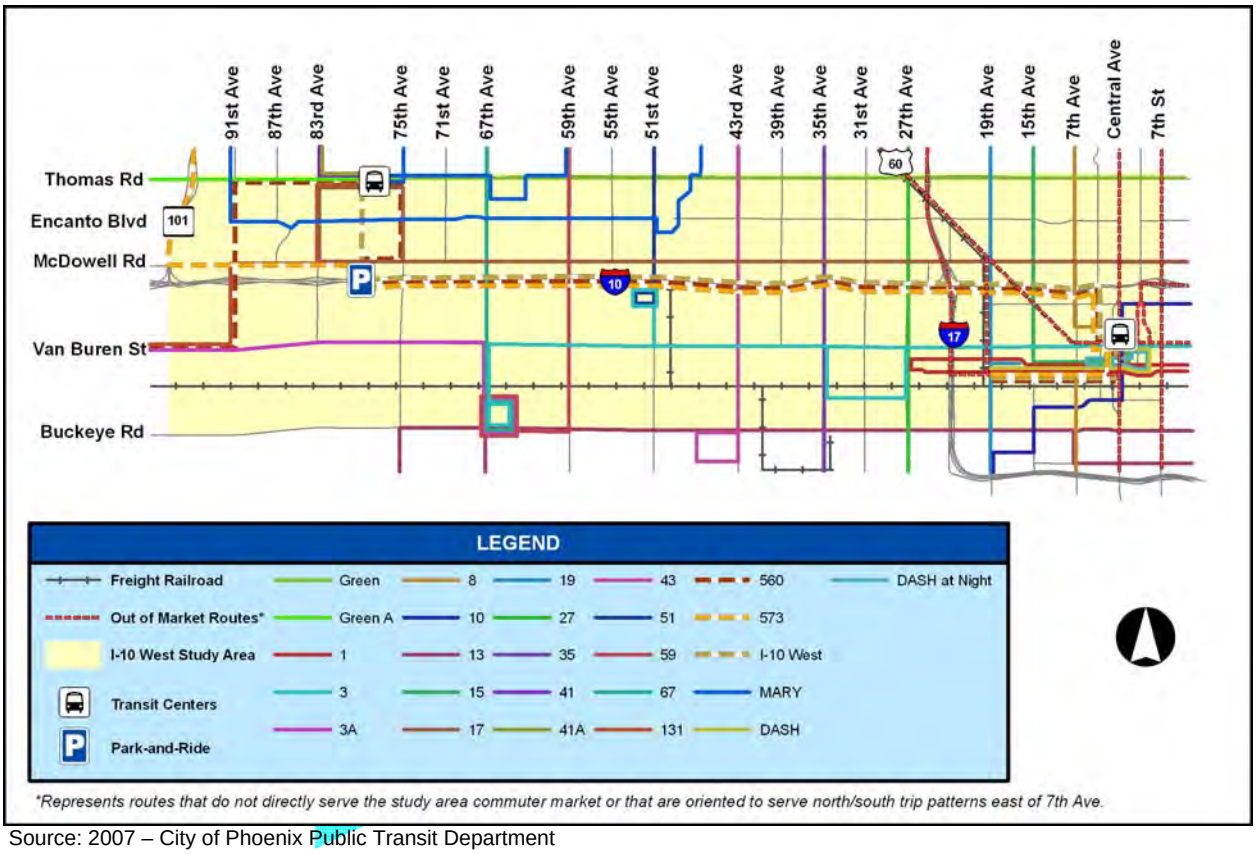
The following section describes the current transit facilities within the I-10 West Study Area and provides information concerning current ridership trends.

1.3.2.1 Transit Services in the I-10 West Study Area

Existing Fixed Route Bus Service

Several modes of fixed route bus service serve the Study Area including local bus, express and RAPID routes, and circulators. The Study Area has a relatively high level of fixed route service compared to the region. Existing fixed route service is depicted in Figure 16.

Figure 16 Existing Fixed Route Transit Service



Source: 2007 – City of Phoenix Public Transit Department

Local bus routes provide transit service on the one-mile grid network of streets in the Study Area. The express and RAPID routes provide weekday peak period commuter service between the western portion of the Study Area and the downtown Phoenix and Capitol Mall District areas. All express and RAPID routes operating on freeway HOV lanes serve the downtown Phoenix and Capitol Mall District areas. Circulators are operated on a free fare basis to provide local circulation and access to the other fixed route transit modes operating in the Study Area.

Table 9 identifies the existing fixed route transit services operating in the Study Area and average weekday boardings.

Table 9 I-10 West Existing Transit Operations

Mode	Total Routes[1]	Total Daily Trips	Average Weekday Boardings		Percent Change
			1999	2006	
Local	20	1,543	57,333	79,309	38.3%
Circulator	3	176	273	1,679	515.0%
Express	2	16	247	118	-52.2%
RAPID	1	25	0	922	100.0%
Total	**26**	**1,760**	**57,853**	**82,028**	41.8%

Source: 2007 – City of Phoenix Public Transit Department

[1] *Statistics do not include routes that primarily serve commuter markets outside of the Study Area or that are oriented to serve north/south trip patterns east of 7th Ave.*

Existing Park-and-Ride Facilities/Transit Centers

The 79th Avenue Park-and-Ride facility is the only park-and-ride lot currently within the Study Area, offering 607 parking spaces for transit riders and carpoolers. Currently, the park-and-ride use is at approximately 74 percent (METRO 2008). Route 560, Route 17 (McDowell Road Route) and the I-10 West RAPID Route serve this facility. No new park-and-ride facilities are planned within the Study Area (MAG 2007a). The Desert Sky Mall Transit Center and the Central Transit Center are the two bus transfer facilities located within the Study Area.

1.3.2.2 Ridership Trends

Regional transit patronage has steadily increased since the City of Phoenix voters approved a 0.40 percent sales tax in 2000 to fund city-wide transit improvements. Nearly 72 percent of all passenger boardings in 2000 occurred within the city's boundaries which can be directly attributed to the regional impact of Phoenix's sales tax measure. Regional transit ridership increased 35.9 percent between 1999 and 2006.

In addition to having positive ridership gains over the last seven years, six of the bus routes in the Study Area are ranked in the top seven of all routes in the region for productivity (average daily ridership). With 11,485 average passenger boardings each weekday, the Green Line on Thomas Road transports more passengers than any other bus route in the region during Fiscal Year 2006. During this same fiscal year, average daily ridership on the Green Line surpassed 12,750 passenger boardings during the month of September.

A closer look at the ridership data for the routes directly serving I-10 and operating in the same directional flow (east/west) up to a mile on either side of the interstate reveals a considerable demand pattern. Three local bus routes, a RAPID route, and an express route operate within this two-mile wide corridor between Van Buren Street and Thomas Road. These routes include the Green Line (Thomas Road), Route 3 (Van Buren Street), Route17 (McDowell Road), I-10 West RAPID and Route 560 Express (Avondale). Combined, more than 29,300 passengers boarded these routes each weekday during FY 2006, representing approximately 14.7 percent of all fixed route boardings within the region (ridership data includes all boardings for each route inside and outside of the Study Area).

A review of trip checks conducted by the City of Phoenix Public Transit Department contract staff indicates that the Green Line, Route 3 and Route 17 are experiencing overcrowding within the Study Area boundaries. The highest number recorded on board a bus at any location within the Study Area was 89 passengers. On a 55-seat coach, this represents a passenger per seat ratio of 1.61. Finally, of the 263 trip checks reviewed, 11 percent showed passengers in excess of seated capacity within the Study Area. Table 10 identifies the sample population size and characteristics.

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Table 10 Trip Check Samples

Route	Major Arterial	Total Trip Checks Sampled	Trip Checks with Passengers Exceeding Seats in Study Area	Percent Samples Exceed Seated Capacity	Maximum Boardings	Study Area Maximum Boarding Location
Green	Thomas Rd	61	15	24.6%	89	Thomas & 19th Ave
3	Van Buren St	78	11	14.1%	58	Van Buren & 7th Ave
13	Buckeye Rd	87	0	0%	29	Buckeye & 75th Ave
17	McDowell Rd	37	3	8.1%	42	McDowell & 11th Ave
Total		**263**	**29**	**11.0%**	**NA**	**NA**

Source: 2007 – City of Phoenix Public Transit Department

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1.3.2.3 Future Transit Service

Significant investments in fixed route bus service have already been implemented within the Study Area through the City of Phoenix Transit 2000 Plan. The MAG RTP also identifies extensions of routes currently serving the Study Area to destinations outside of the Study Area.

In addition, five new express route and two new local routes are identified in the RTP. While five express routes will operate within the I-10 West Corridor by 2030, only one express bus route, the Avondale Express, is identified to serve the I-10 West Study Area. Two additional express routes will operate on I-10 (Papago Freeway Connector and Buckeye Express) and provide service between downtown Phoenix and the cities of Buckeye, Goodyear, and Avondale. The Peoria Express will provide service between downtown Phoenix and the cities of Peoria and Glendale via I-10 and Loop 101. The Loop 303 Express will provide service between downtown Phoenix and the cities of Surprise, Peoria and Glendale via I-10 and Loop 303. The two new local bus routes on 99th Avenue and 83rd/75th Avenues will fill in service gaps in the arterial street grid system in the western portion of the study area. Table 11 identifies the new express and local bus service that will be in operation in the corridor by 2030.

Table 11 Future Express and Local Bus Service

Route	Year of Operation	Type	No. of Daily Trips	Weekday Headways	
				Peak	Base
99th Avenue	2021	Supergrid	68	30	30
83rd/75th Avenue	2023	Supergrid	72	30	30
Papago Freeway Connector	2009	Express	8	N/A	N/A
Peoria Express	2014	Express	12	N/A	N/A
Buckeye Express	2015	Express	6	N/A	N/A
Avondale Express	2020	Express	16	N/A	N/A
Loop 303 Express	2023	Express	8	N/A	N/A

Source: 2007 – HDR | SR Beard & Associates & METRO – 2008.

1.3.2.4 Future Central Phoenix / East Valley Starter Line

In December 2008 the CP/EV LRT Starter Line, located in the eastern extent of the I-10 West Study Area, will begin operation connecting the cities of Phoenix, Tempe, and Mesa. As discussed in Section 1.3, the significance of the CP/EV LRT Starter Line is that the I-10 West Corridor is proposed as an extension of it. The light rail line will operate with service every 10 minutes from dawn to dusk.

1.3.3 Improved Access to Corridor Destinations

Although the I-10 West Corridor features and provides access to several activity centers, as a main thoroughfare in the Southwest Valley, I-10 links travel to additional regional destinations, as discussed in this section.

1.3.3.1 I-10 West Corridor

Figure 17 illustrates several of the following major activity centers/trip generators within the I-10 West Study Area:

- **Downtown Phoenix:** Occupying the eastern extent of the I-10 West Corridor, Downtown Phoenix features several activity centers/trip generators within the project area including:
  - ⇒ *Copper Square: At the heart of Downtown Phoenix is Copper Square, which includes the region's largest concentration of high-rise office buildings, with dispersed regionally important destinations, such as the Phoenix Convention Center, U.S. Airways Center, and Chase Field (described below).
  - ⇒ Capitol Mall District: The Capitol Mall District occupies 300-plus acres and includes the State Capitol building, the Executive Tower, the House, Senate, and State Judicial Buildings, and Bolin Memorial Plaza, an open space in the center of the District.
  - ⇒ City/County Government Center: A major employment center among municipal facilities, the Governmental Mall houses the 600,000 square-foot Phoenix City Hall, the 375,000-square-foot Phoenix Municipal Courthouse, and the 550,000 square-foot Sandra Day O'Connor Federal Courthouse (City of Phoenix 2001).
  - ⇒ Historic Districts: Several historic districts lie within the I-10 West Corridor Study Area in Downtown Phoenix that showcase historic governmental, office and residential buildings and squares, religious buildings, and a mix of historic and contemporary architectural styles (City of Phoenix 2001).
  - ⇒ Hotel Rooms: There are 1,682 existing hotel rooms located in Downtown Phoenix. Currently, another 1,657 rooms are either under construction or approved for future construction, with an additional 750 hotel rooms proposed throughout downtown.
- **U.S. Airways Center** in Downtown Phoenix is a 20,000-seat arena that is home to the National Basketball Association Phoenix Suns, the Women's National Basketball Association Phoenix Mercury, and the Arizona Rattlers of the Arena Football League. Also featuring other various sporting events and concerts throughout the year, U.S. Airways Center draws approximately 2 million visitors every year.

*Copper Square will be known as Downtown Phoenix in the future.

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- **Phoenix Convention Center**, also located in Downtown Phoenix, is one of the premier locations for conventions and trade shows in the Southwest. This facility hosts an average of 540 annual events including more than 45 conventions each year with more than one-million total visitors. The convention center is undergoing an expansion to triple the current amount of exhibition and meeting space that is scheduled for completion by December 2008.
- Opened Fall of 2006, the **Arizona State University (ASU) Downtown Phoenix Campus** houses the University's College of Public Programs and College of Nursing. In 2008, the Walter Cronkite School of Journalism and Mass Communication will move to the ASU Downtown Phoenix Campus. The Master Plan for the Downtown Phoenix Campus projects approximately 15,000 students and provides policies to actively promote transit use, including implementation of campus parking fees and a student/faculty transit pass program.
- **Chase Field**, another Downtown Phoenix attraction, is a 49,000-person capacity retractable roof stadium that is home of the Arizona Diamondbacks Major League Baseball team. Events at this facility attract over 2.16 million attendees every year.
- **Cricket Pavilion** is located just north of the I-10 Corridor. Cricket Pavilion is the Phoenix metropolitan area's largest outdoor entertainment facility. It can accommodate approximately 20,000 people for year-round concerts hosted at this facility.
- Located directly northeast of Cricket Pavilion, **Desert Sky Mall** is a major shopping center that features over 100 businesses that include department stores, restaurants and shops.
- The **West Valley Learning Center**, a **University of Phoenix** campus located northwest of the I-10 West Corridor terminus, offers students the opportunity to pursue several degree programs. 596 students visit the center each week.
- Located just north of the I-10 Corridor, the **Phoenix Art Museum** and the **Phoenix Heard Museum** attracted just over 480,000 visitors in 2007 combined.
- **Translational Genomics Research Institute (TGen)** is located south of I-10 on North 5th Street downtown. There are 270 employees that work at the TGen, and their mission is to make and translate genomic discoveries into advances in human health. "
- **Arizona Center** is located south of I-10 in the heart of downtown Phoenix. The Arizona Center is an open-air attraction that offers dining and shopping in a unique urban setting.

1.3.3.2 Regional Activity Centers

High capacity transit improvements within the I-10 West Corridor would improve access to the region's largest employment centers including those along Central Avenue in Phoenix and those within Westgate Center in Glendale. Some of the regional attractions high capacity transit would serve within the I-10 West Corridor would include:

- The **Arizona State Fairgrounds**, located just north of Downtown Phoenix, hosts year-round festivals and shows, with the largest event occurring annually from early October

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to mid-November. The event, known as the Arizona State Fair, has increased in attendance over the last few years, reaching approximately 1.3 million people in 2006 (Senft 2007).

- **Sky Harbor International Airport** is the sixth busiest airport in the United States, serving approximately 33.5 million passengers annually and located directly east of Downtown Phoenix.
- **Westgate City Center**, located in Glendale approximately 7 miles north of the western extent of the I-10 West Study Area, is a 225-acre mixed-use regional attraction that includes retail shopping, entertainment venues, restaurants, office space, residential dwellings and hotels. **Jobing.com Arena** and the **University of Phoenix Stadium** are home to the National Hockey League Phoenix Coyotes and National Football League Arizona Cardinals, respectively, and both venues host numerous sporting events, concerts, and trade-shows year round. METRO is currently studying whether high capacity transit should connect to Westgate City Center from transit improvements proposed along the I-10 West Corridor or as the northwest extension of the CP/EV LRT Starter Line.

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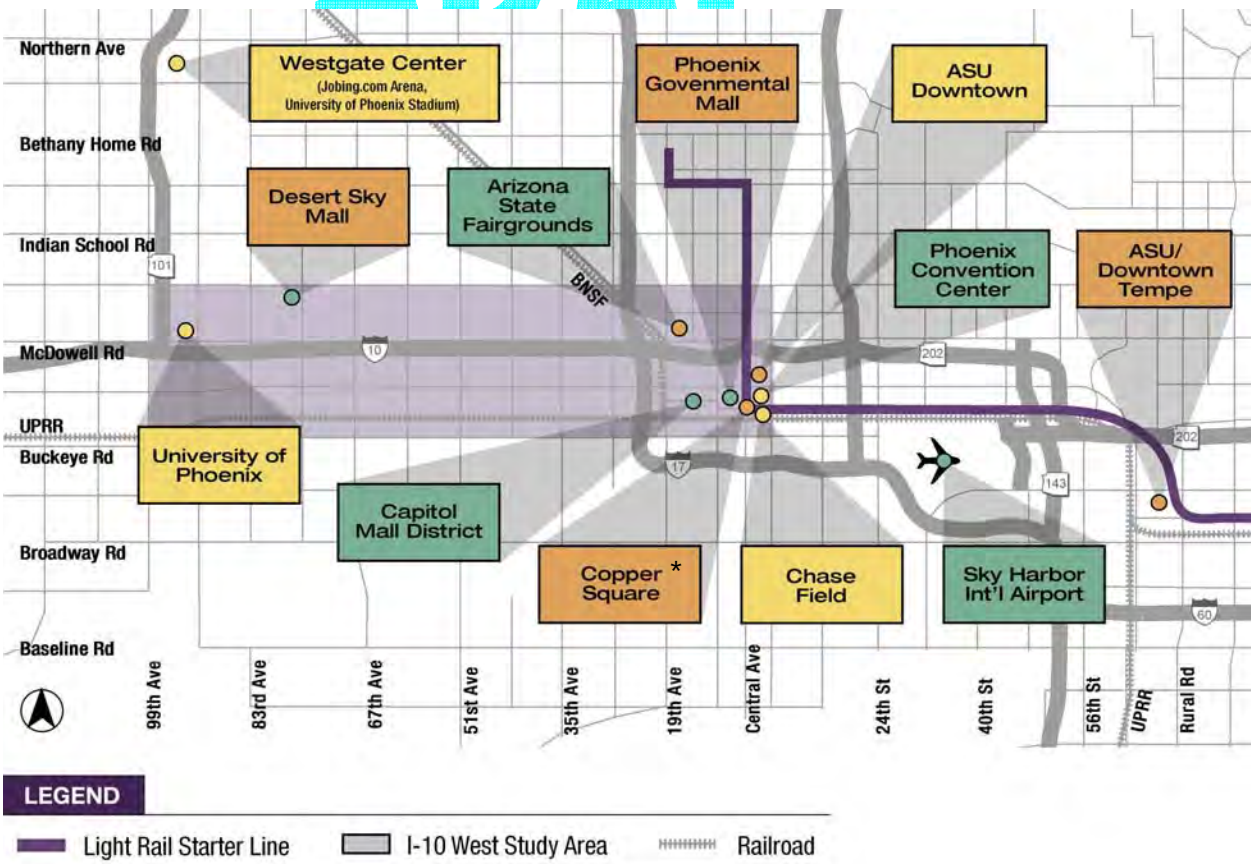
Figure 17 I-10 West Study Area Activity Centers



Source: 2001 – City of Phoenix
*Copper Square will be known as Downtown Phoenix in the future.

1.3.4 Reinforcement of Economic Development Opportunities

The I-10 West Corridor is located in an area that has been scrutinized for growing peak hour congestion problems and a lack of transit options to access activity centers. The I-10 West Corridor has also been the subject of numerous studies and plans concerning the need for transportation improvements and expanded capacity. As noted in Section 1.1, when the original Final Environmental Impact Statement (EIS) for the section of freeway within the I-10 West Corridor was completed and subsequently constructed in 1982, a 50-foot median was reserved for future high capacity transit.

Several regional and local planning documents support transportation improvements and demonstrate the need to make transportation investments. Local governments including the cities of Phoenix and Tolleson, municipalities within the immediate vicinity of the I-10 West Corridor, recommend improved transportation facilities to accommodate forecasted population and employment growth. Some of the transportation studies and plans identify high capacity transit improvements along the freeway within the I-10 Corridor as a means to help alleviate current and forecasted congestion problems. These studies include the MAG RTP, the MAG Fixed Guideway System Study, the MAG High-Capacity Transit Study, the MAG Long Range Transportation Plan, the City of Phoenix General Plan, and the Tolleson General Plan. All of these plans recognize the importance of high capacity transit improvements as part of a "shared solution" of high capacity transit improvements for meeting regional transportation and land use goals and objectives within the I-10 West Corridor.

The Downtown Phoenix Urban Form Project is a collaborative process between the City of Phoenix and interested citizens and stakeholders to comprehensively revise Downtown zoning. To ensure the creation of an attractive Downtown with shade and thermal comfort, pedestrian-oriented streets, and quality design, the Urban Form Project incorporates master plans for Circulation, Public Space and Public Art along with the establishment of environmental regulations for sustainability for use by city departments, developers, and interested citizens in shaping the future development of Downtown. The project Study Area is roughly bounded by 7th Avenue and 7th Street, McDowell Road to the north and Buckeye Road to the south. The Draft Downtown Phoenix Urban Form Plan was released for public review in February 2008, with adoption anticipated to follow in the fall of 2008.

The transformation of the downtown Capitol Mall and Oakland Neighborhood areas depends largely on the initiative of the private sector and market demand for housing, office, hotel, and other land uses. Much of this investment will be focused on development of infill and/or redevelopment of vertical mixed-use projects to accommodate the anticipated increasing in density of both employment and residential activities within Downtown. The City of Phoenix estimates that between 30,000 and 40,000 new residents and approximately 32,000 new jobs will transition to the Downtown Phoenix Urban Form Study Area over the next 20 to 30 years.

Case studies indicate that real estate (residential, commercial and business) served by high-quality transit services can command higher rents and maintain higher value than similar properties not served by transit. Cities like San Diego, Portland, Santa Clara and Sacramento have seen residential property values rise between 2 and 18 percent near LRT alignments (APTA n.d.). Bus rapid transit has also spurred development around transit stations in cities like Eugene, Miami, Boston and Los Angeles, leading to increased land values, rising property valuations, and greater community vitality in diverse neighborhoods (APTA n.d.). As a result of

redevelopment projects currently under construction and the revitalization efforts proposed in Downtown Phoenix through measures such as the Urban Form Projects, it is reasonable to assume extending transit through downtown would encourage further investment in higher-density and mixed-use redevelopment.

1.4 THE FTA NEW STARTS PROGRAM AND THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The FTA's New Starts Criteria (New Starts) program, mandated in Section 5309 of Title 49 of the United States Code (U.S.C.), is the federal government's primary financial resource for supporting capital investment in locally planned, implemented, and operated "fixed-guideway" transit systems. Fixed-guideway systems operate on tracks or in dedicated traffic lanes; among these are light rail and some bus rapid transit systems. Standard bus systems, for instance, are not fixed-guideway systems. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) provides the current authorization and funding for the New Starts program.

SAFETEA-LU directs the FTA to evaluate and rate candidate New Starts projects as an input to federal funding decisions and at specific milestones throughout each project's planning and development. SAFETEA-LU further establishes a comprehensive planning and project development process that New Starts projects must follow. The process is intended to assist local agencies and decision makers in evaluating alternative strategies for addressing transportation problems in specified corridors and selecting the most appropriate improvement to advance into engineering, design, and construction. The planning and project development process for New Starts projects is a continuum of analytical activities carried out as part of the local planning process and NEPA review process (FTA 2008).

1.4.1 FTA New Starts Criteria

SAFETEA-LU identifies several specific New Starts criteria, which the FTA must consider in its decision to advance transit projects through the project development process and to enter into a long-term financial commitment to implement the proposed investments. This Act categorizes these criteria into three broad areas: (1) Alternatives Analysis and Preliminary Engineering, (2) Project Justification, and (3) Local Financial Commitment.

In addition, the NEPA process is an integral part of advancement under the New Starts program, even though it is not identified in SAFETEA-LU as one of the broad areas in which specific New Starts criteria must be considered. No project can be advanced to final design under the New Starts criteria unless a Record of Decision (ROD) or Finding of No Significant Impact (FONSI) has been issued for the project's environmental document. Thus, NEPA documentation constitutes an approval "threshold," rather than a process with specific criteria that must be met under the New Starts program.

The overall planning and project development process, which includes alternatives analysis, NEPA documentation, preliminary engineering, and final design, is the forum for the development and refinement of the project justification and local financial commitment New Starts criteria, and for addressing other planning, environmental, engineering, and design issues and requirements.

1.4.1.1 Alternatives Analysis and Preliminary Engineering

Along with Final Design, activities associated with Alternative Analysis and Preliminary Engineering constitute the planning and project development process for New Starts investments. All projects seeking discretionary New Starts funding must follow this process, and FTA must approve project entrance into all but the alternatives analysis phase of planning and development. The planning and project development process is the forum for the development and refinement of the project justification and local financial commitment New Starts criteria, and for addressing other planning, environmental, engineering, and design issues and requirements (FTA 2008).

1.4.1.2 Project Justification

SAFETEA-LU requires that proposed New Starts projects be evaluated based on several project justification criteria, including the following:

- Mobility Improvements;
- Environmental Benefits;
- Operating Efficiencies;
- Cost Effectiveness;
- Transit Supportive Land Use Policies and Future Patterns; and
- Other Factors.

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SAFETEA-LU further requires that FTA consider the economic development effects of New Starts projects. Because the FTA does not currently have guidelines or regulations in place that measure economic development effects of candidate projects, economic development will not be explicitly considered as a New Starts evaluation criteria during the Fiscal Year 2008 cycle (FTA 2008).

1.4.1.3 Local Financial Commitment

SAFETEA-LU requires that New Starts project sponsors demonstrate adequate local support for the project, as measured by these factors:

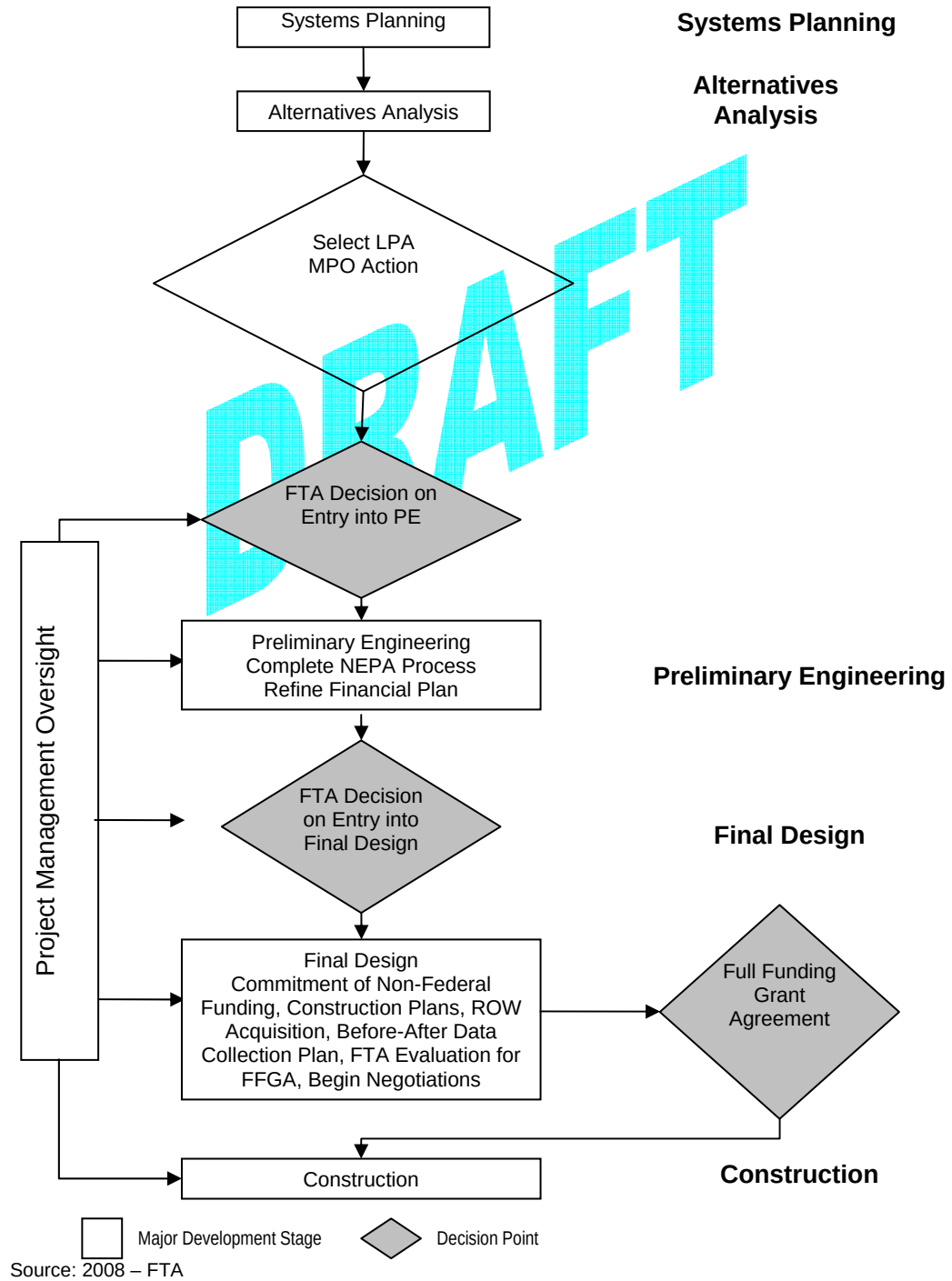
- The proposed share of the total project costs from sources other than from the New Starts program, including federal formula and flexible funds and state and local funding;
- The strength of the proposed project's capital financing plan; and
- The ability of the sponsoring agency to fund operation and maintenance of the entire system – existing and planned – once the guideway project is built.

1.4.2 Planning and Project Development Process for FTA New Starts Projects

Projects seeking FTA New Starts funding, like all federally funded transportation investments in metropolitan areas, must emerge from a locally driven, *multimodal* corridor planning process, adopted by SAFETEA-LU and originated by the Transportation Equity Act for the 21st Century

(TEA-21) (Figure 18). The three key phases in the planning and project development process for projects seeking FTA New Starts funding include: (1) FTA Alternatives Analysis, (2) Preliminary Engineering, and (3) final design. These phases are described in the following sections.

Figure 18 TEA-21 New Starts Planning and Project Development Process



Source: 2008 – FTA

LPA – Locally Preferred Alternative FTA – Federal Transit Administration

FFGA – Full Funding Grant Agreement

1.4.2.1 FTA Alternatives Analysis

To specifically qualify for FTA Section 5309 New Starts funding, candidate projects must have resulted from an alternatives analysis (also known as major investment study or multimodal corridor analysis) that evaluates appropriate modal and alignment options for addressing mobility needs in a given corridor. Alternatives analysis can be viewed as a bridge between systems planning (which identifies regional travel patterns and transportation corridors in need of improvements) and project development (where a project's design is refined sufficiently to complete the NEPA environmental process). The alternatives analysis study is intended to provide information to local officials on the benefits, costs, and impacts of alternative transportation investments developed to address the purpose and need for an improvement in the corridor. Potential local funding sources for implementing and operating the alternatives are identified and studied, and New Starts criteria are developed. At local discretion, the alternatives analysis may include the undertaking of a Draft Environmental Impact Statement.

The alternatives analysis phase is considered complete when a locally preferred alternative (LPA) is selected by local and regional decision makers and adopted by the metropolitan planning organization into the financially constrained metropolitan transportation plan. At this point, the local project sponsor may submit to FTA the LPA's New Starts project justification and local financial commitment criteria and request FTA's approval to enter into the preliminary engineering phase of project development.

1.4.2.2 Preliminary Engineering

During the preliminary engineering phase of project development, local project sponsors refine the design of the proposal, taking into consideration all reasonable design alternatives. Preliminary engineering results in estimates of project costs, benefits, and impacts at a level of detail necessary to complete the NEPA process. The proposed project's New Starts criteria are similarly refined in the preliminary engineering phase of development; project management plans are updated; and local funding sources are committed to the project (if not previously committed).

Preliminary engineering for a New Starts project is considered complete when FTA has issued a Record of Decision or Finding of No Significant Impact, as required by NEPA. Projects that complete preliminary engineering and whose sponsors are determined by FTA to have the technical capability to advance further in the project development process must request FTA approval to enter final design and submit updated New Starts criteria for evaluation.

1.4.2.3 Final Design

Final design is the last phase of project development and includes right-of-way acquisition, utility relocation, and the preparation of final construction plans (including construction management plans), detailed specifications, construction cost estimates, and bid documents. The project's financial plan is finalized, and a plan for the collection and analysis of data needed to undertake a Before and After Study is developed, which is required of all projects seeking a Full Funding Grant Agreement.

1.5 PURPOSE AND NEED SUMMARY

The project needs consist of the following:

1) A need for added peak period travel capacity as part of a balanced multimodal transportation system.
2) A need for increased transit system connectivity.
3) A need for improved access to corridor destinations.
4) A need to reinforce economic development opportunities.

The transit alternatives that will be proposed within the Study Area should address every element of the project purpose:

- As part of a "shared solution" that includes proposed projects along the stretch of I-10 within the Study Area managed by ADOT and in conjunction with the existing HOV and bus transit opportunities within the I-10 West Corridor, either LRT or BRT would provide a transit alternative that would improve the movement of people within the project corridor for present to design year 2030 conditions;
- Because of its proximity to major activity centers and corridor destinations, a high-capacity transit option would enhance economic potential in the corridor by improving access to existing and planned development and by fostering an environment that is conducive to transit oriented development;
- LRT or BRT within the I-10 West Corridor would support regional plans and policies that call for the provision of a balanced transportation system; and
- Since LRT or BRT offers an alternative form of transit that would be equal or better than travel that can be accomplished by automobiles within the corridor, particularly during peak periods, it has the potential to replace automobile trips and thus, support regional air quality goals (METRO 2008).

The purpose and need development results will be used to propose evaluation criteria and to guide screening of the alternatives. The purpose and need summarized above will be considered to be in draft form to elicit comments and input during the alternatives analysis phase of the project.

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I-10 WEST

ALTERNATIVES ANALYSIS/ ENVIRONMENTAL IMPACT STATEMENT

DRAFT
EVALUATION METHODOLOGY REPORT

July 2008

METRO

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1.0 INTRODUCTION

1.1 OVERVIEW

This report presents the draft methodologies that will be used to evaluate the alternatives as part of the I-10 West Alternatives Analysis. The intent of the evaluation process is to provide an objective and structured approach to screening a wide range of alternatives down to a manageable set of transit improvement strategies. The ultimate goal of this process is to evaluate and eliminate all other alternatives with the aim to identify the "locally preferred alternative" with possible design options and a No-Build Alternative.

This report begins with background information and a description of the study. Section 2 describes the two-tiered approach that will be used to evaluate the alternatives developed at each stage of the process. The criteria to be used in the Tier 1 evaluation are presented in Section 3. Section 4 discusses the criteria to be employed in the Tier 2 analysis.

1.2 PROJECT DESCRIPTION

1.2.1 Introduction

Valley METRO Rail, Inc. (METRO), in coordination with the Federal Transit Administration (FTA), is undertaking an Alternatives Analysis and an Environmental Impact Statement to evaluate high-capacity transit service improvements in the I-10 West Corridor in the City of Phoenix, Arizona. Capital improvements under consideration include light rail transit (LRT) and/or bus rapid transit (BRT). In addition, a local bus network will be integrated into the selected higher-capacity rapid transit system.

The purpose of this study is to develop project information in sufficient detail so that citizen groups, local and federal agencies, elected officials, and other study participants can make informed decisions on the appropriate transit technology and alignment to address future travel demand in the I-10 West Corridor. This information will include, but not be limited to, the following:

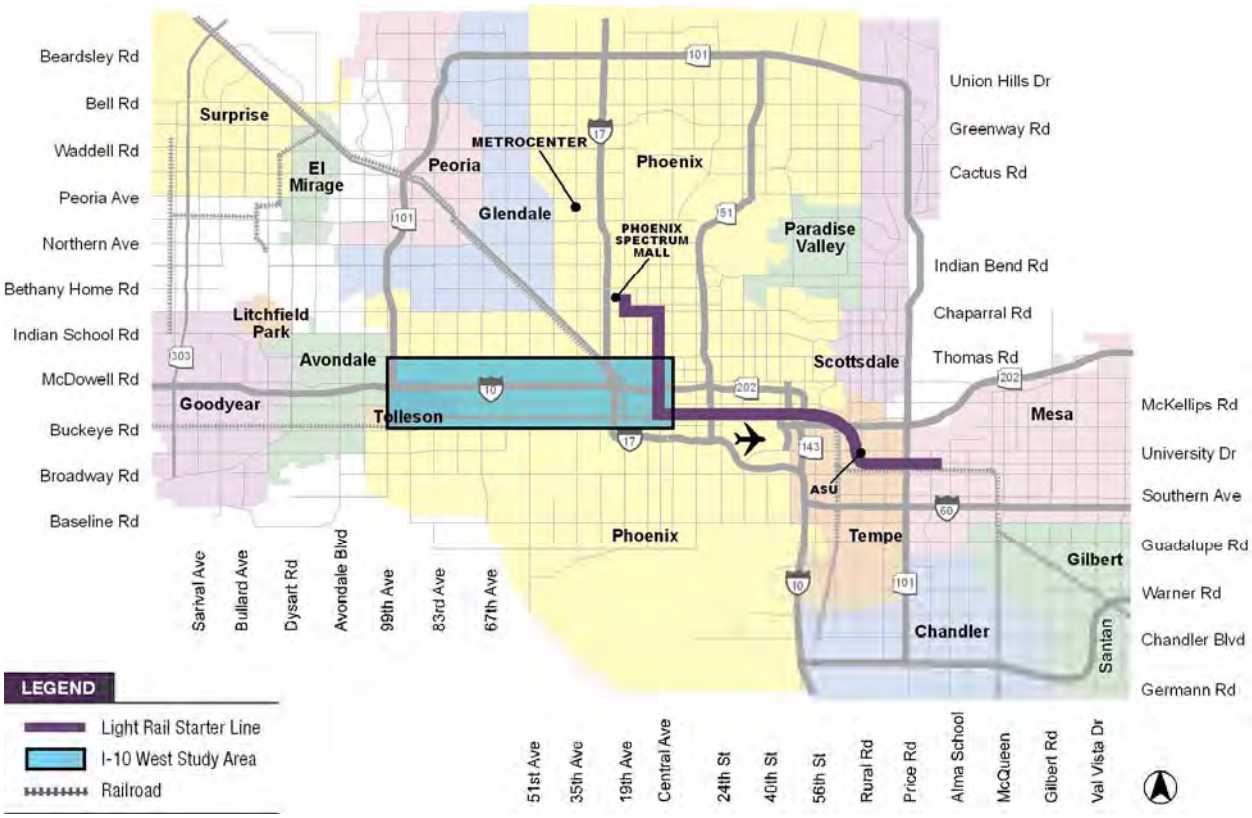
- Identify technology modes and potential alignment options;
- Evaluate modes and alignments using a variety of criteria (as discussed in Sections 3 and 4) to narrow the range of alternatives;
- Define an enhanced bus system that integrates with the "build" alternative(s);

- Select a preferred mode and route or "alignment." For the selected alternative provide detailed information about the following:
  - Operating plans;
  - Environmental impacts and appropriate mitigation;
  - Traffic impacts;
  - Cost estimates and financial plan;
  - Cost effectiveness and efficiency;
  - Forecasted ridership;
  - Land use and economic development implications; and
  - Location and configuration of stations, park-and-ride lots, and maintenance facility.

1.2.2 Study Area Corridor Definition

The first phase of the study is the Alternatives Analysis that is expected to last about 18 months. The purpose of the study is to evaluate potential high-capacity transit improvements, including a potential LRT line and/or BRT in the I-10 West Corridor study area bounded by State Route 101 (Loop 101) to the west, 7th Street to the east, Thomas Road to the north, and Buckeye Road to the south, as shown in Figure 1. The environmental impact statement is the second phase of the study, which will analyze the environmental impacts of a select group of alternatives. The Alternatives Analysis study and Environmental Impact Statement will be prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) and its implementing regulations. For purposes of this report, the terms "study area" and "corridor" may be used interchangeably.

Figure 1 I-10 West Study Area

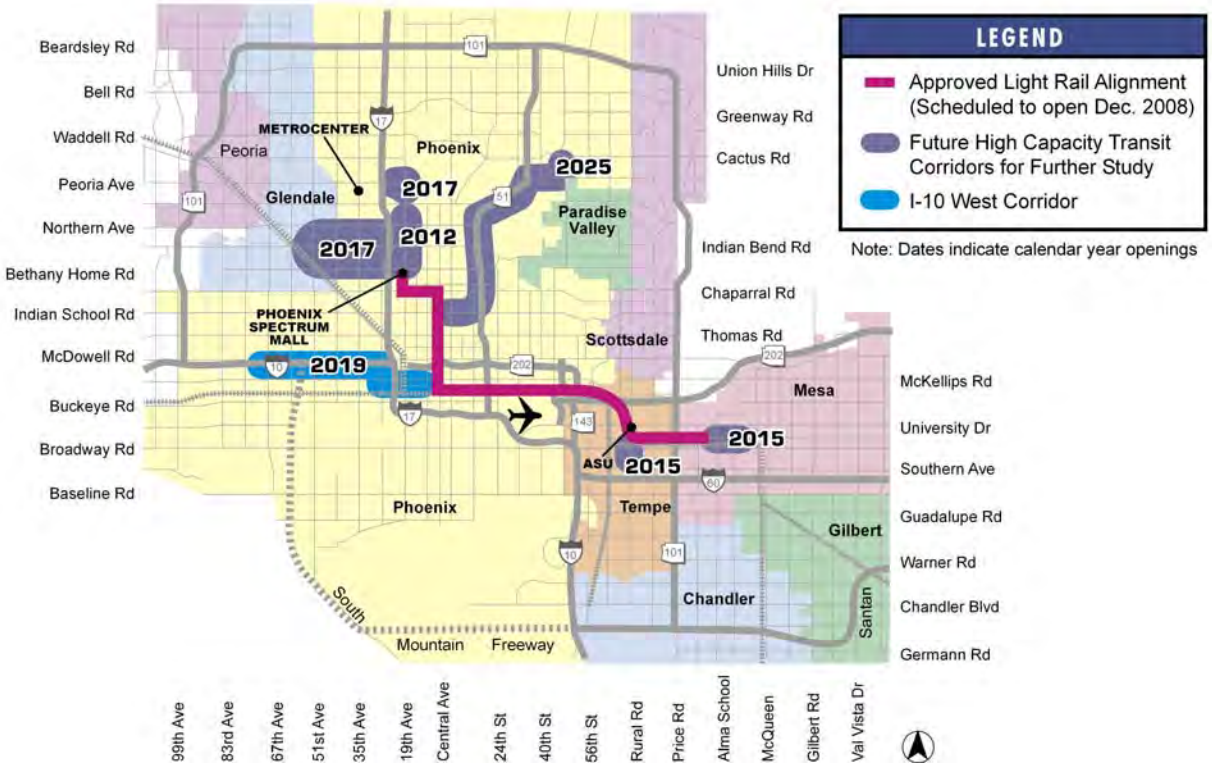


1.2.3 Project Background

The I-10 West Alternatives Analysis is funded by the Proposition 400 one-half-cent transportation sales tax extension approved by Maricopa County voters in 2004 and is contained in the Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP) as a component of the 57 miles of high capacity/light rail transit network to be implemented by 2026 (Figure 2).

The established schedule for high capacity transit implementation in the Phoenix area provides regional context for the I-10 West Alternatives Analysis. Construction of the 20-mile light rail starter line through Phoenix, Tempe, and west Mesa will open for passenger service in December 2008. Other high-capacity or light-rail corridors are planned to be implemented as follows: Northwest Phase I opens in 2012; Phase II opens in 2017; Tempe South opens in 2015; Central Mesa opens in 2015; Glendale opens 2017; I-10 West opens in 2019; and Northeast opens in 2025.

Figure 2 High Capacity/Light Rail Transit Corridors

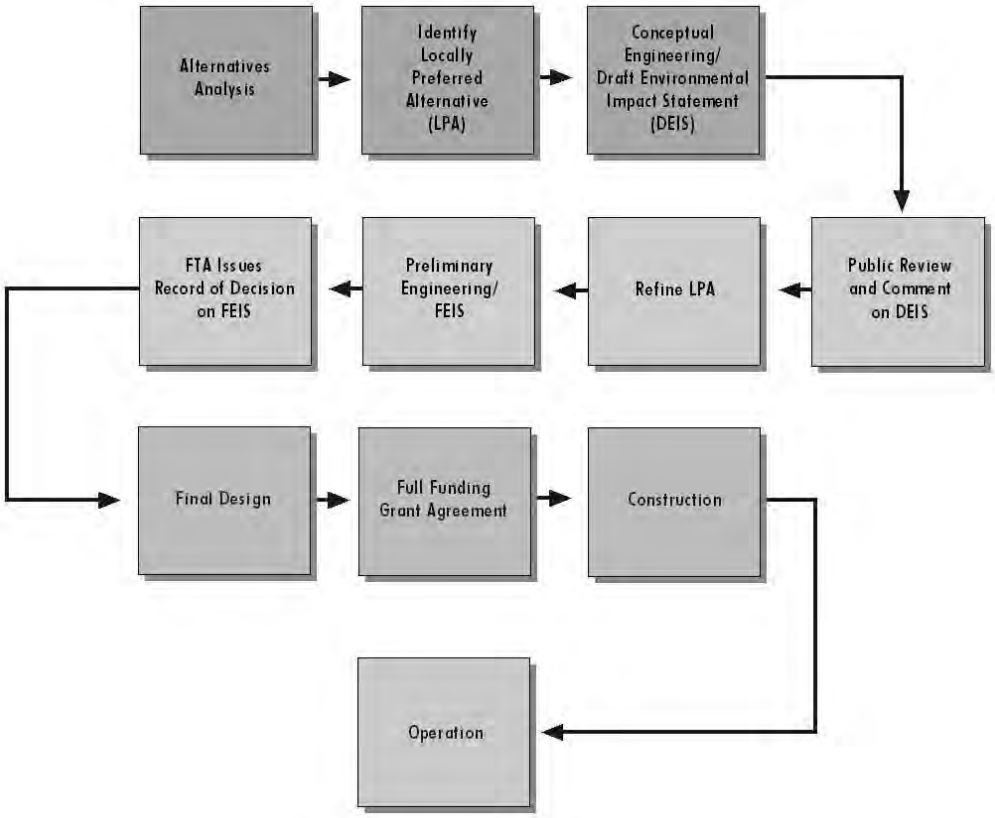


1.2.4 Project Development Process

The I-10 West Alternatives Analysis is proceeding in accordance with the project development process (Figure 3) outlined by FTA for major transit capital investments and in accordance with the rules and regulations specified under NEPA.

To qualify for FTA Section 5309 New Starts funding, candidate projects must have resulted from an alternatives analysis (also known as major investment study or multimodal corridor analysis) that evaluates appropriate modal and alignment options for addressing mobility needs in a given corridor. Alternatives analysis can be viewed as a bridge between systems planning (which identifies regional travel patterns and transportation corridors in need of improvements) and project development (where a projects' design is refined sufficiently to complete the NEPA environmental process). The alternatives analysis study is intended to provide information to local officials on the benefits, costs, and impacts of alternative transportation investments developed to address the purpose and need for an improvement in the study area corridor.

Figure 3 Project Development Process



The steps from Alternatives Analysis through Final Environmental Impact Statement make up the project planning phases. During this time, an analysis of various alternatives will be conducted considering a variety of criteria. Based on the results of the evaluation and the public input received during the public scoping meetings, the Phoenix City Council and the METRO Board of Directors will identify a Locally Preferred Alternative (LPA). The goal is to conduct a detailed analysis of the LPA and No-Build Alternative during the Draft Environmental Impact Statement (Draft EIS) and to propose mitigation measures for adverse impacts.

Upon completion of the Draft EIS, it will be circulated for public and agency review and comment, and public hearings will be held during the specified review period. Based on the findings of the Draft EIS and public comments received, FTA, the Phoenix City Council, and the METRO Board of Directors will then adopt a refined LPA. Preliminary Engineering will then be conducted concurrently with preparation of the Final EIS. The Final EIS will respond to and in some cases incorporate public comments and identifies specific mitigation measures for adverse impacts. Upon completion of the Final EIS, it will be submitted to FTA for consideration, and FTA will then issue a Record of Decision (ROD) that may provide environmental clearance.

Following issuance of a ROD that recommends a build alternative, final design would commence, and the financing plan would be finalized. Construction would then begin, and the project is expected to be fully operational by the end of 2015, four years earlier than identified in the RTP.

1.3 PROJECT PROBLEM STATEMENT

The I-10 West corridor is one of the most heavily traveled in the Phoenix metropolitan area. The rapid growth of West Valley communities has generated significant travel demands for trips to and from the central part of the region.

At the same time, no new major capacity additions to east/west travel have been added to the system since the construction of I-10 through central Phoenix in the mid 1980's. As part of the Final Environmental Impact Statement for the construction of I-10, a 50-foot wide right-of-way was reserved in the median of the highway for future transit options.

Current travel on I-10 is extremely congested during the morning and evening peak periods. Coupled with the increasing traffic volumes and associated congestion on parallel arterials such as Buckeye Road, Van Buren Street, McDowell Road and Thomas Road, the transportation system is failing to meet existing demands. Continued growth will only contribute to congestion.

Transit services in the project study area are currently limited. One of the highest volume bus routes in the Phoenix system is the West Thomas Road Green Line running between Central Avenue and the Loop 101. New bus rapid transit service on the I-10 West RAPID has been successful, carrying over 900 daily riders.

Additional travel options are needed in the study area, specifically along the I-10 West corridor. The Arizona Department of Transportation (ADOT) is currently evaluating capacity improvements for I-10 west of Interstate 17 (I-17) to address travel demands in that corridor. The widening projects were authorized by voters in 2004. Construction completion is scheduled for 2012. During Alternatives Analysis, METRO will coordinate with ADOT to determine the best use of the reserved right-of-way.

1.4 STATEMENT OF PROJECT PURPOSE AND NEED

The purpose of the proposed high capacity transit improvement in the I-10 West Study Area is to provide a dependable and efficient high-capacity transit option between central Phoenix and the West Valley in support of regional plans and policies contained in the MAG RTP.

This project would meet four primary needs stemming from regional growth, increased travel demand, changes in land use patterns, lack of access to activity centers, air quality problems, inadequate transit service, and regional planning goals. The project would help to satisfy the four following primary needs:

A need for added peak period travel capacity as part of a balanced transportation system. Travel demands are expected to more than double by 2030. Highway and transit improvements are needed to address the future demands as part of a "shared solution" to facilitating the safe and efficient movement of people and goods within the project study area, specifically along the I-10 corridor.

A need for increased transit system connectivity. Transit service coverage in the study area is limited, especially for longer peak period commute trips. Improved services and connections are needed between and among the destinations within and connected to the study area.

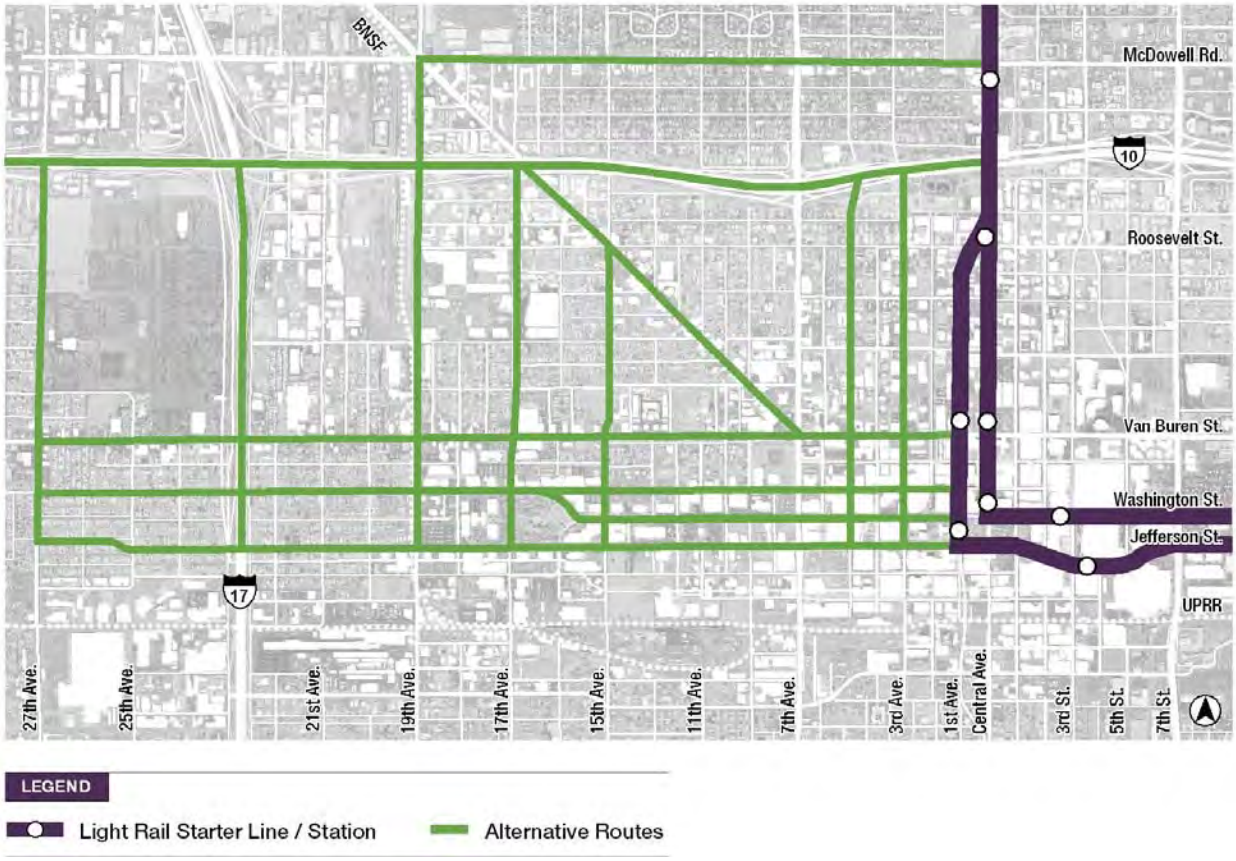
A need for cost effective use of public funds. Investment in high capacity transit improvements must be accomplished to maximize potential ridership while minimizing capital and operating costs.

A need to reinforce economic development opportunities. Investments in high capacity transit should be leveraged to encourage more intensive transit oriented development in the study area.

2.0 BASIC ALTERNATIVES AND EVALUATION PROCESS

In coordination with State, County, and local agencies and in coordination with the general public during the scoping process, basic alternatives have been identified that will be further developed during Tier 1 analysis. Additionally, documentation provided in the METRO document *Tier 2 Evaluation of I-10 West Alternative Alignments and Final Recommendation* (September 2006) will be considered during the evaluation process. All proposed alternatives start at Central/1st Avenue in Downtown Phoenix, connecting to the Central Phoenix/East Valley LRT starter line, and terminate at approximately 83rd Avenue to the west. Alignment options west of 27th Avenue include McDowell Road, I-10, and Van Buren Avenue. Several alignment options for the downtown portion of the study area that extend east of 27th Avenue have also been identified, including east-west routes along I-10, McDowell Road, Van Buren Street, Adams Street, Washington Street, and Jefferson Street. North-south routes identified downtown include I-17 and 3rd, 5th, 17th, 19th, Grand, and 27th Avenues. A combination of these east-west and north-south corridors shown on Figure 4 will be carried forward as alignment alternatives.

Figure 4 Downtown Phoenix Alignment Alternatives



2.1 NO-BUILD ALTERNATIVE

The No-Build Alternative will incorporate changes in the transportation network that are already approved or programmed by the Year 2030. The No-Build Alternative would consist of a modified plan of existing and committed highway and transit improvements as defined by the RTP. The No-Build Alternative definition will be coordinated with the cities of Phoenix and Tolleson. METRO and MAG have begun coordination to establish the list of highway and arterial roadway projects that will be included in the No-Build Alternative.

To assess the level of uncertainty of each project listed in the Freeway/Highway element of the RTP, METRO staff, in cooperation with MAG, assessed the likelihood of each project being completed and operational by the year 2027 and agreed upon a reasonable set of projects. Each listed project was evaluated for five characteristics:

- Project definition
- Status of environmental clearance
- Sufficiency of project funding
- Schedule
- Potential for public controversy

2.2 TRANSPORTATION SYSTEM MANAGEMENT (TSM) ALTERNATIVE

The Transportation System Management Alternative, also known as the Baseline Alternative, would include relatively low-cost safety, operational, and capacity enhancements to the existing transit system. This alternative would not include a major investment and would represent a less-capital intensive improvement strategy to address identified project needs in the I-10 West study area. The TSM Alternative would be focused on increased bus services and selected facility improvements and would implement all of the projects in the No-Build Alternative. Improvements to the RAPID service will be the key component of this alternative, in conjunction with improvements to local bus service.

2.3 BUILD ALTERNATIVE

A range of modal and alignment alternatives that have been proposed in the RTP, previous work, and the project scoping process will be evaluated for the project study area. Modal alternatives would include both LRT and BRT technologies operating in exclusive guideway. Project alternatives will also include the consideration of Express Bus operating in high-occupancy vehicle (HOV) lanes along I-10.

2.3.1 Express Bus in HOV Lanes Alternative

Similar to the TSM Alternative, the Express Bus in HOV Lanes Alternative would increase bus service use of the I-10 freeway HOV lanes. The Express Bus in HOV Lanes Alternative would rely upon improvements to the existing freeway system to accommodate bus travel, such as construction of additional HOV access ramps in the freeway median similar to the HOV ramp at 79th Avenue, possibly supplemented by the creation of HOV lanes on arterial roads such as Thomas, McDowell, or Buckeye Roads or Van Buren Street.

2.3.2 Bus Rapid Transit in HOV Lanes Alternative

The City of Phoenix and METRO currently utilize BRT modes of transit through arterial BRT and RAPID/express bus service within the study area. However, development of the BRT in HOV Lanes Alternative would consider the following issues related to BRT improvement in the I-10 West study area to provide high capacity transit service:

- New and revised feeder bus routes to collect and drop off passengers in outlying areas;
- Use of park-and-rides within the study area including the existing facility at 79th Avenue;
- Use of I-10 HOV lanes;
- Use of the 3rd/5th Avenue HOV ramps;
- Circulate in the downtown and historical areas;
- Serve the Downtown Transit Center; and
- Utilize the Deck Park Station (if the selected alternative extends to the Deck Park along I-10).

2.3.3 Bus Rapid Transit in Exclusive Guideway

A BRT alternative could potentially utilize the I-10 median that has been reserved for high capacity transit. This alternative would build a separate busway designed to exclusively accommodate BRT travel. The RAPID and express bus routes that serve the study area along I-10 would have access to this busway via drop-ramps or slip ramps that would be physically separated from freeway traffic. On-line stations in the median of I-10 could be used to minimize service delays for BRT to leave the guideway to pick-up or drop off patrons.

Similar to the BRT in HOV Lanes Alternative, the following issues would be considered for the BRT in Exclusive Guideway Alternative:

- New and revised feeder bus routes to collect and drop off passengers in outlying areas;
- Use of park-and-rides within the study area including the existing facility at 79th Avenue;
- Use of I-10 HOV lanes;
- Potential use of on-line stations in the median of I-10 to limit BRT diversion;
- Use of the 3rd/5th Avenue HOV ramps;
- Circulate in the downtown and historical areas;
- Serve the Downtown Transit Center; and
- Utilize the Deck Park Station (if the selected alternative extends to the Deck Park along I-10).

2.3.4 Light Rail Transit Alternative

This alternative would consist of an extension to the Central Phoenix/East Valley (CP/EV) LRT system within the median of I-10 and parallel arterials within the study area. Similar to the Central Phoenix/East Valley starter line, new LRT within the I-10 West study area would likely operate at-grade using existing freeway and/or roadway rights-of-way. Property acquisition would likely be considered to accommodate new light rail stations or other facilities. Use of existing rail lines operated by Burlington Northern Santa Fe (BNSF) or Union Pacific Railroad would not be considered since those rail lines are designed primarily for freight transportation and LRT vehicles are not compatible with freight trains. In addition, both rail lines within the study area experience a high volume of trains resulting from freight service and switching operations.

Although different than a BRT system, the LRT Alternative will have similar considerations such as:

- Providing service to passengers in outlying areas through feeder bus routes in collection/distribution mode;
- Providing access to the existing 79th Avenue or future park-and-rides;
- Serving activity centers, especially the Phoenix Central Business District (CBD) area;
- Serving the Downtown Transit Center; and
- Examining how or if use of the Deck Park Station is feasible.

2.4 TECHNOLOGIES

Transit technologies under consideration are express bus operating in HOV lanes, BRT in HOV lanes, BRT in an exclusive guideway, and LRT. The design criteria being evaluated will be modeled after the 20-mile starter line and consistent with METRO's adopted design criteria. Modern Streetcar technology was eliminated from consideration given that the purpose of the I-10 West Alternatives Analysis/Environmental Impact Statement is to define a transit project that would provide an efficient transit option with increased mobility along a congested corridor, with the possibility of serving destination activity and employment centers in the Phoenix CBD. The City of Phoenix may determine streetcar technology is a desirable downtown transit mode in conjunction with transit improvements implemented in the I-10 West study area; however, streetcar technology would be considered separate from the METRO I-10 West AA/EIS study.

2.5 EVALUATION PROCESS

A two-tiered alternatives development process will be implemented to evaluate the I-10 West AA/EIS alternatives. The first phase (Tier 1) includes a general level of evaluation that analyzes the advantages and disadvantages of a "long list" of potential alternatives

to address the transportation needs of the study area. The purpose of the Tier 1 evaluation is to determine which of the alternatives included on the “long list” would be the most feasible, thus narrowing down the range of options to be considered for more detailed analysis. The Tier 1 evaluation criteria are qualitative in nature and seek to eliminate alignment and, possibly, technology options that do not support project goals.

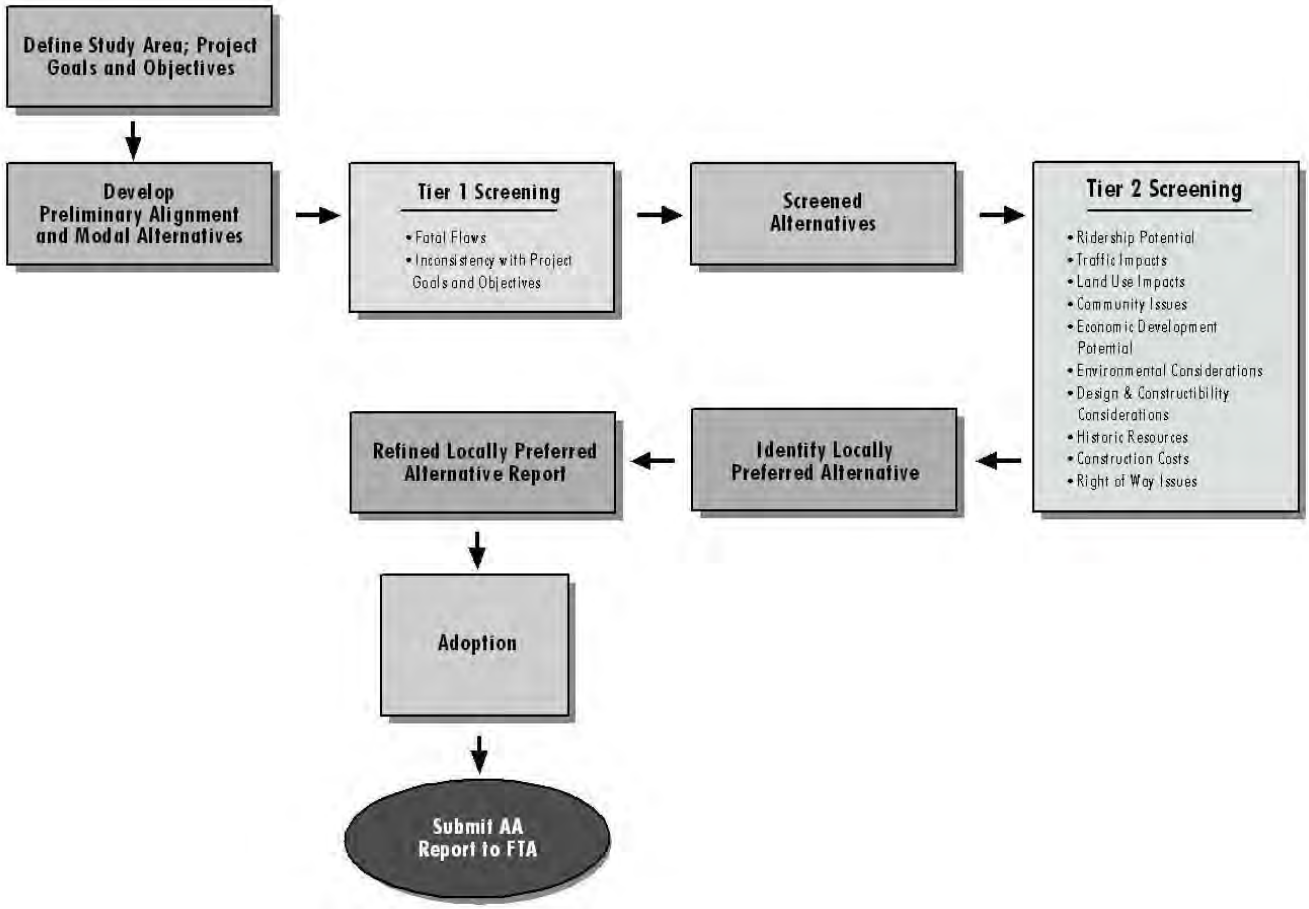
The alternatives that pass the Tier 1 evaluation will then be subjected to a more rigorous evaluation (Tier 2). The Tier 2 evaluation criteria will begin to quantify ridership potential, capital costs, land use and economic development impacts, traffic issues, environmental factors, conceptual engineering, and public preferences. The Tier 2 alternatives will be advanced to a schematic design evaluation level and their definitions will include plans and cross-sections, right-of-way requirements, station locations, storage and maintenance facility site alternatives and/or expansion/upgrades, park-and-ride locations and capacity, intermodal transfer stations, end-of-line station location and size, feeder bus service, potential minimum operable segments, and operating plans. Capital and operating cost estimates will be provided for each alternative.

The evaluation of the Tier 2 alternatives is intended to remove from consideration all but a “locally preferred alternative” with possible design options. However, if the Tier 2 evaluation result in more than one optimal alternative with no clear choice, then those alternatives will be modeled and assessed against the Section 5309 New Starts criteria and community acceptance to help achieve the best possible project as identified by the FTA criteria. The alternative that best satisfies the criteria would then be the one recommended as the “preferred alternative” for further detailed evaluation in the Environmental Impact Statement. The Alternatives Development Process is shown on Figure 5.

In addition to structuring the analysis into tiers, the evaluation methodology has provisions for separate consideration of transportation technologies and corridor alignments. Transportation technology refers to the travel method and technology used (e.g., BRT and/or LRT). Transportation corridor alignment refers to the specific geographic areas where modal improvements may occur.

An essential component throughout the evaluation process is the Public Involvement Program (PIP). The PIP identifies the public, interested groups and stakeholders and will solicit their input and participation at key points in the process.

Figure 5 Alternatives Development Process



3.0 EVALUATION CRITERIA—TIER 1

3.1 INTRODUCTION

As discussed in Section 2.0, the objective of the Tier 1 evaluation process is to analyze the initial "long list" of alternatives to be considered. The criteria developed for this process are generally qualitative in nature and their purpose is to eliminate alternatives that do not support the overall goals and objectives of the project. Tier 1 is a "critical flaw" analysis designed to efficiently screen the initial universe of alternatives to a more manageable number of feasible alternatives to include both mode and alignment options.

The I-10 West Alternatives Analysis/Environmental Impact Statement project must follow NEPA and Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) guidelines as well as requirements of the FTA during its evaluation of alternatives. New Federal Highway Administration/FTA policy (Linking

Transportation Planning and NEPA, February 2005) encourages the use of previous transportation studies in the NEPA process.

The evaluation of the alternatives will be structured around basic criteria developed to measure the alternatives' performance relative to meeting the project goals of the I-10 West AA/EIS. These primary project goals are defined as follows:

1. Identify a transit alternative that increases regional travel and mobility along the I-10 West Corridor.
2. Identify a transit improvement alternative, with a recommended alignment and technology, to connect the local and express bus system and the LRT system currently under construction with the West Valley.
3. Identify an alternative that provides cost-effective transit improvements.
4. Identify a transit alternative that ensures enhanced connectivity among existing and planned regional and local activity centers and attractions and employment centers (including the State Capitol) and supports economic development.
5. Identify a transit alternative that minimizes environmental impacts.

The project goals will be reviewed and may be revised based on additional input from the cities of Phoenix and Tolleson as well as the public and other stakeholders. However, these project goals have been used as a baseline for the initial development of the Tier 1 evaluation criteria and screening process.

3.2 TIER 1 EVALUATION CRITERIA

The goal of the Level 1 screening process is to eliminate alternatives that are clearly unacceptable because they:

- Do not fulfill the primary project goals;
- Are not supported by existing land use, and other plans, including the MAG RTP;
- Are too costly (including those alternatives that have a need for substantial right of way acquisition);
- Have serious and obvious environmental impacts; or
- Are not technically feasible.

Table 1 summarizes the criteria and the methodologies used to establish and apply them. For the purposes of the Tier 1 screening, alignments are screened together with the modes.

Table 1 Level 1 Evaluation Criteria and Methodology

Evaluation Criteria	Method/ Technique	Resources	Level of Detail/ Expected Results
Fulfillment of primary project goals	Conduct a high level assessment to determine if the primary project goals are met.	Project goals and draft Purpose and Need Statement	Determination of project goals are potentially met.
Consistency with existing plans and studies	Review available transportation and land use plans and studies with relevance to the project area. Determine if alternative is consistent with plans.	MAG RTP, City of Phoenix General Plan, other related plans and studies	Determination if consistency with past transportation plans and studies exists to the extent possible.
Irresolvable environmental impacts	Conduct a high level assessment of environmental resource impacts that could cause budget overruns or negatively impact (halt) the project schedule.	Review of project corridor, survey information regarding cultural resources, identification of potential Environmental Justice populations	Determination if any foreseeable potential environmental impacts exist that could cause budget overruns or negatively affect the schedule.
Technical feasibility	Confirm the alignment and associated technology is feasible; conducting a high level assessment of topography, planned infrastructure in the study area; and other potential constructability or implementation issues.	Observation of the corridor; background on technology options	Determine if the alternative is technically feasible given the study area topography, soils, and planned infrastructure.

Source: URS, November 2007

4.0 PRELIMINARY EVALUATION CRITERIA—TIER 2

4.1 INTRODUCTION

The alternatives remaining after the Tier 1 evaluation will be subjected to a more detailed evaluation in the Tier 2 screening. The evaluation of the Tier 2 alternatives is intended to eliminate all but a “locally preferred alternative” along with possible design options. However, if the Tier 2 evaluation results in more than one optimal alternative with no clear choice, then those alternatives will be modeled and assessed against the Section 5309 New Starts criteria to help identify the best possible project as identified by the FTA criteria. The alternative that most satisfies the criteria would then be the one recommended as the “preferred alternative” for further detailed evaluation in the EIS.

The criteria to be employed for the Tier 2 screening are presented below. This is followed by the list of the New Starts Criteria that will be used in the even that there is more than one favorable alternative surviving the Tier 2 screening.

4.2 PRELIMINARY TIER 2 CRITERIA CATEGORIES

The Tier 2 alternatives will be evaluated based on the five project goals previously described in Section 3.1. The Tier 2 screening process builds on these goals with refined criteria and a smaller set of alternatives resulting from the Tier 1 screening process.

Goal 1: Improve regional mobility along the I-10 West corridor

Criteria:

- Ridership Benefits
- Transportation System Performance
- Traffic Issues

Goal 2: Connect the local and express bus system and the CP/EV LRT system with the West Valley

Criteria:

- Transit System Performance
- Connectivity to Downtown Phoenix and existing system

Goal 3: Provide cost-effective transit improvements

Criteria:

- Costs
- Design and constructability issues

Goal 4: Serve major employment centers, including the State Capitol, and support economic development

Criteria:

- Land Use
- Economic Development Potential

Goal 5: Minimize environmental impacts

Criteria:

- Environmental issues
- General Impact to community
- Community support

A ranking of “High,” “Moderate,” and “Low” will be used to indicate the relative performance of the alternative to the specific criterion. The specific method to determine the ranking within each category will be selected after the alternatives are developed. The outcome of the Tier 1 screening will be presented to the public along with the preliminary considerations regarding the screening process for those alternatives to be screened in Tier 2. The public will have the opportunity to comment on these preliminary screening alternatives as the alternatives analysis process move forward. Table 2 presents the individual evaluation criterion and summarizes how each will be measured. The remainder of this section details the methodology for the evaluation of each criterion.

Table 2 Tier 2 Alternatives Preliminary Screening Criteria

Criteria	Measure
Goal 1: Improve regional mobility along the I-10 West corridor	
Ridership Benefits	
Ridership potential	Increase in transit ridership compared to the No-Build Alternative for: -I-10 West Corridor
Transit patron travel time savings	Comparison with No-Build Alternative travel times to downtown Phoenix from: -83rd Avenue/79th Avenue Park and Ride -Loop 101
User benefits	Comparison of the weekday and annual users benefits (users’ expenditure savings in hours)
New riders by auto ownership	Comparison with No-Build Alternative of new riders generated by the build alternative
Transit dependent riders benefits	New riders generated from those owning one or more automobiles (i.e. choice riders). User benefit hours for transit dependents as compared to the No Build Alternative. Transit dependent population is defined as riders who do not own a car.
Transportation System Performance	
Vehicle miles of travel savings	
Changes in vehicle miles traveled	Amount of traffic diverted? Changes in vehicle miles traveled compared to No-Build Alternative
Energy consumption savings	Change in energy consumed in BTU
Air pollutant emission savings	Change in air pollutant emissions for HC, CO and NOx.
Traffic Issues	
Roadway capacity impacts	Lane miles of roadway with diminished geometric cross-section
Traffic operational impacts	Number of intersections with degraded level of service Number of residential locations having diminished left-turn access Number of commercial locations having diminished left-turn access Number of additional traffic signals required.
Goal 2: Connect the local and express bus system and the CP/EV LRT system with the West Valley	
Transit System Performance	

Criteria	Measure
Transit service efficiency	Riders per service hour or mile by type of service
Number of Transfers	Change in number of transfers by type of service
Downtown Phoenix	
Number of travel lanes	Reduction in number of travel lanes
Pedestrian crosswalks	Quantitative assessment of accommodating the current signalized pedestrian crosswalks
Bicycle lanes	Detailed assessment of impact on bicycle lanes
On-street parking	Detailed assessment of impact to on-street parking
Curbs and sidewalks	Detailed assessment of maintaining existing curbs and sidewalks
Landscaping/streetscape elements	Ability to preserve landscaping and streetscape elements.
Left turns	Impacts to number of left turn lanes
Populations served	
Populations served Total persons Total workers Minority population Low-Income households Zero-car households	Numbers of each population located within 0.5 mile of each station for each alternative
Goal 3: Provide cost-effective transit improvements	
Costs	
Capital costs	Rough capital costs
Operation and maintenance costs	Estimated operation and maintenance costs
Design and Constructability Issues	
Utility conflicts	Proximity to major utilities and potential for conflicts requiring utility relocation
Grade separation	Span lengths, vehicle load requirements.
Contractor access during construction	Will the alignment result in major limitations on contractor access during construction?
Goal 4: Serve major employment centers, including the State Capitol, and support economic development	
Land Use	
Consistency with adopted plans	Does the alternative compliment or conflict with plans adopted by local agencies?
Proximity to activity centers and recreational opportunities	Numbers of activity centers, public facilities and recreational areas served within ½ mile of each station for each alternative, as well as proximity to the activity centers served by the CP/EV LRT alignment
Proximity to medium and high-density residential areas	Acreages of medium- and high-density residential areas within ½ mile of each station for each alignment
Economic Development Potential	
Economic development potential	Acreage of vacant land available to develop, amount of employment (location of major employers, future job creation, job growth), and future land use shifts to business, office, commercial, and high-density residential land uses
Goal 5: Minimize Environmental Impacts	
Environmental Issues	
Property acquisitions	Extent of property acquisitions required

Criteria	Measure
Environmental justice	Estimated acquisitions within areas of high concentrations of minority and low-income populations
Potential historic resources	Numbers of potentially historic resources adjacent to alignment
Parklands or other Section 4(f) resources	Numbers of Section 4(f) resources, excluding historic, adjacent to alignment
Endangered and threatened species	Will the alignment travel through critical habitat or affect endangered or threatened species?
Floodplains and riparian areas Contamination sites	Will the alignment travel through floodplains or riparian areas? Numbers of potentially contaminated sites in close proximity of alignment
Visual impacts	Will the alignment cause significant visual impacts to the surrounding areas?
General Impact to community	
Access to employers or activity centers	Does the alignment provide better access to employers or activity centers?
Economic development	Potential for future economic development.
Community support	
Responsiveness to community needs.	Does the alignment address general issues raised by the public for alignment and mode?

Source: I-10 West AA/EIS project team, November 2007

4.3 RIDERSHIP BENEFITS

The alternatives will be evaluated based on five criteria: (1) increase in transit ridership compared to the No-Build Alternative for the I-10 West Corridor; (2) comparison with the No-Build Alternative of travel times from the alternative's western terminus to downtown Phoenix; (3) user benefits; (4) new riders by auto ownership; and (5) hours of user benefits for transit dependent riders.

Ridership information used in this evaluation will be obtained from the MAG travel demand model. Those alternatives with higher ridership, shorter travel times, higher overall user benefits, more new choice riders and higher benefits for transit dependent riders will receive higher rankings. The numbers of automobiles owned by new riders will also be estimated. Those alternatives showing the greatest numbers of new riders from those owning one or more automobiles will receive the highest rankings.

4.4 TRANSPORTATION SYSTEM PERFORMANCE

This category compares changes in key parameters related to transportation system performance. This is important because the transit investment should shift users from automobile travel to transit, resulting in savings in vehicle travel. Measures will include Vehicle Miles of Travel Savings, Energy Consumption Savings, and Air Pollutant Emission Savings. Region and corridor VMT will be estimated using the EMME/2 model for each alternative and then compared to VMT for the No-Build Alternative. Those alternatives with the greatest decrease in VMT as compared to the No-Build Alternative will be ranked higher than those having lesser or no decrease in VMT.

4.5 TRAFFIC ISSUES

The alternatives will be evaluated based on three criteria: (1) effect on roadway capacity; (2) traffic operational impacts; and (3) changes in vehicle miles traveled (VMT).

Roadway capacity involves capacity at intersections and at midblock locations. Midblock capacity is primarily a function of number of lanes; therefore, alternatives having a smaller number of lane miles lost will be rated higher than those that lose more lane miles. Level of service (LOS) will be calculated at affected intersections using the SYNCHRO traffic analysis program. For each alternative, intersection LOS will be compared for two conditions: (1) implementation of the alternative; and (2) No-Build Alternative. The numbers of intersections with degraded LOS as a result of the alternative will be estimated. Similarly, intersections having improved intersection LOS for each alternative will be identified. The algebraic sum of intersections improved minus intersections degraded will be calculated for each alternative. Those alternatives having the most net intersections improved will be rated higher.

The effect on access to residential and commercial property will be calculated by counting the number of existing driveways and intersections that will no longer have full movement access because of conflicts with transit guideways. The fewer accesses affected, the higher the ranking.

The number of potential new traffic signals will be estimated by counting the number of proposed LRT and BRT fixed guideway crossings that are not currently signalized. In addition, the amount of through and cross traffic diverted will also be estimated. The fewer the number of proposed signals and amount of traffic diversions, the higher the ranking.

4.6 TRANSIT SYSTEM PERFORMANCE

This criteria category compares the changes in transit operations among alternatives. Investment in a transit improvement should result in better transit system efficiency and savings in operating parameters. Measurements will include changes in Number of Transfers and productivity measures such as Riders per Hour or Mile of Service. These measures will be consistent with overall productivity measures in use by the transit operators in the corridor.

4.7 DOWNTOWN PHOENIX

The alternatives will be evaluated based on whether they could have an impact on Downtown Phoenix which is defined generally as the project study area between 7th Street and 27th Avenue with north and south boundaries of Thomas Road and Buckeye Road, respectively. Those alternatives that would have right-of-way impacts to properties and businesses along arterial streets within the study area may be ranked

lower than those that do not. Additionally, the alignments that impact design elements such as the number of through travel lanes, pedestrian crosswalks, bicycle lanes, on-street parking, bulb-outs, curbs and sidewalks, landscape and streetscape elements, left turns and economic development may be ranked lower than other alternatives. The design for each of the proposed alternatives will incorporate some type of connection with the CP/EV starter line along Central Ave./1st Ave. in Downtown Phoenix. Activity centers in the downtown area are also being evaluated for potential ridership and future connections.

4.8 POPULATIONS SERVED

Five criteria will be used to evaluate the populations served by each alternative: (1) total persons; (2) total workers; (3) minority populations; (4) low-income households; and (5) zero-car households.

Title VI of the Civil Rights Act of 1964 and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, require consideration of minority and low-income populations in major transportation investments. High-capacity transit is considered more beneficial and cost-effective when there is a large potential for riders living with walking, biking, or short driving distance. For these reasons, the five populations within 0.5 mile of each station for each alignment will be evaluated. If an alignment has a large populations base, it would rank high in the evaluation. Information to evaluate overall population and employment will be obtained through MAG. Information to evaluate minority and populations will be obtained from the 2000 Census. Data on low-income and zero-car households will be obtained from 2005 and 2030 MAG socioeconomic models.

4.9 COSTS

Two criteria will be evaluated: (1) capital costs and (2) operation and maintenance (O&M) costs. Capital costs will include construction costs and other fixed costs such as vehicle procurement. Construction costs will be estimated based on the cross section of each mode and the overall length of each alignment alternative. Construction costs will also consider the cost of associated project elements such as stations, transit centers, park-and-ride lots, maintenance and storage facilities; signalization and service equipment, and right-of-way costs. LRT unit costs will be based on estimates developed for the CP/EV & Northwest Phase I LRT, and BRT unit costs will be based on estimates from other cities having similar systems. Those alternatives having lower capital costs will be ranked higher than those having higher capital costs.

O&M costs will be estimated based on typical O&M costs from other operating transit systems in the United States. Typical operating costs include: energy costs, labor costs, repair costs, and preventative maintenance costs. Those alternatives having lower O&M costs will be ranked higher than those having higher such costs.

4.10 DESIGN AND CONSTRUCTABILITY ISSUES

The alternatives will be evaluated based on three criteria: (1) potential conflicts with major utilities; (2) grade separation requirements including potential span lengths, vehicle loads, and ease of construction; and (3) potential limitations on property access during construction.

Maps of major utilities will be reviewed in the vicinity of each alternative to determine if the alignment location could conflict with existing major utilities. Those alternatives having the least impact on major utilities will be ranked higher than those requiring relocation of those utilities.

The need for grade separations (e.g., over or under major railroad crossings, roadways, freeways, etc.) will be determined for each alternative. Span lengths will be estimated for each new aerial structure, and existing structures will be evaluated against expected vehicle loads. Alternatives that have no grade separation requirements or where existing bridges and underpasses can be utilized without major modifications will be ranked higher than those alternatives that require new grade separation structures or extensive modification of existing structures. Potential subterranean grade separations will be evaluated against constructability issues typically associated with aerial grade separations such as rail freight disruptions or freeway or roadway closures.

The limitation on construction access will be estimated for each alternative. Those alternatives requiring extensive construction within major street rights-of-way, within neighborhoods, and in areas with many businesses where contractor access could be restricted or impaired will be ranked lower than those alternatives having fewer such accessibility impacts.

4.11 LAND USE

Three criteria will be used to evaluate the impacts of each alternative on land use: (1) consistency with adopted plans; (2) proximity to activity centers; and (3) proximity to medium- and high-density residential areas.

4.11.1 Consistency with Adopted Plans

MAG, Arizona Department of Transportation (ADOT), Regional Public Transportation Authority (RPTA), and the cities of Phoenix and Tolleson have adopted plans concerning future land use and/or transportation issues. Alignments will be evaluated based on how well each supports or conflicts with various plan goals. Alignments will be ranked high if they support the plan goals and low if they contradict local plans. The information used to evaluate consistency with adopted plans will include the following documentation:

- MAG Commuter Rail Study
- MAG Fixed Guideway System Study
- MAG High Capacity Transit Plan
- MAG Long Range Transportation Plan
- MAG Park-and-Ride Study
- ADOT Freeway Expansion Plans: I-10 & Loop 202 (I-10 West)
- Central Phoenix/East Valley DEIS
- Central Phoenix/East Valley FEIS
- Central Phoenix/East Valley New Starts Report
- Central Phoenix/East Valley Project Management Plan
- Phoenix General Plans
- Phoenix Street Classification Map
- Phoenix Transportation Plans
- Tolleson General Plan
- RPTA Freeway Express Bus/BRT Operating Plan (I-10 West)
- Papago Intermodal Transfer Station Feasibility Study
- Others, as appropriate and applicable

4.11.2 Proximity to Activity Centers

Each alternative's proximity and ease of access to activity centers will also be assessed. An activity center is defined as a concentration of employment, retail stores, housing, public facilities, and recreation opportunities within a relatively small area. Alignments may be evaluated based on the number of activity centers that they connect. In consideration of the study purpose and need, the higher number of activity centers served will merit a higher ranking than those alternatives connecting few or no activity centers. The locations of activity centers will be determined through GIS data and field surveys.

4.11.3 Proximity to Medium- and High-Density Residential Uses

The effectiveness of high-capacity transit is enhanced when there are a large number of housing units within walking distance of the potential station location. The alternatives will be ranked according to the existing and future estimated number of housing units that will be within 0.5 mile of each station for each alignment under consideration. Medium- and high-density residential is typically composed of condominiums, townhouses, apartments, and houses on small lots. Potential station location with

existing or planned high density of nearby housing will be ranked higher than those with fewer or no such existing or planned high density housing in close proximity. The information used to evaluate an alignment's proximity to medium- and high-density residential includes the cities of Phoenix and Tolleson land use and general plan maps as well as a field review of the alignments. Those alignments having higher acres per station of medium- and high-density residential uses will be ranked higher than those having lesser land areas with these uses.

4.12 ECONOMIC DEVELOPMENT POTENTIAL

The economic development potential of each alternative will be measured by the number of vacant land parcels available to develop, amount of employment (location of major employers, future job creation, job growth), and future land use shifts to business, office and commercial uses. Information used to evaluate economic development will include the City of Phoenix General Plan land use maps, the Downtown Phoenix Urban Form Project maps, and City of Tolleson existing and future land use maps.

4.13 ENVIRONMENTAL ISSUES

The alternatives will be evaluated based on the potential for impacts on the following: (1) property acquisitions; (2) environmental justice; (3) potential historic resources; (4) parklands or other Section 4(f) resources; (5) endangered and threatened species; and (6) floodplains and riparian areas. In addition, the potential for the alternative to affect, or be affected by, hazardous materials sites will be evaluated.

4.13.1 Property Acquisitions

The extent of property acquisitions needed to accommodate each alternative's right-of-way will be estimated based on the cross-section of each alignment in relation to the existing street rights-of-way. The additional properties required to accommodate the transit project while still maintaining acceptable traffic capacity will be estimated. Those alignments requiring fewer properties will be ranked higher than those having higher property acquisition needs.

4.13.2 Environmental Justice

As discussed in Section 4.8, Title VI of the Civil Rights Act and Executive Order 12898 require consideration of minority and low-income populations in major transportation investments. In addition to considering potential benefits, they require evaluating if disproportionately high adverse environmental effects on these populations could potentially occur. One potential indicator is the extent of property acquisitions potentially affecting minorities and low-income populations. This will be estimated based on the extent of property acquisitions within areas with high concentrations of these populations. The regional recipient responsible for civil rights compliance will define these areas according to whether they have higher concentrations than the regional

transit service area. Currently, the regional transit service area percentage for minority populations is 35.6 percent and for low-income population is 12.1 percent. Those alignments requiring fewer properties within Title VI areas will be ranked higher than those having higher property acquisition needs within those areas.

4.13.3 Historic Resources

NEPA and Section 106 of the National Historic Preservation Act of 1966, as amended, stipulate that federal agencies work to preserve not only natural resources but also important historical and cultural aspects of our national heritage. Potentially historic architectural and archaeological resources will be identified along each of the alignments. Architectural resources will be identified based on comparison of development shown in old aerial photos vs. recent aerial photos of the study area and coordination with both the State and the City of Phoenix Historic Preservation Office (SHPO and CHPO) regarding resources eligible or listed on the National Register of Historic Places. A windshield survey will be conducted in those areas where older buildings still remain based on the photo comparison and will be evaluated to determine their possible eligibility based on integrity. Alignments with higher numbers of adjacent architectural resources will be ranked lower than those having fewer or no such resources adjacent to them. The project team archaeologist will conduct a Class I overview of the alignments with regard to potential archaeological resources that could be affected. Records from the following sources will be reviewed: (1) Pueblo Grande Museum; (2) State Historic Preservation Office; and (3) AZSite (Arizona's state-wide repository for cultural resource management projects). Native American Tribes with an interest in the study area will also be contacted to determine if traditional cultural properties exist that could be adversely affected. Basic information will be gathered such as site type, age, recording institution, and eligibility recommendations for the Arizona and National Registers of Historic Places. Those with no such resources affected will be ranked higher than those alignments where there could be an adverse effect. To protect potential sensitive archaeological sites that may be located in the study area, specific data will not be available for public review. However, generalized mapping will be prepared.

4.13.4 Section 4(f) Resources

Section 4(f) of the Department of Transportation Act of 1966, as amended, restricts the use of any publicly owned land in a park, recreation area, wildlife or waterfowl refuge, or land from historical sites for transportation purposes unless: (1) there is no feasible and prudent alternative to the use of such land; and (2) the project includes all possible planning to minimize harm. Parks, recreation areas, trails, and wildlife and waterfowl refuges adjacent to the alignments will be identified based on geographic information system (GIS) data obtained from the City of Phoenix and MAG and supplemented by field survey as necessary. Alignments with higher numbers of adjacent such resources will be ranked lower than those having fewer or no such resources adjacent to them.

Cultural resources will not be included in this portion of the evaluation since they are being considered in a separate criterion.

4.13.5 Threatened and Endangered Species

To aid in determination of impacts on threatened and endangered species, the U.S. Fish and Wildlife Service (USFWS) website will be reviewed to determine the potential for threatened or endangered species to occur within the project limits. The Arizona Game and Fish Department (AGFD) will be contacted to request a check of the Heritage Management Database to determine what species have been recorded within the vicinity of the proposed alignments. In addition, critical habitat in proximity of the alternatives will be identified based on information obtained from the USFWS Arizona Ecological Services. Those alternatives not affecting threatened and endangered species or critical habitat will be ranked higher than those having potential impacts on critical habitat.

4.13.6 Floodplains and Riparian Areas

Floodplains and riparian areas within or adjacent to the alternatives will be identified through FEMA data obtained from the Flood Control District of Maricopa County and from the State Lands Department. Those alternatives not affecting floodplains and riparian areas will be ranked higher than those having potential impacts on those resources.

4.13.7 Hazardous Materials

To perform the general environmental evaluation, sites within a one-mile corridor, centered along each proposed alignment, will be identified for potential contamination concerns. These sites will be investigated using existing database services which evaluate resource files from up to 30 state and federal databases. These resources include databases such as the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) databases. The results of the database search will be reviewed to locate potential areas of environmental concern, areas which are compliant with enforcement action, and investigations involving hazardous material and/or waste, including recorded releases, within each alignment corridor. Aerial photographs and current 7.5-minute topographic maps will be examined to establish physical parameters, such as drainage channels, which may contribute to potential environmental concerns from adjoining properties. In addition, current land use will be identified to determine if there is the potential for environmental issues associated with property uses such as automobile repair and dry cleaning facilities. Those alternatives not in close proximity of potentially contaminated sites will be ranked higher than those having many such sites in close proximity.

4.14 GENERAL IMPACT TO COMMUNITY

The alternatives will be evaluated based on an estimate of the overall effect (other than right-of-way and environmental impact) of proposed improvements on the communities most directly affected. Specific impacts could include traffic safety, access to employers or activity centers, economic development and aesthetics. The impacts considered under this criterion may be either positive or negative.

4.15 COMMUNITY SUPPORT

This criterion will evaluate the alternatives based on the estimated breadth and depth of community support for and acceptance of the alternative, based on input from municipal staff, stakeholders, and the public open houses conducted during the study process.

4.16 NEW STARTS CRITERIA

In the event that more than one favorable alternative remains after Tier 2 screening, remaining alternatives will be evaluated against the most recent Section 5309 New Starts criteria to help achieve the best possible project as identified by the FTA criteria. In addition, public comment and acceptance will be used to assist in evaluating those alternatives and in recommending the "preferred alternative" if possible. If one alternative moves forward, the alternative that most satisfies the criterions would then be the one recommended as the "preferred alternative" for further detailed evaluation in the EIS phase. The alternative(s) would be subject to the most recent New Starts criteria.

FTA evaluates each project sponsor's submittal of information addressing specific project justification and local financial commitment criteria which are defined by law. The ratings assigned to these criteria are used by FTA to develop overall project ratings, make decisions for advancing proposed projects in the New Starts project development process, and for recommending projects for funding.

4.16.1 <u>Project Justification Criteria</u>

FTA considers several project justification criteria contained in SAFETEA-LU in its evaluation of proposed New Starts projects as outlined in Table 3.

Table 3 New Starts Evaluation Project Justification Criteria

Criteria	Measure
Mobility Improvements	Normalized Travel Time Savings (Transportation System User Benefits per Project Passenger Mile) The Number of Transit Dependent Riders Using the Proposed New Starts Project Transit Dependent User Benefits per Passenger Mile on the Project The Share of User Benefits Received by Transit Dependents Compared to the Share of Transit Dependents in the Region
Environmental Benefits	EPA Air Quality Designation
Cost Effectiveness	Incremental Cost Per Hour of Transportation System User Benefit Incremental Cos Per New Rider (for informational purposes only)
Transit Supportive Land Use and Future Patterns	Existing Land Use Transit Supportive Plans & Policies Performance & Impacts of Policies
Other Factors	Economic Development Making the Case Congestion Pricing Optional Considerations

Source: FTA/METRO, November 2007

4.16.2 Local Financial Commitment Criteria

Section 5309(d)(2)(C) of SAFETEA-LU requires that proposed projects be supported by an acceptable degree of local financial commitment, including evidence of stable and dependable financing sources to construct, maintain and operate the transit system. The criteria used in making this determination are outlined in Table 4.

Table 4 New Starts Evaluation Local Financial Commitment Criteria

Criteria	Measure
Share of Non-Section 5309 New Starts Funds	Share of other Federal funds, including formula and flexible funds; Required local match; and Additional capital funding.
Strength of Capital Funding Plan	Capital financial condition of the sponsoring agency and funding partners; Commitment and availability of Non-Section 5309 New Starts funds for construction of the project; and Reasonability of capital planning assumptions and capital cost estimates and financial capacity to cover capital cost increases or funding shortfalls.
Strength of Operating Funding Plan	Operating financial condition; Commitment of O&M funds needed to fund the transit system's subsidy; and Reasonability of operating planning assumptions and O&M cost estimates and financial capacity to operate and maintain all proposed, existing and planned transit services.

Source: FTA/METRO, November 2007

I-10 WEST

ALTERNATIVES ANALYSIS/ ENVIRONMENTAL IMPACT STATEMENT

DRAFT
TIER 1 ANALYSIS REPORT

November 2008

METRO

METRO I-10 West Corridor Alternatives Analysis
Draft Tier 1 Analysis Report

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LIST OF ACRONYMS

AA	Alternatives Analysis
ADOT	Arizona Department of Transportation
BNSF	Burlington Northern Santa Fe
BRT	Bus Rapid Transit
CP/EV	Central Phoenix/East Valley
DASH	Downtown Area Shuttle
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HOV	High Occupancy Vehicle
I-10 West AA/EIS	I-10 West Alternatives Analysis/Environmental Impact Statement
LOS	Level of Service
LPA	Locally Preferred Alternative
LRT	Light Rail Transit
MAG RTP	2003 Maricopa Association of Governments Regional Transportation Plan
METRO	Valley Metro Rail, Inc.
NEPA	National Environmental Policy Act
NOI	Notice of Intent
PE	Preliminary Engineering
ROD	Record of Decision
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
TAZ	Traffic Analysis Zone
TSM	Transportation System Management
UPRR	Union Pacific Railroad

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1.0 INTRODUCTION

1.1 OVERVIEW

This report presents the evaluation of the initial set of Tier 1 Alternatives that are under consideration for high-capacity transit improvements in the I-10 West Corridor. Section 1.2 provides information about the overall study, its purpose, and goals and objectives. Chapter 2 describes the comprehensive process for evaluating and narrowing down the range of alternatives considered with the goal of achieving one Locally Preferred Alternative (LPA) that will be studied in greater detail in an Environmental Impact Statement (EIS). Chapter 3 defines the study goals in accordance with the *I-10 West Alternatives Analysis/Environmental Impact Statement Draft Purpose and Need* (METRO 2008a). Chapter 4 presents the development of alternatives and their definitions. Chapter 5 presents the evaluation criteria for the Tier 1 evaluation. The report concludes with Chapter 6 that summarizes recommendations for alternatives to be retained for further analysis during the Tier 2 evaluation.

1.2 PROJECT DESCRIPTION

Valley Metro Rail, Inc. (METRO), in cooperation with the Federal Transit Administration (FTA) is conducting a study to analyze potential high-capacity transit improvements in the I-10 West Study Area (Study Area), which extends along the I-10 freeway west of downtown Phoenix to SR-101 (Loop 101) in Maricopa County, Arizona. The north and south boundaries of the Study Area include Thomas and Buckeye Roads, respectively. High-capacity transit improvements under consideration include bus rapid transit (BRT) in an exclusive guideway and light rail transit (LRT) in an exclusive guideway. An alternative to expand express bus service in high occupancy vehicle (HOV) lanes is also under consideration. The purpose of the proposed project is to serve existing and projected travel demand through the forecast year 2030 along the east-west corridor centered along a section of I-10. This corridor serves as the primary transportation corridor between downtown Phoenix and the cities of Avondale, Tolleson, Litchfield Park, and Goodyear. To a greater extent, the portion of I-10 through the Study Area also serves communities further west including the cities of Buckeye, El Mirage, Youngtown, and portions of unincorporated Maricopa County. Figure 1 identifies the Study Area and surrounding communities.

The proposed high-capacity transit improvements would provide essential transportation capacity within the Study Area and outlying region that are currently experiencing a substantial amount of growth. As population increases and development expands throughout the Southwest Valley and outlying areas, I-10 and arterial streets will continue to experience intense peak-period congestion.

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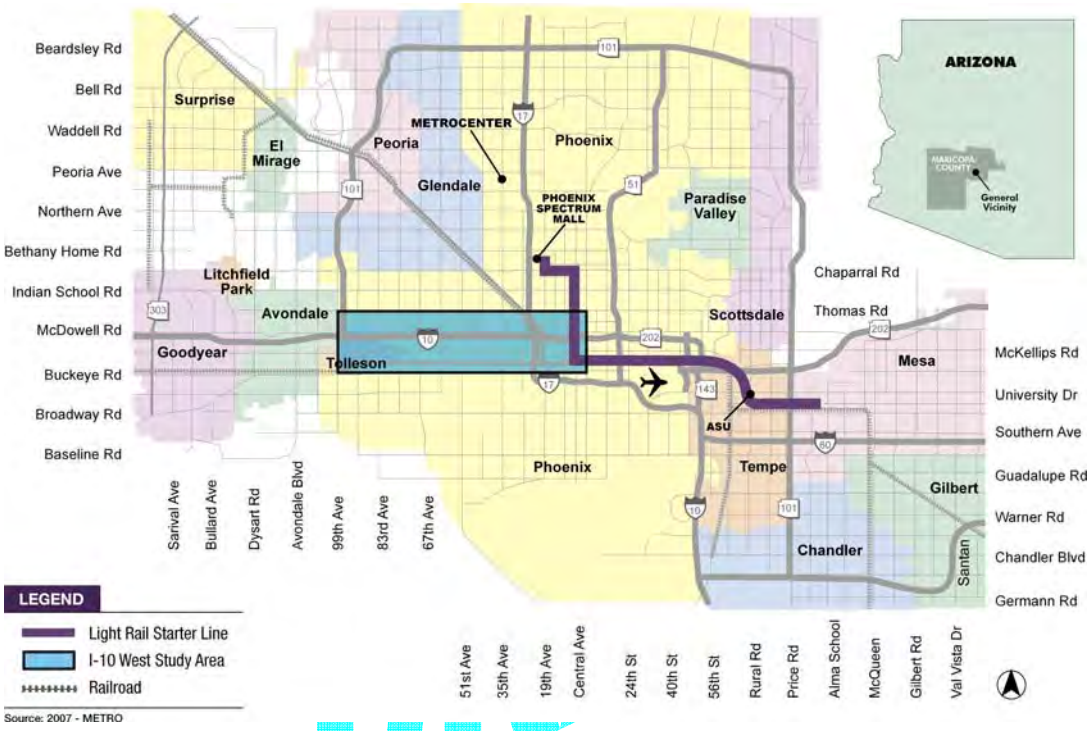
Figure 1 Study Area and Vicinity Map

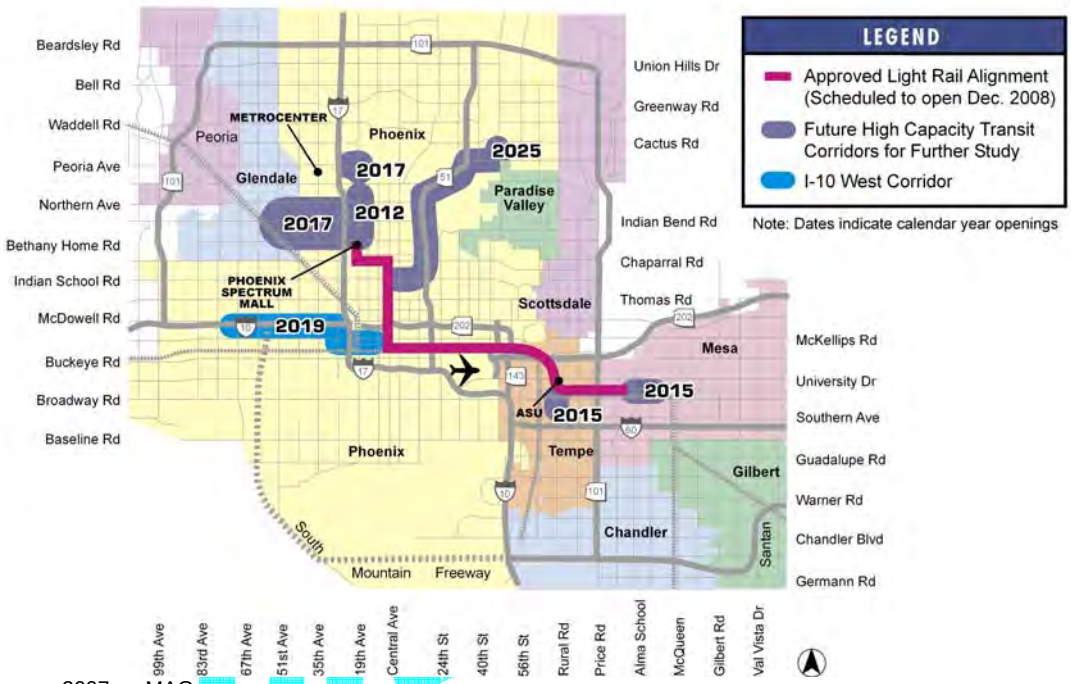


1.3 PROJECT BACKGROUND

The passage of Proposition 400 by Maricopa County voters in November of 2004 signified a substantial increase in the amount of funding for public transit. Over the 20-year life of the one-half-cent sales tax, it is anticipated that about $4.7 billion will be raised for public transit projects (MAG 2007a). Proposition 400 also represented the public's interest to provide a transportation system that could accommodate regional growth.

Funds from the Proposition 400 half-cent transportation sales tax extension were allocated toward the 57.7-mile LRT system identified in the 2003 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP). The 20-mile Central Phoenix/East Valley (CP/EV) LRT Starter Line is scheduled to open for service through the cities of Phoenix, Tempe, and Mesa beginning in December of 2008. The MAG RTP identified an 11-mile extension along west I-10, from the CP/EV LRT Starter Line to the vicinity of 79th Avenue, as one of six additional LRT/high-capacity transit corridors within Maricopa County (MAG 2003). The extensions are illustrated in Figure 2. This segment of I-10, defined as the I-10 West Corridor is scheduled to be in operation by 2019, with the remaining system to be operational by 2025.

Figure 2 High-Capacity Transit Corridor Extensions



Source: 2007a – MAG

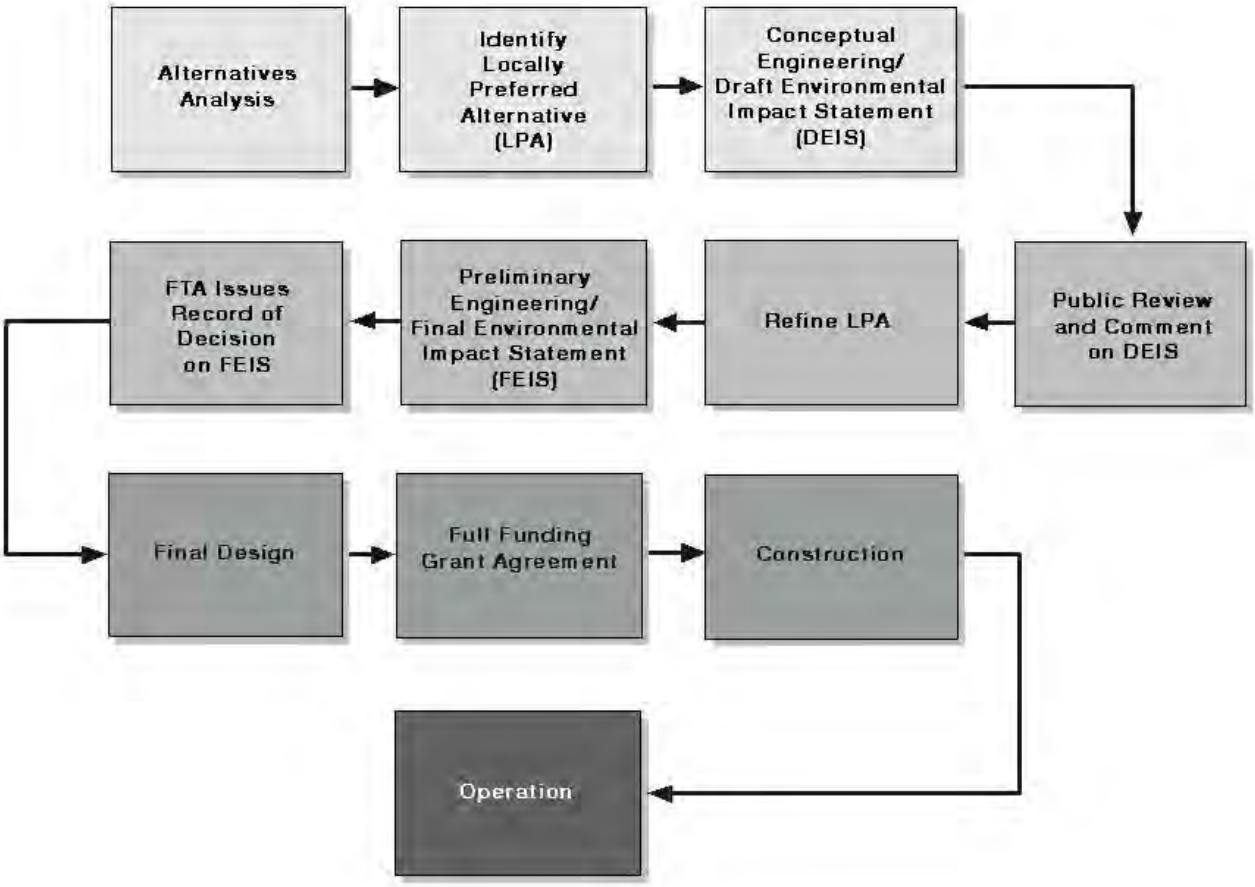
The section of freeway through the I-10 West Study Area was not completed until the mid-1980's. A 15-mile section of freeway from approximately 91st Avenue in western Phoenix to 20th Street in downtown Phoenix was considered the "missing link" as traffic utilized Buckeye Road/US 80 as the primary access route between the west and downtown Phoenix and the metropolitan region (Federal Highway Administration [FHWA] 1978). When this missing segment along I-10 was originally designed, the 50-foot wide right-of-way within the freeway median was reserved for future transit options. The right-of-way extends from the eastern intersection of I-10 and I-17 at 24th Street west to 91st Avenue. Preservation of the 50-foot median for future transit is further detailed in the *Interstate 10 – 91st Avenue to Junction I-10 Final EIS and Section 4(f) Statement* (FHWA 1978).

As an additional improvement along I-10 in anticipation of future transit use, in 1988 the Arizona Department of Transportation (ADOT) began construction of an express bus facility located within the I-10 freeway median between 3rd Street and 3rd Avenue. This facility was designed to allow express buses to access the facility from exclusive bus-only entrance and exit (at 3rd Street and 3rd Avenue) lanes from the HOV lanes. During the construction of this facility, the station "shell" was completed and includes a partially completed station platform directly below Central Avenue, as well as three currently blocked off access points at the top of the structure to allow vertical circulation to Central Avenue. Today, Margaret T. Hance Park, a passive-use recreational facility, sits on top of the unfinished station facility.

1.4 PROJECT DEVELOPMENT PROCESS

The I-10 West Alternatives Analysis/Environmental Impact Statement (AA/EIS) study is proceeding in accordance with the project development process outlined by FTA for major transit capital investments and in accordance with the rules and regulations specified under the National Environmental Policy Act (NEPA), as shown in Figure 3.

Figure 3 Project Development Process



Source: 2008 – FTA

The steps from AA through Final EIS are considered to be the project planning phases. The AA process commenced with the publication of the Notice of Intent (NOI) in the Federal Register on October 2, 2007, which notified the public that an EIS would be prepared and considered for the I-10 West study. The publication of the NOI also signified the start of the "scoping" process. Scoping is an early and open interactive process that allows public participation in determining the scope of issues to be addressed and identifies significant issues related to the proposed project. Scoping is an ongoing process where input is received during public and agency

meetings or through other forms of communication including submittals via the project website, letters, and emails.

During the AA phase, an analysis of various alternatives will be conducted while considering a variety of criteria. The Phoenix City Council and the METRO Board of Directors will identify an LPA based on the results of analysis and input received during agency and public scoping meetings. The goal is then to conduct a detailed analysis of the LPA and No Build Alternative in the Draft EIS and to propose mitigation measures to address adverse impacts. The Baseline Alternative, described later in Section 4.3.3.2, may also be analyzed separately in the Draft EIS. Upon completion of the Draft EIS, it will be circulated for public review and comment, and public hearings will be held at that time. FTA, the Phoenix City Council, and the METRO Board of Directors will adopt a refined LPA based on the findings of the Draft EIS and public comments.

Preliminary Engineering (PE) will then be conducted concurrently with preparation of the Final EIS that responds to public comments and commits to specific mitigation measures for adverse impacts. Upon completion of the Final EIS, it will be submitted to FTA for consideration, and FTA will then issue a Record of Decision (ROD) that provides environmental clearance to proceed.

Following issuance of a ROD, final design would be conducted, the financing plan would be finalized and construction would then begin. The projected start of operation along the I-10 West Corridor is projected for the end of 2019.

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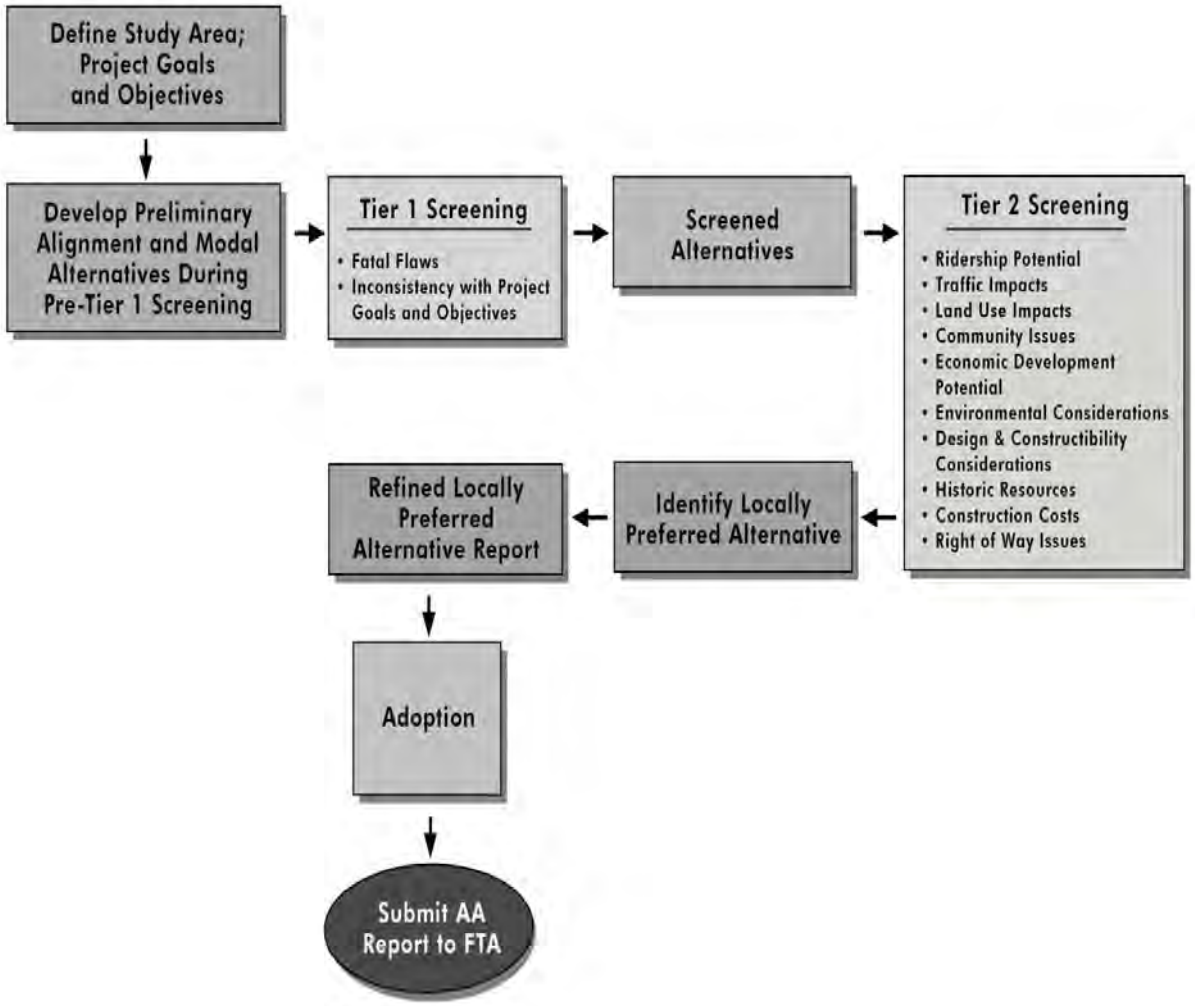
2.0 EVALUATION PROCESS

A two-tiered alternatives development process, illustrated in Figure 4, is being used to evaluate the I-10 West Study Area conceptual alternatives. Prior to initiating the Tier 1 analysis, the project team conducted Pre-Tier 1 Screening, which is the planning phase used to determine the broad range of high-capacity transit modes and alignments possible within the Study Area based on minimal constraints. Alternatives developed during the Pre-Tier 1 Screening phase were developed through an examination of existing physical characteristics associated with the Study Area (e.g., potential connections to the CP/EV LRT Starter Line and rights-of-way that could accommodate high-capacity transit alignments) and through public meetings and stakeholder meetings with representation from the State of Arizona, Maricopa County, and City of Phoenix.

Figure 4 Alternatives Development Process



Source: 2008 – FTA

The next phase of the AA process, known as the Tier 1 screening phase and the subject of this report, includes a conceptual level evaluation that analyzes the advantages and disadvantages of a "long list" of potential alternatives to address the transportation needs of the Study Area. The purpose of the Tier 1 evaluation is to determine which of the proposed alternatives are considered the most feasible, thus narrowing down the range of options to be considered for more detailed analysis. The Tier 1 evaluation criteria are qualitative in nature and seek to eliminate alignments and technology options that are not feasible or do not support the study goals.

The I-10 West alternatives that advance as a result of this Tier 1 evaluation will be subjected to a more rigorous evaluation during Tier 2. The more detailed evaluation for Tier 2 will be presented in a subsequent report. The Tier 2 evaluation criteria will include a quantitative analysis that will examine issues including: ridership potential, capital costs, land use and economic development impacts, traffic impacts, environmental factors, conceptual engineering, and public preferences. Schematic designs for the proposed Tier 2 alternatives will be evaluated. The alternatives will include plans and cross-sections, right-of-way requirements, general station locations, storage and maintenance facility site alternatives and/or expansion/upgrades, feeder bus service, potential minimum operable segments (shorter alternatives that reduce construction costs and in some cases environmental impacts), and draft conceptual operating plans. Capital and operating cost estimates will be provided for each alternative.

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The evaluation of the Tier 2 alternatives is intended to remove from consideration all but a LPA with possible design options, in accordance with the Section 5309 New Starts Criteria. However, if the Tier 2 evaluation results in more than one optimal alternative, then those alternatives will be evaluated further and community acceptance would be required to help achieve the best possible project as identified by the FTA criteria. Comparatively, the alternative that proves to satisfy the criteria in a more sufficient manner would then be recommended as the LPA that would require further detailed evaluation in the EIS.

In addition to structuring the analysis into tiers, the evaluation methodology has provisions for separate consideration of transportation technologies and corridor alignments. Transportation technology refers to the travel method and technology used (e.g., BRT or LRT). Corridor alignment refers to the specific geographic areas where modal improvements may occur.

An essential component throughout the evaluation process is the Public Involvement Program (PIP). The *I-10 West Alternatives Analysis/Environmental Impact Statement Draft Public Involvement Plan* (METRO 2007) identifies the public, interested groups, agencies, and stakeholders and will solicit their input and participation at key points in the study process.

3.0 PROJECT PURPOSE AND NEED

The evaluation of the alternatives is structured around basic criteria developed to measure alternative performance relative to meeting the project goals of the I-10 West AA/EIS study. These primary project goals are defined as follows:

1. Identify a transit alternative that improves regional mobility along the I-10 West Corridor.
2. Identify a transit improvement alternative that connects the local and express bus system and the CP/EV LRT system with the West Valley.
3. Identify an alternative that provides cost-effective transit improvements.
4. Identify a transit alternative that serves major employment centers, including the State Capitol, and supports economic development.
5. Identify a transit alternative that minimizes environmental impacts.

As identified in the *I-10 West AA/EIS Draft Purpose and Need* (METRO 2008a), the purpose of the proposed I-10 West Corridor high-capacity transit project is to:

- Offer a viable transportation alternative that will facilitate the safe and efficient movements of people, particularly commuters, through and within the project corridor;
- Provide efficient high-capacity transit service within the project corridor;
- Provide additional capacity as part of a "shared solution" incorporating transit, highway improvements, and existing service such as HOV lanes and bus service along I-10 in the Southwest Valley that are currently operating at level of service (LOS) E-F and are anticipated to steadily deteriorate;
- Enhance economic development potential within the corridor by improving access to existing and planned employment and activity centers in both the West Valley and Downtown Phoenix;
- Support regional plans and policies that support an efficient transit system; and
- Support regional air quality goals.

Using the framework outlined in the project purpose above, project needs have been applied to the I-10 West AA/EIS study to guide the evaluation process and development of alternatives. The overall goal of the study is to provide a high-capacity transit option that addresses regional growth, increased travel demand, changes in land use patterns, lack of access to activity centers, air quality problems, inadequate transit service, and regional planning goals. The project would help to satisfy the four following primary needs:

1) **A need for added peak period travel capacity as part of a balanced transportation system.** According to the *I-10 West Transportation Assessment* (METRO 2008a), travel demands are expected to more than double by 2030. Transit improvements are needed to address the future demands as part of a "shared solution" to facilitate the safe and efficient movement of people and goods within the project Study Area, specifically along the I-10 corridor.

2) **A need for increased transit system connectivity.** Transit service coverage in the Study Area is limited, especially for longer peak period commute trips. Improved services and connections are needed between and among the destinations within and connected to the Study Area.

3) **A need for improved access to corridor destinations.** Improved transit service should be implemented to provide safe and efficient access to numerous local and regional destinations within and adjacent to the I-10 West Study Area including the State Capitol, the City of Phoenix/Maricopa County Government Center, Phoenix Governmental Mall, and entertainment destinations including Downtown Phoenix sports and arts venues and Cricket Pavilion located in western Phoenix.

4) **A need to reinforce economic development opportunities.** Investments in high-capacity transit should be leveraged to encourage more intensive transit oriented development in the Study Area consistent with prior planning studies and future development.

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4.0 TIER 1 ALTERNATIVES DEVELOPMENT

4.1 INTRODUCTION

This chapter summarizes the process used to develop a list of conceptual alternatives and alternatives proposed for Tier 1 evaluation.

4.2 TIER 1 ALTERNATIVES DEVELOPMENT PROCESS

The development of conceptual alternatives is the first step in selecting alternatives for the Tier 1 evaluation. As the funnel in Figure 5 demonstrates, this "Top-Down" approach begins with identifying a multitude of transit modes and alignments based on community factors including public input and existing characteristics of the Study Area. The next step is to present all potential alignment alternatives and transit modes at public scoping and stakeholder meetings to gather input to refine transit modes and alignments (also known as Pre-Tier 1 Screening as defined in Section 2.0). As a result of public and stakeholder input, a list of transit modes and alignments are carried into the Tier 1 evaluation process where a "Fatal Flaw" analysis is conducted to determine which alternatives should be removed from consideration and which alternatives should be recommended for Tier 2 analysis.

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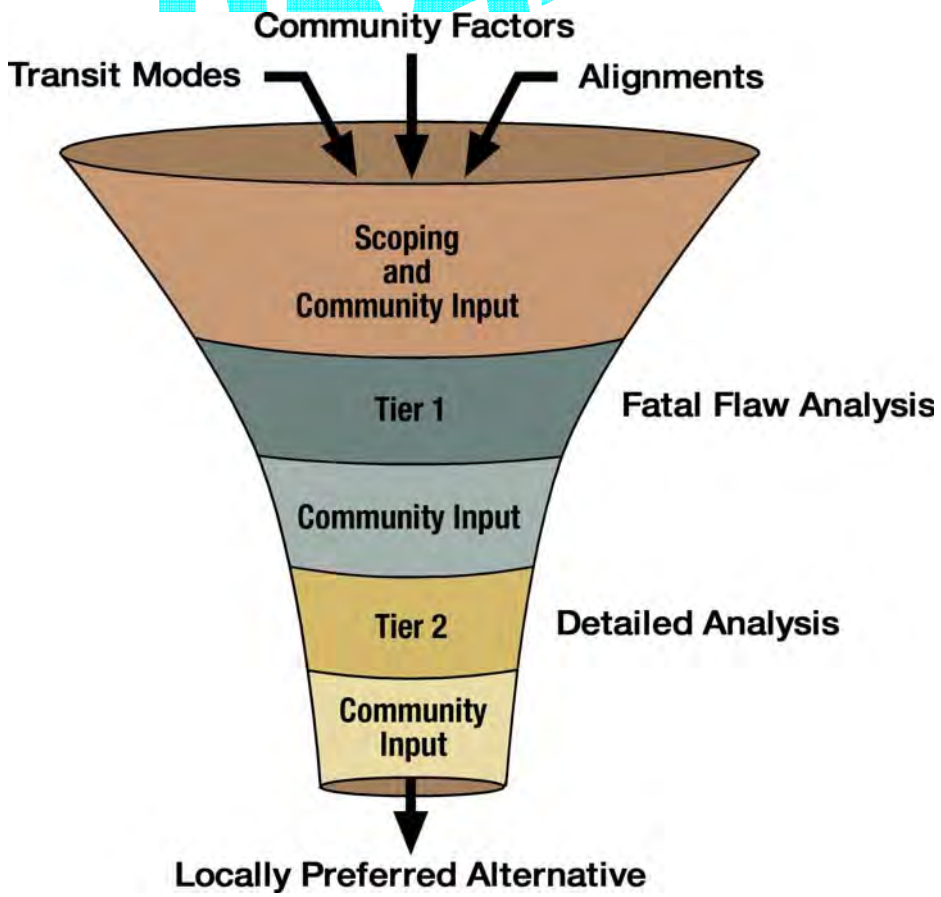
Figure 5 Alternatives Analysis Process



Source: 2008a – METRO

4.3 DEVELOPMENT OF CONCEPTUAL ALTERNATIVES

The process for developing conceptual alternatives consists of identifying the existing characteristics of the I-10 West Study Area and identifying all potential transit modes and alignments that should be analyzed. This section is organized as follows:

- Study Area Characteristics
- Transit Modes Considered
- General Location Alternatives Considered

4.3.1 Study Area Characteristics

This section provides a summary of existing population and employment, the existing and proposed highway system, transit system, land use, and travel patterns within the Study Area.

4.3.1.1 Population and Employment

Table 1 provides a summary of population characteristics for the MAG region, the Southwest Valley, and the I-10 West Study Area. With an estimate of approximately 1.4 million people in 2004, the City of Phoenix ranks as the fifth largest city in the nation. By 2030, the population in Phoenix is expected to grow to approximately 2.2 million. The estimated population of the metropolitan region in 2004 was approximately 3.7 million, and is projected to increase to 6.1 million by 2030. By comparison, with the Southwest Valley, a conglomerate of the communities directly west of the I-10 Corridor, population is expected to nearly triple by 2030 and account for over 45 percent of the population growth in the region (METRO 2008b).

Table 1 Population Growth

	Population			
	2004	**2030**	**Change**	**Percent Change**
Region	3,681,025	6,135,000	2,453,975	67%
Southwest Valley*	400,600	1,572,300	1,171,700	292%
Study Area**	160,616	222,678	62,062	39%

Source: 2008b – METRO
*Districts 1, 10, 11, 17, 18 (see section 4.3.1.5 for district definitions)
** Districts 1, 2 (see section 4.3.1.5 for district definitions)

As regional population is expected to substantially increase, the number of employment opportunities is also expected to follow this trend. Table 2 provides a summary of employment characteristics for the MAG region, the Southwest Valley, and the I-10 West Study Area. At the regional level, employment is projected to experience a yearly growth rate of 2.6 percent, compared to the 6.1 percent annual growth expected in the Southwest Valley through 2030. This equates to an approximately 93 percent increase in employment for the region and a 371 percent increase for the Southwest Valley.

Table 2 Employment Growth

	Employment			
	2004	2030	Change	Percent Change
Region	1,747,532	3,378,800	1,631,268	93%
Southwest Valley*	139,500	656,900	517,400	371%
Study Area**	151,022	213,225	62,203	41%

Source: 2008b – METRO
*Districts 1, 10, 11, 17, 18 (see section 4.3.1.5 for district definitions)
** Districts 1, 2 (see section 4.3.1.5 for district definitions)

Within the I-10 West Study Area, employment is concentrated in the Downtown Phoenix area, with most of the employment concentrated at the State Capitol and City/County Government Center areas as shown in Figure 6. Approximately 120,000 to 180,000 employees per square mile work at the City/County Government Center, which is the largest concentration of employment within the study area. Once in operation, the CP/EV LRT Starter Line will serve this employment center in December 2008. With approximately 20,000 to 40,000 employees per square mile, the State Capitol area represents the second greatest concentration of employment within the Study Area. As illustrated in Figure 6, this concentration of employment would not be directly served by the CP/EV LRT Starter Line.

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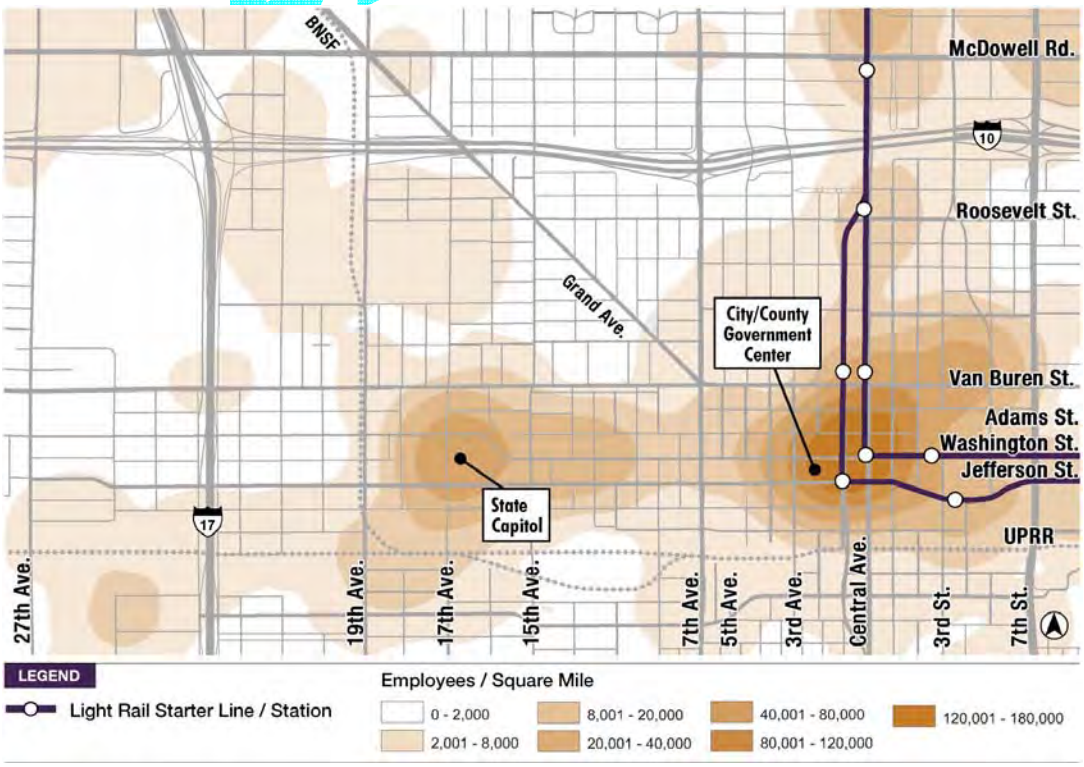
Figure 6 Downtown Phoenix Employment Concentrations



Source: 2005 – MAG

4.3.1.2 Highway System

Existing System

The highway network within the Study Area consists of a well-established grid system of north-south and east-west arterials at mile intervals and collector streets at half mile intervals (City of Phoenix 2007). I-10 traverses the entire length of the Study Area with interchanges generally at mile intervals. I-10 currently consists of four general purpose lanes and one HOV lane in each direction. HOV-only interchanges are located at 3rd Street and a freeway access ramp shared by 3rd and 5th Avenues. A restricted direct access ramp at the east side of the 79th Avenue interchange provides direct freeway access to buses and carpools utilizing the 79th Avenue Park-and-Ride. Within the median of I-10 is a 50-foot wide right-of-way that is reserved for future transit options. Figure 1, as previously shown on page 2, illustrates the current highway network.

Proposed ADOT Projects

In anticipation of projected population and employment growth, ADOT is planning several large-scale highway improvement projects that either fall within the Study Area or will directly impact traffic conditions within the Study Area as illustrated in Figure 7. Throughout the planning process, METRO will coordinate with ADOT on proposed projects including the following:

- ADOT I-10 Freeway Expansion – An additional general purpose lane will be constructed on I-10 in each direction between Loop 101 and I-17. This project is expected to be complete in 2012 (METRO 2008a.
- ADOT Loop 202 (South Mountain Freeway) – The Loop 202 Freeway will be designed to connect I-10 in the Southeast Valley with I-10 in the West Valley. Loop 202 is planned to intersect I-10 near approximately 55th Avenue. Construction funding for this project is not anticipated until 2009-2015 (METRO 2008a).
- ADOT Loop 101 to I-10 HOV Direct Connector – A project scheduled for 2025, the Direct Connector project would add an HOV direct connector ramp at the Loop 101/I-10 interchange and would include the south-to-east and west-to-north HOV ramp movements (METRO 2008a).
- ADOT SR-801 – SR-801 is an east-west freeway proposed in western Maricopa County that would connect the existing SR-85 to the proposed Loop 202 (South Mountain Freeway), with a connection to the proposed SR-303 (Loop 303). Design and construction of SR-801 are anticipated to occur from 2021 to 2025 (METRO 2008a).

Additional Roadway Improvement Projects

The 2007 MAG *FY 2008 – 2012 Transportation Improvement Program* identifies several transportation improvement projects within the I-10 West Study Area. However, improvement projects identified with in the I-10 West Study Area are limited to intersection widening and general improvement projects that would not affect high-capacity transit improvements proposed within the Study Area.

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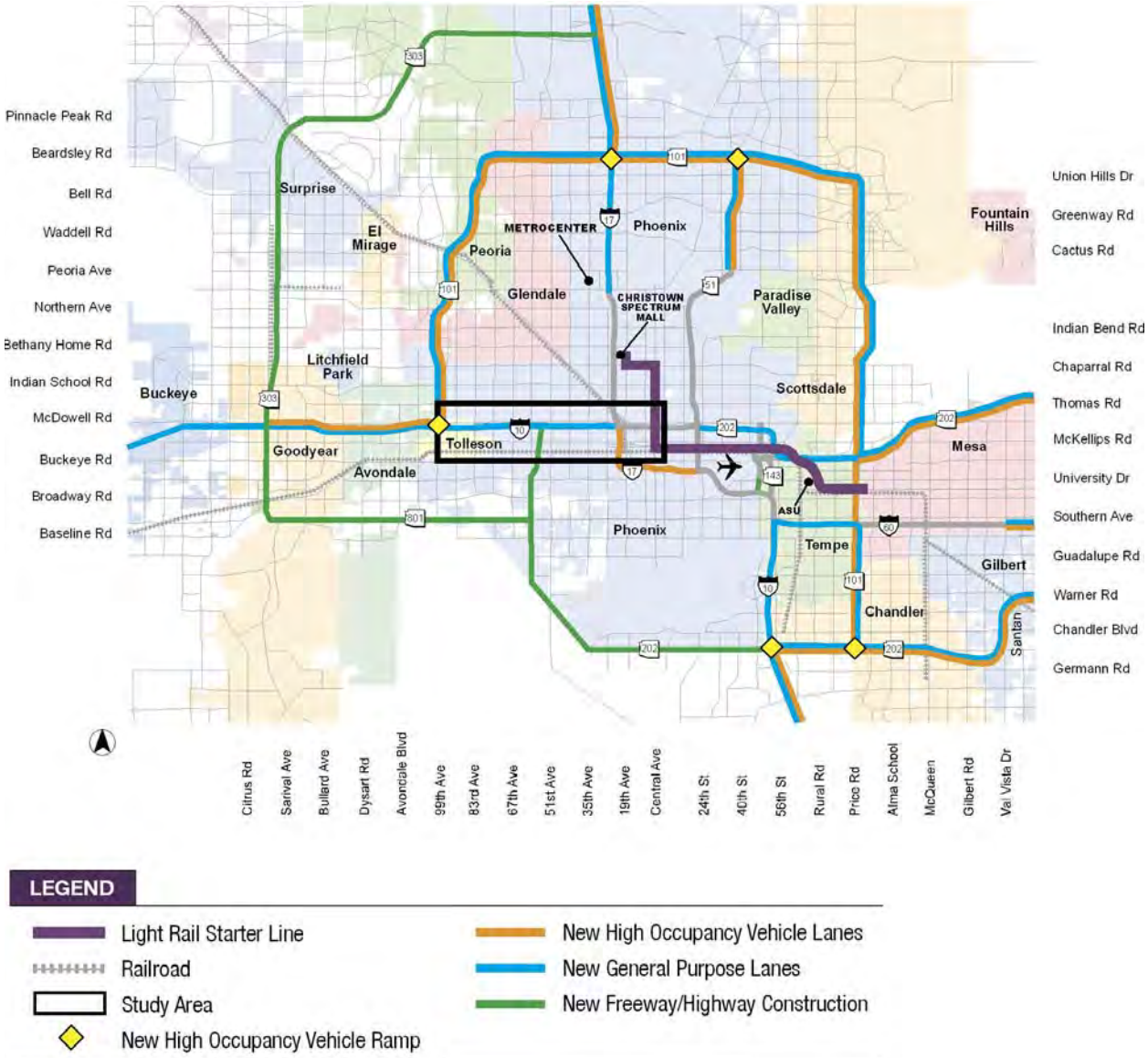
Figure 7 Proposed Highway Improvements in the MAG Region



Source: 2007a – MAG

4.3.1.3 Transit System

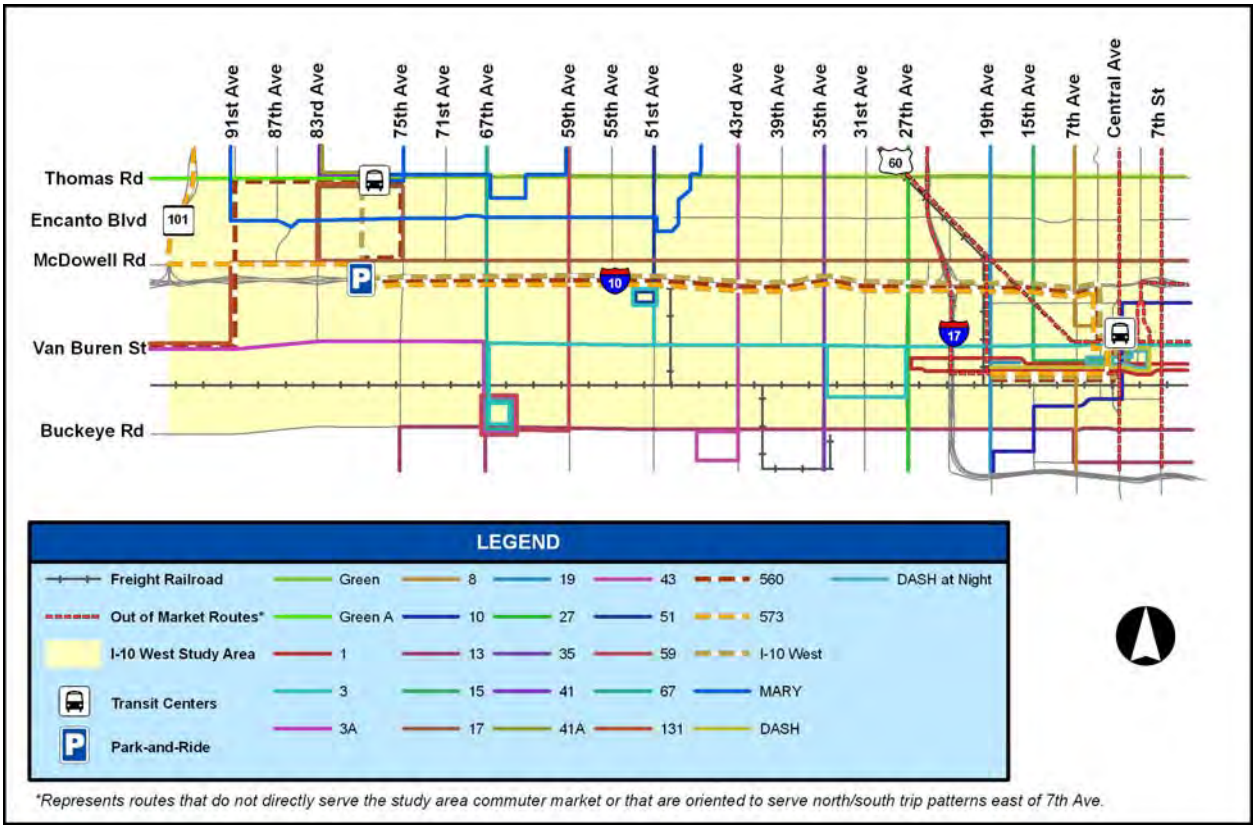
The existing transit system is comprised of three components:

- Existing Fixed Route Bus Service
- Park-and-Ride Facilities/Transit Centers
- Central Phoenix / East Valley Light Rail Transit Starter Line

Existing Fixed Route Bus Service

Several modes of fixed route bus service serve the Study Area including local bus, express and RAPID routes, and circulators. The Study Area has a relatively high level of fixed route service compared to the region. Existing fixed route service is depicted in Figure 8.

Figure 8 Existing Transit Service



Note: Routes designated with an "A" are Avondale connection routes (i.e. Green A). Avondale connection routes do not operate on Sundays.
Source: 2007 – City of Phoenix Public Transit Department

Local bus routes provide transit service on the one-mile grid network of streets in the Study Area. The express and RAPID routes provide weekday peak period commuter service between the western portion of the Study Area and downtown Phoenix. All express and RAPID routes operating on freeway HOV lanes serve the downtown Phoenix and Capitol Mall District areas. Circulators are operated on a free fare basis to provide local circulation and access to the other fixed route transit modes operating in the Study Area.

Future Transit Service

Significant investments in fixed route bus service have already been implemented within the Study Area through the City of Phoenix Transit 2000 Plan. The MAG RTP also identifies extensions of routes currently serving the Study Area to destinations outside of the Study Area.

In addition, five new express routes and two new local routes are identified in the RTP. While five express routes will operate within the I-10 West Corridor by 2030, only one express bus route, the Avondale Express, is identified to serve the I-10 West Study Area. Two additional express routes will operate on I-10 (Papago Freeway Connector and Buckeye Express) and provide service between downtown Phoenix and the cities of Buckeye, Goodyear, and Avondale. The Peoria Express will provide service between downtown Phoenix and the cities of Peoria and Glendale via I-10 and Loop 101. The Loop 303 Express will provide service between downtown Phoenix and the cities of Surprise, Peoria and Glendale via I-10 and Loop 303. The two new local bus routes on 99th Avenue and 83rd/75th Avenues will fill in service gaps in the arterial street grid system in the western portion of the Study Area (METRO 2008b). Table 3 identifies the new express and local bus service that will be in operation in the corridor by 2030.

Table 3 Future Express and Local Bus Service

Route	Year of Operation	Type	No. of Daily Trips	Weekday Headways	
				Peak	Base
99th Avenue	2021	Supergrid	68	30	30
83rd/75th Avenue	2023	Supergrid	72	30	30
Papago Freeway Connector	2009	Express	8	N/A	N/A
Peoria Express	2014	Express	12	N/A	N/A
Buckeye Express	2015	Express	6	N/A	N/A
Avondale Express	2020	Express	16	N/A	N/A
Loop 303 Express	2023	Express	8	N/A	N/A

Source: 2007 – HDR | SR Beard & Associates/2008b – METRO

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Existing Park-and-Ride Facilities/Transit Centers

The 79th Avenue Park-and-Ride facility is the only park-and-ride lot currently within the Study Area, offering 607 parking spaces for transit riders and carpoolers. It is currently at capacity. Route 560, Route 17 (McDowell Road Route) and the I-10 West RAPID Route serve this facility. No new park-and-ride facilities are planned within the Study Area (MAG 2007a). The Desert Sky Mall Transit Center and the Central Transit Center are the two bus transfer facilities located within the Study Area.

Future Central Phoenix / East Valley Starter Line

In December 2008 the CP/EV LRT Starter Line, located in the eastern extent of the I-10 West Study Area, will begin operation connecting the cities of Phoenix, Tempe, and Mesa. As discussed in Section 1.3, the significance of the CP/EV LRT Starter Line is that the I-10 West Corridor is proposed as an extension of it. The light rail line will operate with service every 10 minutes from dawn to dusk (METRO 2008c).

4.3.1.4 Land Use

The Study Area contains a diverse range of land use including residential, industrial, commercial, public/government and agricultural uses that extends through western Phoenix and along the northern boundary of Tolleson. Downtown Phoenix, located east of I-17, includes a

mix of residential, commercial, and government uses. Although the downtown portion of the Study Area is mostly built-out, several redevelopment projects are proposed including large-scale mixed-use developments, renovation of the State Capitol, and construction of new government buildings. Conversely, the area west of I-17 includes primarily residential and commercial uses, with industrial developments located along the south side of I-10. Several large vacant parcels exist in the western portion of the Study Area.

4.3.1.5 Travel Patterns

The *I-10 West AA/EIS Transportation Assessment* (METRO 2008b) presents an analysis of travel projections and patterns in the Study Area for the year 2030, the planning horizon year. Daily person-trips from the MAG regional travel demand model were analyzed to develop an understanding of travel patterns in the Study Area. Travel patterns were evaluated to determine if a new transit system has the potential to serve the future ridership market.

For purposes of the analysis presented in the *Transportation Assessment*, the Valley region was organized into 18 distinct districts that are aggregations of Traffic Analysis Zones (TAZs). TAZs are areas delineated by transportation officials for tabulating traffic-related data and usually consist of one or more census blocks, block groups, or census tracts.

Several districts are directly related to the I-10 West Corridor and comprise the "Southwest Valley" for purposes of this document, including:

- District 1 – Along I-10 between 27th Avenue and 91st Avenue along the study area
- District 2 – District along the I-17 portion of the study area, includes portions of downtown
- District 10 – West of the Study Area and Loop 101
- District 11 – District south and adjacent to the Study Area
- District 17 – West of District 10 includes the far West Valley
- District 18 – District southwest of the Study Area

Figure 9 and Figure 10 illustrate these districts and projected travel patterns in terms of the number of daily person trips between each district. For example, there are 28,135 daily person trips between District 10 and 1 that originate from District 10 whereas 22,726 trips between the same two districts originate from District 1. Table 4 shows travel patterns between Districts 1, 2, 3, 9, 10 and 11 in terms of the number of daily person trips between each district. District 2 includes the State Capitol and other government offices while district 3 includes the Phoenix Central Business District. District 1 includes the rest of the I-10 West Study Area. The analysis shows substantial daily person-trips coming from outlying districts (9, 10, and 11) to Study Area districts (1, 2, and 3), identified on Figure 9 and Figure 10. Daily person-trips are highest to District 1 and District 3 from all three outlying districts. District 9, located north of the Study Area, is expected to produce over 130,000 daily person-trips from the Study Area to the study corridor and attract nearly 80,000 daily person-trips by 2030, as depicted in Table 4.

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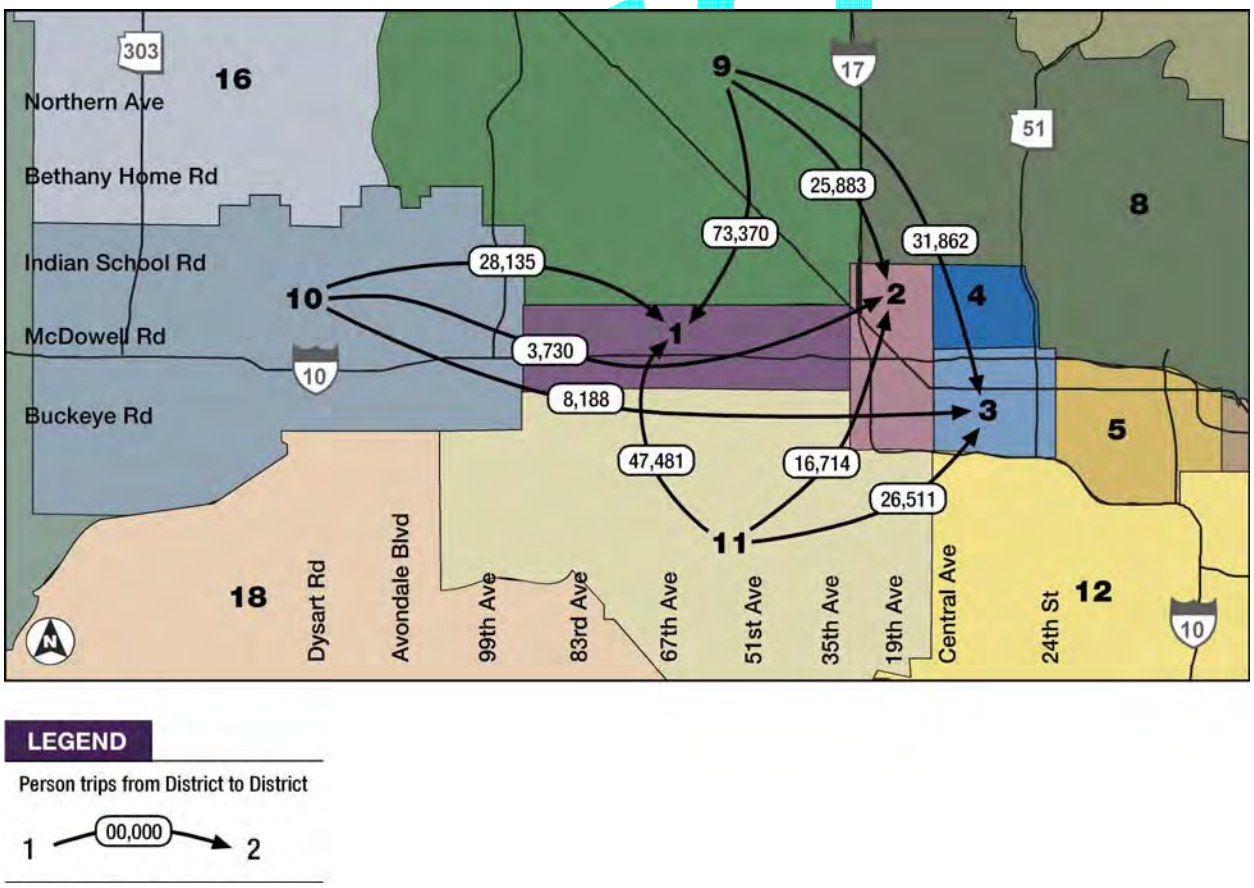
Table 4 2030 Daily Person-Trips for Study Area and Influence Area Districts

	To District					
From District	**1**	**2**	**3**	**9**	**10**	**11**
1	128,806*	**11,252**	**12,533**	**55,092**	**22,726**	**33,845**
2	**6,369**	25,095*	**23,175**	**12,721**	**1,715**	**8,980**
3	**6,929**	**19,520**	123,787*	**12,156**	**3,318**	**12,870**
9	**73,370**	**25,883**	**31,862**	1,487,340*	**72,924**	**52,311**
10	**28,135**	**3,730**	**8,188**	**62,590**	465,873*	**35,524**
11	**47,491**	**16,714**	**26,511**	**36,141**	**34,931**	315,346*

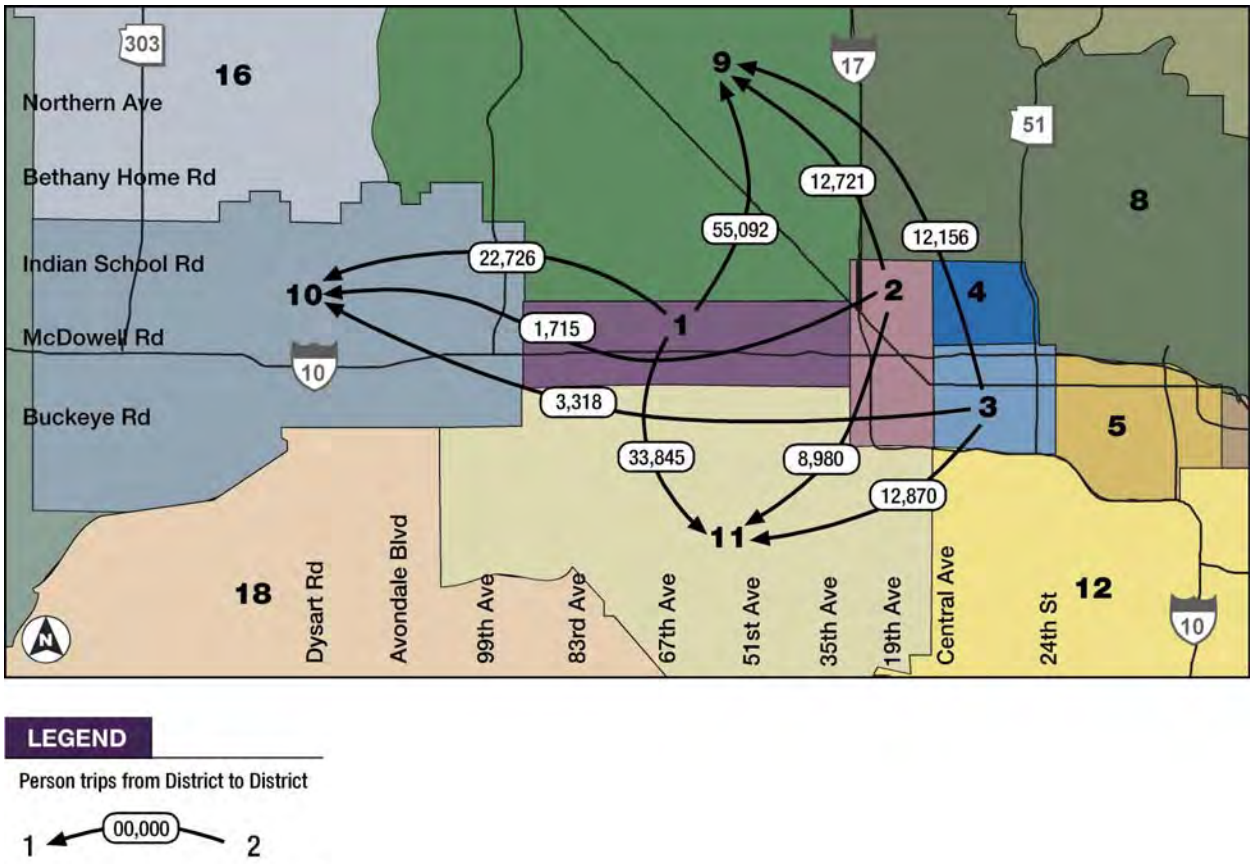
Source: 2008b – METRO
* Numbers represent person-trips completely within a district.

Figure 9 2030 Daily Person Trips from Districts 9, 10, 11 to Districts 1, 2, 3



Source: 2008b – METRO

Figure 10 2030 Daily Person Trips from Districts 1, 2, 3 to Districts 9, 10, 11



Source: 2008b – METRO

4.3.2 Transit Modes Considered

Transit modes that were considered for the I-10 West AA/EIS included BRT, LRT, and commuter rail. The commuter rail option was eliminated from consideration for the Study Area during the Pre-Tier 1 process because MAG has completed a separate region-wide Commuter Rail Strategic Plan. As the planning process for the I-10 West AA/EIS evolves, coordination with the findings of the Commuter Rail Strategic Plan will be necessary. Therefore, the following two transit modes were considered for the I-10 West AA/EIS study:

- BRT
- LRT

4.3.2.1 Bus Rapid Transit

BRT is designed to operate in an exclusive right-of-way, HOV lanes, and/or mixed-traffic lanes on urban arterials. BRT buses are typically unique vehicles that emphasize time saving features such as low-floor vehicles with multiple entries and exits doors that are level with station platforms. Vehicles will usually accommodate 50 to 70 seated passengers. BRT operations often include on-line stations that allow for streamlined fare collection and boarding. These

stations or shelters differentiate bus rapid transit service from standard bus service and provide additional passenger amenities. Traffic signals are usually designed to give preference to buses through electronic sensors that cause traffic signals to shorten or eliminate intersection wait times for buses. Intelligent Transportation Systems (ITS) technologies can be used to maintain more consistent distances between buses and inform passengers when the next bus is arriving.

4.3.2.2 Light Rail Transit

LRT is an electrically powered railway, typically operating at grade in exclusive right-of-way. LRT can be operated using a single vehicle or coupled to form a two, three, or four vehicle train. For the CP/EV LRT Starter Line, vehicles will accommodate 64 seated passengers and 86 standing passengers for 150 total riders per car. LRT typically carries between 4,000 and 6,000 passengers per hour, per direction. LRT operations typically include unique stations that allow for streamlined fare collection and stations that are generally located a mile apart, but closer (typically 0.5 miles or less) in urban centers. Traffic signals are usually designed to give preference to light rail through electronic sensors that cause traffic signals to shorten or eliminate intersection wait times. ITS technologies can be used to maintain more consistent headways and inform passengers when the next train will be arriving.

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4.3.3 General Alternatives Considered

Several transit alternatives were considered for the I-10 West Corridor based on a universe of modal options and FTA requirements. FTA requires that the No Build and Baseline Alternatives be evaluated as part of the AA study. NEPA requires that the No Build Alternative be further evaluated in the EIS.

A total of four alternatives are under consideration for the I-10 West Corridor:

- No Build Alternative
- Baseline Alternative/Express Buses in HOV Lanes
- Build Alternatives:
    - BRT in an Exclusive Guideway
    - LRT in an Exclusive Guideway

4.3.3.1 No Build Alternative

As part of the EIS process, FTA requires that a “no build” alternative is considered in the evaluation of alternatives. The No Build Alternative accounts for planned or committed improvements that are included in the fiscally constrained long-range plans, transportation improvement programs, or local capital programs, resulting in an alternative that considers future transportation and transit conditions without substantial new capital investment. The No Build Alternative would incorporate changes in the transportation network that are already approved or programmed by the Year 2030. METRO and MAG have begun coordination to establish the list of highway and arterial roadway projects that will be included in the No Build Alternative.

4.3.3.2 Baseline Alternative (Express Bus in HOV Lanes)

The Baseline Alternative, also known as the Transportation System Management (TSM) Alternative, would include relatively low-cost safety, operational and capacity enhancements to the existing transit system in the Study Area. FTA requires that the Baseline Alternative is analyzed during the EIS process. This alternative would not include a major investment in new facilities, such as a fixed guideway, and represents a less capital-intensive improvement strategy to address identified transit needs in the I-10 West Study Area. This alternative would focus on transit facility and highway improvements, increased local bus connectivity and the operation of new fixed-route bus service within the I-10 West Study Area. The development of this alternative could include increasing existing express bus frequencies by up to 50 percent to accommodate ridership demand. In addition, the following improvements in the I-10 West Study Area will be considered:

- Operate new and revised feeder bus routes to collect and drop off passengers in outlying areas;
- Provide direct bus access to the existing 79th Avenue or future park-and-ride facilities;
- Use I-10 HOV lanes;
- Incorporate new HOV direct access ramps;
- Use the 3rd/5th Avenue HOV direct access ramp;
- Serve the downtown Phoenix and Capitol Mall District areas along existing arterial rights-of-way;
- Serve the Central Station Transit Center and CP/EV LRT Starter Line.
- Enhance existing bus service and stations

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4.3.3.3 Bus Rapid Transit in Exclusive Guideway

A BRT alignment could potentially use the I-10 right-of-way, including the median that has been reserved for future transit options. This alternative would include constructing a separate busway designed exclusively to accommodate BRT travel. The RAPID and express bus routes that serve the Study Area along I-10 would have access to this busway via direct access ramps or slip ramps. On-line stations in the median of I-10 could be used to minimize service delays that would occur if BRT were to leave the guideway to pick up or drop off passengers.

Similar to the Express Bus in HOV Lanes Alternative, the following improvements would be considered:

- Operate new and revised feeder bus routes to collect and drop off passengers in outlying areas;
- Provide access to the existing 79th Avenue or future park-and-ride lots;
- Use a separate BRT guideway in the median of I-10 with limited on-line stations;
- Incorporate new BRT-only direct access ramps;

- Use the 3rd/5th Avenue HOV direct access ramp or exclusive BRT direct access ramps;
- Serve the downtown Phoenix and Capitol Mall District areas along existing arterial rights-of-way;
- Serve the Central Station Transit Center and the CP/EV LRT Starter Line; and
- Utilize the Hance Park transit facility (if the selected BRT alignment extends to the Hance Park transit facility along I-10).
- Enhance existing bus service and stations

4.3.3.4 Light Rail Transit in Exclusive Guideway

Similar to the CP/EV LRT Starter Line, new LRT within the I-10 West Study Area would likely be operated at-grade using existing freeway and/or roadway rights-of-way. Property acquisition would likely be considered to accommodate new light rail stations or other facilities where right-of-way is unavailable (e.g., downtown Phoenix). Use of existing rail lines operated by Burlington Northern Santa Fe (BNSF) or Union Pacific Railroad would not be considered because those rail lines are designed for freight transportation, and because LRT vehicles are not compatible with freight trains.

Although different than a BRT system, the LRT Alternative would have similar considerations mentioned in the previous section such as the following improvements:

- Extend service to passengers in outlying areas through feeder bus routes that connect to stations;
- Provide access to the existing 79th Avenue or future park-and-ride lots;
- Connect to the CP/EV LRT Starter Line to link the two LRT corridors;
- Serve the Central Station Transit Center; and
- Examine how or whether the use of the Hance Park transit facility is feasible for LRT.

For the I-10 West AA/EIS, it is assumed that the LRT alternative would also include enhancements to existing bus service in the Study Area. The LRT alterative would include two sets of tracks offering an east-west connection between western Phoenix and downtown Phoenix. Specific station locations are not defined for the Tier 1 analysis, but will be determined during the Tier 2 evaluation process. However, it would generally be assumed that stations located west of 27th Avenue would be located approximately two to three miles apart, while station locations within downtown Phoenix would be more closely spaced to support ridership to activity and employment centers. New park-and-ride facilities will also not be identified until the Tier 2 evaluation process.

4.4 DEFINITION OF CONCEPTUAL ALTERNATIVES

Following the scoping meetings, the Project Team reviewed the alignment alternatives and modes identified. A logic-based process was used to generally evaluate the alternatives, eliminate alternatives that did not respond to the Purpose and Need of the project, and identify the alternatives that should be carried into the Tier 1 evaluation. The definition of conceptual

alternatives was based in part on input received during the scoping process, including a Downtown Workshop held in September of 2007 and two public scoping meetings and an agency scoping meeting held in October of 2007.

Using input received during the agency and public scoping meetings, four potential high-capacity transit corridors along arterial rights-of-way were removed from further study west of 27th Avenue, leaving I-10 as the preferred alternative west of 27th Avenue. In the Downtown Section, three north-south alternatives and three east-west alternatives were removed from consideration. The following sections describe these results in more detail.

4.4.1 Universe of LRT and BRT Alignment Alternatives

Based on land uses within the Study Area, the I-10 West Corridor was organized into two distinct areas: west of 27th Avenue and east of 27th Avenue, as illustrated in Figure 11. The section west of 27th Avenue, known as the Mainline Section, serves as the east-west connection from the Southwest Valley and outlying areas to central Phoenix. The Downtown Section east of 27th Avenue serves as the connection between the Mainline Section, downtown Phoenix, and the CP/EV LRT Starter Line.

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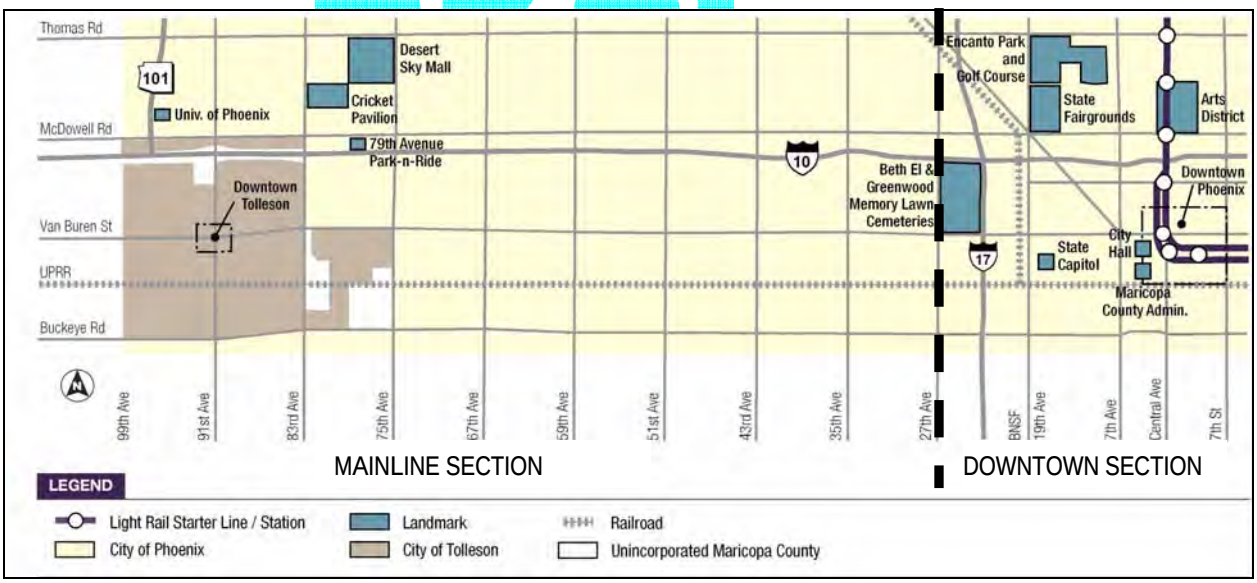
Figure 11 I-10 West AA/EIS Study Mainline and Downtown Sections

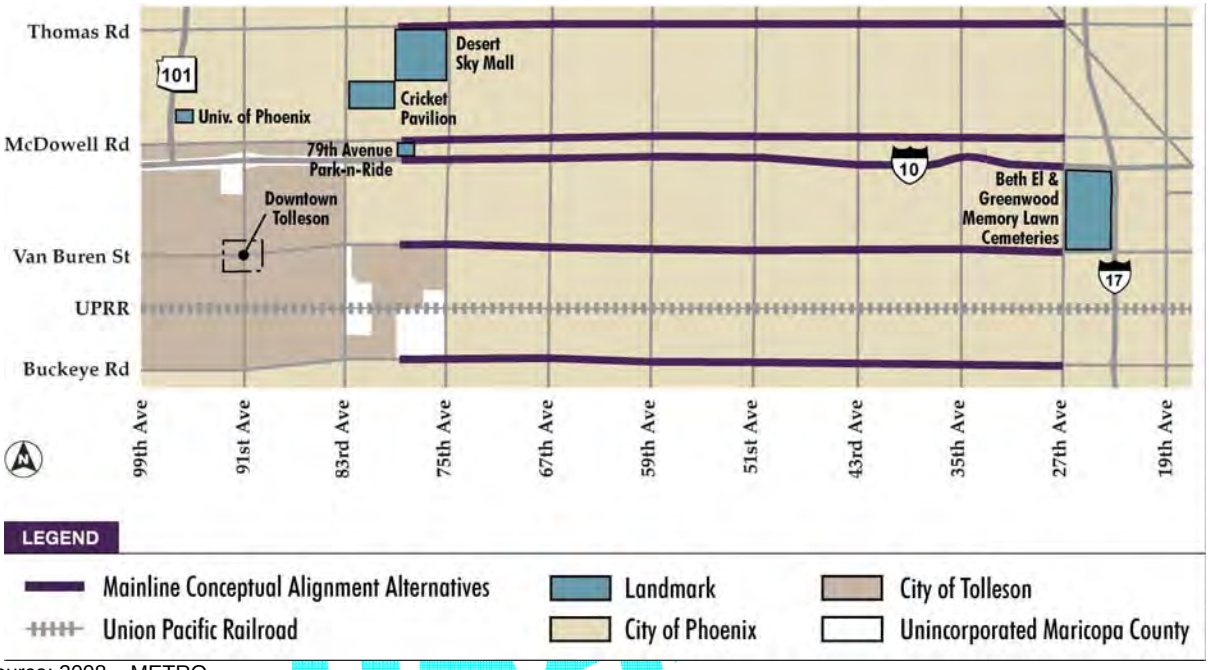


Source:2008a – METRO

4.4.1.1 Mainline Section

The universe of alignment alternatives identified in the Mainline Section would follow an east-west alignment and include the I-10 right-of-way and several arterials including Thomas Road, McDowell Road, Van Buren Street, and Buckeye Road, as illustrated in Figure 12.

Figure 12 Mainline Section: Universe of Alignment Alternatives

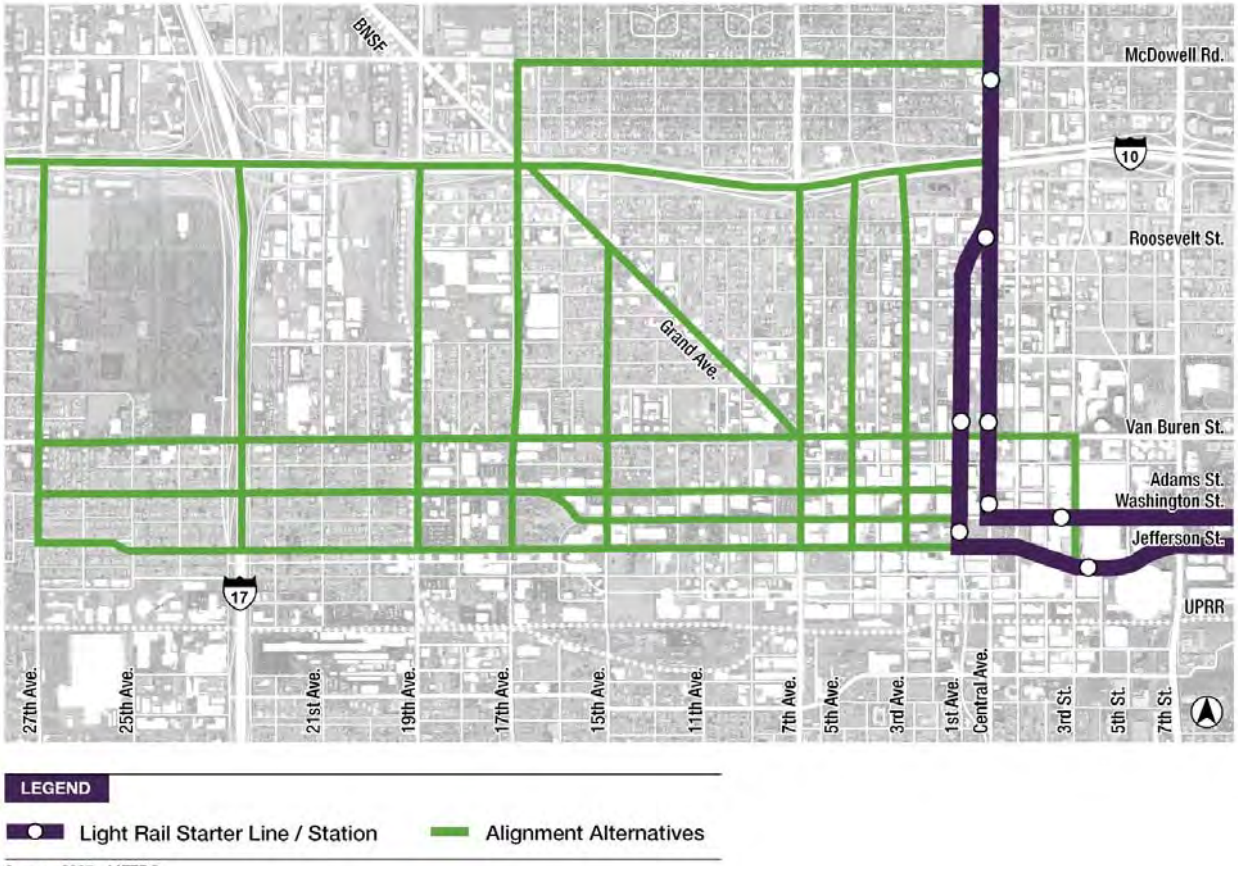


Source: 2008 – METRO

4.4.1.2 Downtown Section

The universe of alignment alternatives identified in the Downtown Section were the result of an early scoping process workshop held with the State of Arizona, Maricopa County, and City of Phoenix agency representatives in September 2007. Agencies in attendance included ADOT, the Maricopa Department of Transportation, the Arizona State Historic Preservation Office, the City of Phoenix City Manager's Office, and the Arizona State Governor's Office. Representatives from local community groups, including the Phoenix Community Alliance and Downtown Phoenix Partnership were also in attendance. The purpose of the workshop was to identify alternatives based on the knowledge that a connection to the CP/EV LRT Starter Line through downtown Phoenix was needed as part of the I-10 West AA/EIS study. East-west alignment alternatives that were identified included McDowell Road, I-10, Van Buren Street, Adams Street, Washington Street, and Jefferson Street. North-south alignment alternatives identified included 27th Avenue, I-17, 19th Avenue, 17th Avenue, 15th Avenue, Grand Avenue, 7th Avenue, 5th Avenue, and 3rd Avenue. Thomas and Buckeye Roads were not considered feasible options since neither alignment would serve activity and employment centers in the downtown area. The alignment alternatives identified in the Downtown Section are shown in Figure 13.

Figure 13 Downtown Section: Universe of Alignment Alternatives



Source: 2008 – METRO

4.4.2 Screening of the Universe of Alternatives

The universe of alignment alternatives identified during the Pre-Tier 1 screening process was evaluated using the project goals previously discussed in Section 3.0.

4.4.2.1 Mainline Section

Each of the arterial alignments west of I-17 were removed from further consideration because they do not meet the following purpose and need statements identified in Section 3.0 related to the I-10 West AA study, including:

- *Offer a viable transportation alternative that will facilitate the safe and efficient movement of people, particularly commuters, through and within the corridor.*
  - The I-10 freeway alignment provides a competitive service compared to automobile travel in terms of providing a reliable option that travels at a higher speed and has a greater passenger capacity.

- The I-10 freeway alignment would incur the lowest implementation cost compared to the arterial alignments because construction within the I-10 right-of-way would minimize property acquisition, require minimal street construction, and result in minimal utility relocations.

- *Support regional plans and policies that support an efficient transit system.*
  - The I-10 freeway alignment is consistent with the MAG RTP alignment approved by voters in 2004.
  - The I-10 freeway alignment is consistent with the 1978 *Interstate 10 – 91st Avenue to Junction I-10 Final EIS and Section 4(f) Statement* that addressed the preservation of the 50-foot wide median for future transit.
- *Add peak period travel capacity as part of a balanced transportation system.*
  - The I-10 freeway alignment best addresses projected travel demand increases within the I-10 West Corridor (e.g., approximately 250,000 vehicles per day in 2007 is projected to increase to approximately 550,000 vehicles per day by 2030).

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During the initial screening of the universe of Mainline Section alternatives, travel time savings was considered for a high-capacity transit option (either BRT or LRT) to determine how each of the alignment alternatives compared in terms of approximate trip travel time from approximately 83rd Avenue to 27th Avenue. Table 5 provides the results of this analysis, which assumed a total of four stations between the western end of the corridor and the intersection of 27th Avenue and Adams Street. Table 5 also accounts for freeway and arterial speed limits and signal delay along arterials, which would result in additional travel time compared to the freeway.

An estimate of travel times for arterial alignments along Thomas Road, McDowell Road, Van Buren Street, and Buckeye Road, presented in Table 5, assumes additional stations compared to I-10. This difference is based on the premise that an alignment along I-10 would be focused on intercepting vehicle trips at park-and-ride lots to provide a reliable alternative to vehicle travel in the freeway, resulting in a desire to minimize freeway travel time. Conversely, arterial alignments would have a substantially higher walk-up market and would be focused more on economic development, but travel time would be impeded by stop-and-go associated with signals and a greater number of stations compared to I-10.

Table 5 Mainline Section: Travel Time between 83rd Avenue/I-10 and 27th Avenue/Adams Street

Option	Stations*	Travel Time	Compared to I-10	
			Time Difference	Percentage Increase
I-10	4	10:17	n/a	n/a
Thomas Road	8	20:02	9:45	95%
McDowell Road	7	16:40	6:23	62%
Van Buren Street	7	14:45	4:28	43%
Buckeye Road	6	14:54	4:37	45%

*Assumes a station at or near 27th Avenue and Adams Street
Source: 2008 – URS

4.4.2.2 Downtown Section

Preliminary alternative alignments along Thomas, McDowell, and Buckeye Roads and 7th, 5th, and 3rd Avenues were removed from consideration because none of these alignments would serve the State Capitol, and therefore would not meet an established goal of the project. Additionally, reconfiguring the existing freeway access ramp shared by 3rd and 5th Avenues would be required.

Table 6 summarizes the results of the screening of the universe of alternatives by showing which alternatives were removed from consideration.

Table 6 Screening of the Universe of Alternatives

Mainline Section Alignment Alternatives	Reason for Elimination
Thomas Road	• Operations constrained by lower posted speed limits compared to the freeway, travel time savings would be reduced due to increased number of stations compared to I-10. • Numerous impacts to existing rights-of-way.
McDowell Road	• Operations constrained by lower posted speed limits compared to the freeway, travel time savings would be reduced due to increased number of stations compared to I-10. • Numerous impacts to existing rights-of-way.
Van Buren Street	• Operations constrained by lower posted speed limits compared to the freeway, travel time savings would be reduced due to increased number of stations compared to I-10. • Numerous impacts to existing rights-of-way.
Buckeye Road	• Operations constrained by lower posted speed limits compared to the freeway, travel time savings would be reduced due to increased number of stations compared to I-10. • Numerous impacts to existing rights-of-way.
Downtown Section East-West Alignment Alternatives	**Reason for Elimination**
Thomas Road	• Does not provide direct access to the primary ridership base in downtown Phoenix major employment centers.
McDowell Road	• Does not provide direct access to the primary ridership base in downtown Phoenix major employment centers.
Buckeye Road	• Does not provide direct access to the primary ridership base in downtown Phoenix major employment centers.
Downtown Section North-South Alignment Alternatives	**Reason for Elimination**
7th Avenue	• Does not provide either a single trip (no transfer) or direct access to the primary ridership base in downtown Phoenix major employment centers and the State Capitol. • Would not provide space for a new guideway without reconstruction of the I-10 mainline and 7th Avenue interchange.

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5th Avenue	• Does not provide either a single trip (no transfer) or direct access to the primary ridership base in downtown Phoenix major employment centers and the State Capitol. • Would not provide space for a new guideway without reconstruction of the I-10 mainline and 5th/3rd Avenue HOV direct access ramp.
3rd Avenue	• Does not provide either a single trip (no transfer) or direct access to the primary ridership base in downtown Phoenix major employment centers and the State Capitol. • Would not provide space for a new guideway without reconstruction of the I-10 and 5th/3rd Avenue HOV direct access ramp.

Source: 2008 – METRO

4.5 TIER 1 ALTERNATIVES

The alignment and transit mode alternatives subjected to the Tier 1 evaluation process are described in this section.

4.5.1 Tier 1 Alignment and Transit Mode Alternatives

All alignment alternatives begin in downtown Phoenix with a linkage to the CP/EV LRT Starter Line that travels along Central Avenue in downtown Phoenix. The alignment alternatives terminate at 79th Avenue in west Phoenix. As stated in the Pre-Tier 1 Screening, I-10 between 83rd Avenue and 27th Avenue was identified as the preferred alignment alternative in the Mainline Section. Both BRT and LRT technologies are considered for each of the Tier 1 alignment alternatives Figure 14 depicts the downtown alignments considered for Tier 1 Screening, including:

East-West Alignments

- I-10
- Van Buren Street
- Adams Street
- Washington Street
- Jefferson Street

North-South Alignments

- 27th Avenue
- I-17
- 19th Avenue
- 17th Avenue
- 15th Avenue
- Grand Avenue

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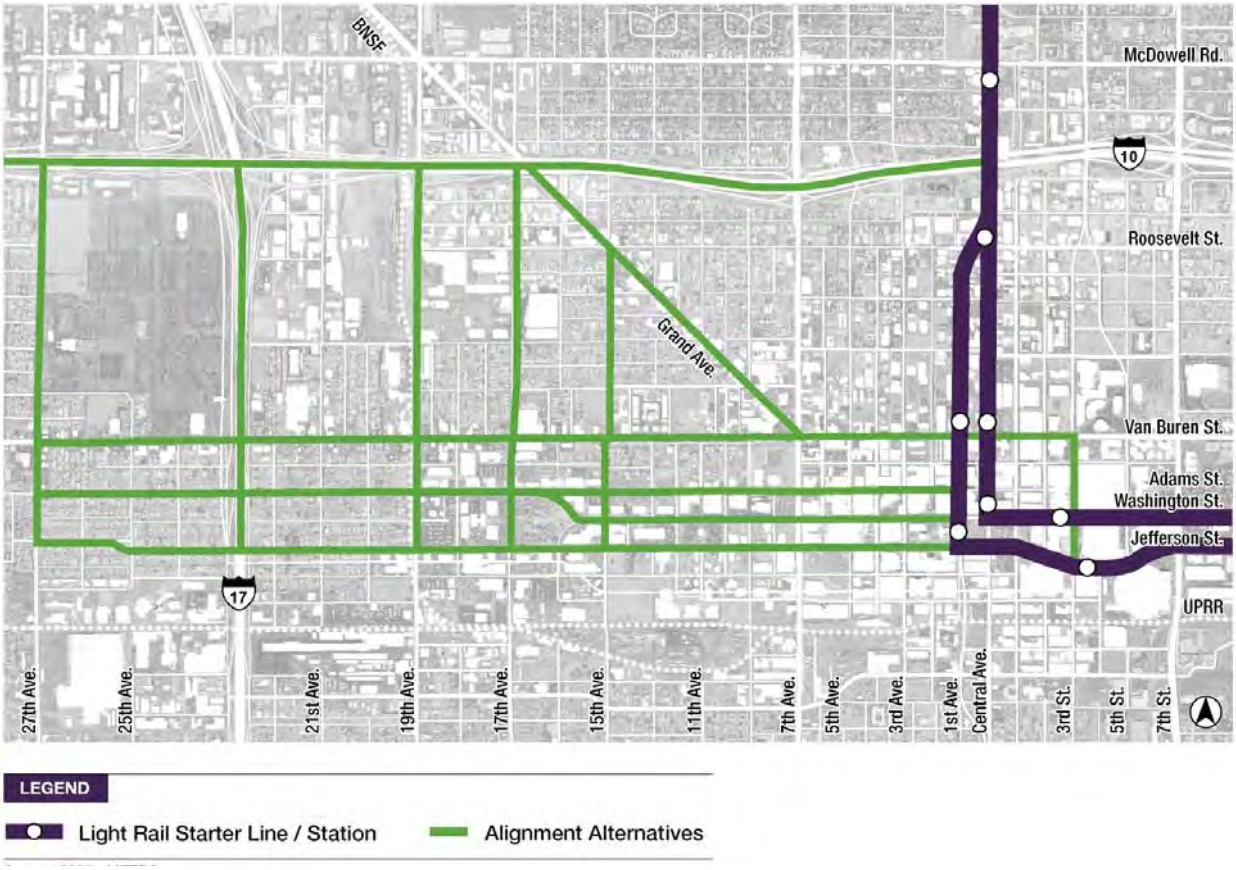
Figure 14 Downtown Section Alignment Alternatives for Tier 1 Screening



Source: 2008 – METRO

5.0 TIER 1 EVALUATION

5.1 INTRODUCTION

The objective of the Tier 1 evaluation process is to analyze alternatives carried forward as a result of the Pre-Tier 1 Screening process. The criteria developed for this process are generally qualitative in nature and their purpose is to eliminate alternatives that do not support the overall goals and objectives of the study, and therefore would not be suitable as an LPA in the EIS. Tier 1 is a "fatal flaw" analysis designed to efficiently screen alternatives based on basic criteria established for the Tier 1 screening process. It should be noted that the Tier 1 Evaluation was primarily focused on the Downtown Section alignment alternatives rather than the Mainline Section because the preliminary screening of the Universe of Alternatives resulted in the identification of the I-10 right-of-way west of 27th Avenue as the recommended high-capacity transit corridor within the I-10 West AA/EIS Study Area, as described in Section 4.5.1.

5.2 TIER 1 EVALUATION CRITERIA

The goal of the Tier 1 screening process is to eliminate alternatives that are clearly unacceptable because they don't meet the primary project goals identified in Section 3.0.

Table 7 summarizes the evaluation criteria and the methodologies used to establish and apply them to the Tier 1 alternatives. For the purposes of the Tier 1 screening, alignments are screened together with the transit modes. The project goals, listed as the first evaluation criteria in Table 7, will be reviewed and may be revised based on additional input from the City of Phoenix as well as the public and other stakeholders. However, these project goals have been used as a basis for the initial development of the Tier 1 evaluation criteria and screening process.

Table 7 Tier 1 Evaluation Criteria and Methodology

Project Goals	Category of Evaluation Criteria	Method/ Technique	Resources	Level of Detail/ Expected Results
Improve Regional Mobility along the I-10 West Corridor	Transit patron travel time savings	Determine the approximate travel time of high capacity transit on Tier 1 alternative alignments.	Travel distance along alignments.	Comparative assessment of travel time.
Connect the local and express bus system and the CP/EV LRT system with the West Valley	Connections	Determine if alternative alignments connect to the State Capitol, in addition to other activity centers, and local/Express bus routes and the CP/EV LRT Starter Line.	Travel distances from alignments to the State Capitol and local/Express bus routes.	Determination if destinations associated with project goal are served.

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Project Goals	Category of Evaluation Criteria	Method/ Technique	Resources	Level of Detail/ Expected Results
Provide cost-effective transit improvements	Technical feasibility	Confirm the alignment and associated technology is feasible; conducting a high level assessment of topography, planned infrastructure in the Study Area; and other potential constructability or implementation issues.	Observation of the corridor; background on technology options	Determine if the alternative is technically feasible given the Study Area topography, soils, and planned infrastructure.
Serve major employment centers, including the State Capitol, and support economic development.	Consistency with existing plans and studies	Review available transportation and land use plans and studies with relevance to the project area. Determine if alternative is consistent with plans.	MAG RTP, City of Phoenix General Plan, other related plans and studies such as the Downtown Phoenix Urban Form Plan	Determination if consistency with past transportation plans and studies exists to the extent possible.
Minimize environmental impacts	Irresolvable environmental impacts to cultural resources or environmental justice populations	Conduct a high level assessment of environmental resource impacts that could cause budget overruns or negatively impact (halt) the project schedule.	Review of project corridor, survey information regarding cultural resources, identification of adverse impacts to environmental justice populations	Determination if any foreseeable potential environmental impacts exist that could cause budget overruns or negatively affect the schedule.

Source: 2008 – METRO

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5.2.1 Improve Regional Mobility along the I-10 West Corridor

Estimating the travel time associated with each of the Tier 1 alternative alignments establishes an evaluation criterion aimed at determining if the goal of increasing regional mobility is met.

5.2.1.1 Mainline Section

As described in Section 4.4.2.1, a high-capacity transit system in an exclusive guideway along I-10 from approximately 83rd Avenue to 27th Avenue would result in an approximate travel time of just over 10 minutes. With a high-capacity transit system operating along the freeway, at freeway speeds with the exception of acceleration and deceleration required at stations, the goal of promoting travel time savings compared to vehicular freeway mobility is met by the I-10 freeway alignment.

5.2.1.2 Downtown Section

Travel times were estimated for the Downtown Section Tier 1 alignment alternatives to determine whether the alignment alternatives would exhibit markedly different performance with respect to travel time. Travel times were estimated in a similar fashion as described earlier for the east-west arterial alignments parallel to I-10, using speed limits and rough estimates for station dwell time.

This rough analysis demonstrates that a difference of approximately 1.5 minutes separates the five north-south alternative alignments. I-17 would provide the fastest connection to downtown Phoenix from I-10, at just over 5 minutes, whereas 27th Avenue would result in the longest travel time, estimated at about 6.5 minutes. These times can be considered close enough that travel time is not a substantial discriminator between downtown alignment alternatives at this level of detail.

5.2.2 Connect the Local and Express Bus System and the CP/EV LRT System with the West Valley

During the scoping phase of the AA process, public officials representing local city and county government offices, individual stakeholder groups, and public representatives acknowledged the importance of new high-capacity transit service within the I-10 Study Area serving the major downtown employment centers, namely the State Capitol and city and county government offices. The future CP/EV LRT Starter Line will serve the eastern portion of the city and county government office complex, leaving the State Capitol area as a major employment area where transit service is desired.

5.2.2.1 Mainline Section

As discussed in the previous section, the I-10 freeway alignment would provide the fastest connection to downtown Phoenix from the Mainline Section of the I-10 West Study Area; therefore, the I-10 freeway alignment meets this goal.

5.2.2.2 Downtown Section

Based on this criterion, the two Tier 1 alternative alignments that do not serve the State Capitol are I-10 and Grand Avenue. I-10 is approximately 4,400 feet (0.8 mile) north of the State Capitol at 17th Avenue. In addition, because I-10 is elevated at 17th Avenue (which is the cross-street upon which the State Capitol is located), it cannot be assumed a station would be located at the 17th Avenue crossing of I-10. If I-10 were the selected high-capacity transit alignment in the Downtown Section, a connection from the Hance Park transit facility would be required, which would result in additional travel time and a bus transfer to reach the State Capitol area.

A connection along Grand Avenue would also not serve the State Capitol because it is located approximately 3,600 feet (0.7 mile) northeast of the State Capitol. Similar to the I-10 alignment alternative, riders accessing the State Capitol would be required to double back, resulting in additional travel time.

5.2.3 Provide Cost-Effective Transit Improvements

The screening criterion used for this goal is determining whether proposed Tier 1 alignment alternatives are technically feasible. Specifically, design and constructability issues were examined for each of the Tier 1 alternatives to determine whether any fatal flaws exist at the Tier 1 phase of the planning process that warrants their removal from further consideration.

5.2.3.1 Mainline Section

Due to the preservation of the freeway median for transit, implementing a high-capacity transit system within the I-10 freeway would minimize property acquisition, require minimal street construction, and result in minimal utility relocations. Therefore, the I-10 freeway alignment best meets the criterion of providing a cost-effective transit improvement in the Mainline Section.

5.2.3.2 Downtown Section

Table 8 summarizes the technical design issues faced by the downtown section alignment alternatives for the Tier 1 cost-effectiveness screening criterion. For several of the downtown section alignment alternatives, they could be designed within their respective rights-of-way; however, further study is warranted to determine the specific design needs of each alternative. Due to the existing location and design of the Hance Park transit facility, design constraints would not allow an LRT option to utilize this structure; therefore, I-10 for LRT service does not meet the cost-effectiveness criterion. Additionally, surrounding residential and cemetery land uses along 27th Avenue present engineering challenges to maintain the current traffic configuration, as discussed in the table below.

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Table 8 Technical Feasibility Assessment of Tier 1 Alternatives

Downtown Alignment Alternatives	Feasibility Considerations
North/South Alignment Alternatives	
27th Avenue	• I-10 is currently elevated over 27th Avenue and an exclusive guideway would require a flyover from the I-10 median to 27th Avenue or extensive reconstruction of the I-10 Mainline bridges and interchanges to bring the LRT or BRT exclusive guideway down to grade. • Widening of 27th Avenue would be required to preserve traffic lanes. Widening to the east would result in impacts to Beth El and Greenwood Memory Lawn Cemeteries between I-10 and Van Buren Street. Widening to the west would impact residential and commercial properties. Either of these impacts are likely to be considered unacceptable. • Any of the east/west LRT alignments extending from 27th Avenue (Van Buren, Adams, or Washington/Jefferson Streets) would require a grade separation at 19th Avenue for LRT to cross the BNSF railroad tracks. The Express Bus and BRT Alternatives would not require grade separation.
I-17	• A complex series of ramps exists at the I-10/I-17 interchange along the I-10 Mainline. Constructing a new transit guideway between I-10 West and I-17 South could require reconstruction of some ramps. • A new guideway along the I-17 alignment would likely require an

Downtown Alignment Alternatives	Feasibility Considerations
	elevated structure or property impacts to maintain existing mainline and frontage road lanes. • Transitioning out of the I-17 alignment to an east-west street alignment (East of I-17) would require a long elevated structure and would impact residential property. • Any of the east/west LRT alignments extending from I-17 (Van Buren, Adams, or Washington/Jefferson Streets) would require a grade separation at 19th Avenue for LRT to cross the BNSF railroad tracks. The Express Bus and BRT Alternatives would not require grade separation.
19th Avenue	• Direct access from I-10 is not feasible due to the clearance required over the BNSF Mobest Railyard. The bottom of the transit guideway structure must be 23 feet above the railyard, which results in an insufficient distance to bring the ramp from I-10 directly to 19th Avenue. A likely solution is to cross the guideway over 19th Avenue to the east, drop the ramp to grade at 17th Avenue, and then double back west to 19th Avenue. • 19th Avenue right of way is constrained by BNSF property to the west. Widening to maintain travel and turning lanes would require property acquisition. • Six parcels along the east side of 19th Avenue South of Polk Street are in the Oakland Historic District.
17th Avenue	• The 17th Avenue right-of-way is too narrow along the proposed alignment to provide an exclusive transit guideway without impacting either travel lanes or adjacent property. However, LRT could share space with street traffic at low speeds. • Residential homes associated with the Oakland Historic District line the 17th Avenue right-of-way between Fillmore and Van Buren. • Capitol Elementary School is directly east of the 17th Avenue right-of-way between Polk and Van Buren.
15th Avenue	• Use of the Grand Avenue right of way to connect I-10 to 15th Avenue would require property acquisition and/or reduction in the number of lanes. • The 15th Avenue right-of-way is particularly narrow along the proposed alignment. Additionally, residential homes associated with the Oakland Historic District line the 15th Avenue right-of-way. • 15th Avenue has a high frequency of street intersections, many of which are off-set from east to west.
Grand Avenue	• Use of the Grand Avenue right of way would require substantial commercial property acquisition and/or reduction in the number of travel lanes. • The Grand Avenue right-of-way is particularly narrow along the proposed alignment. Additionally, properties associated with the Oakland Historic District line the Grand Avenue right-of-way on the west side between Fillmore and Polk Streets. • The Grand Avenue alignment does not come within a reasonable walking distance of the State Capitol, which is a major employment destination.
East/West Alignment Alternatives	

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Downtown Alignment Alternatives	Feasibility Considerations
I-10 Freeway	• Either BRT or LRT in an exclusive guideway would need to account for the freeway access ramp shared by 3rd and 5th Avenues. • Structural limitation on the existing Hance Park transit facility would preclude LRT high-capacity transit service along the I-10 freeway. • The Hance Park transit facility could potentially accommodate BRT service; however, further study is needed for specific design requirements.
Van Buren Street	• Further study is needed to determine the feasibility of high-capacity transit along Van Buren Street due to the narrow width of the right-of-way, which would require widening to retain traffic lanes. Additionally, further study is required to determine impacts to existing driveways.
Adams Street	• Further study is needed to determine the feasibility of high-capacity transit along Adams Street due to the narrow width of the right-of-way, which would require widening to retain traffic lanes. • The Adams Street alignment alternative would not be able to connect to the CP/EV LRT Starter Line directly because the radius required to connect with the existing track could not be provided without impacting large commercial buildings. Construction would impact the Wells Fargo Parking Structure at the southwest corner of the Adams Street and Central Avenue intersection.
Washington / Jefferson Street	• Substantial right-of-way width could accommodate either a one-way couplet transit alignment (e.g., west-bound on Washington Street and east-bound on Jefferson Street) or utilizing one roadway for two-way transit operations. • Washington Street has been identified as a potential corridor for view preservation. • Both Washington and Jefferson Streets have a relatively high frequency of street intersections.

Source: 2008 – METRO

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5.2.4 Serve Major Employment Centers, including the State Capitol, and support economic development.

To determine the Tier 1 alignment alternatives relevance to this goal, existing plans and studies were examined to determine the consistency of each alternative alignment.

5.2.4.1 Mainline Section

The I-10 freeway alignment provides a corridor that would provide direct service to and from downtown Phoenix; therefore, the I-10 alternative meets the Support Economic Development in Downtown Phoenix criterion. Additionally, I-10 was identified as the preferred alignment in the MAG RTP approved by voters in 2004.

5.2.4.2 Downtown Section

A qualitative review of the following plans and studies was conducted to determine the consistency of potential high-capacity transit alternatives based on existing and proposed land uses and developments:

- MAG, *Draft Regional Transportation Plan* (2007 Update)
- MAG, *FY 2008 – 2012 Transportation Improvement Program* (2007)
- MAG, *Regional Transportation Plan* (2003)
- City of Phoenix, *Proposed Arts, Culture, and Small Business Overlay Map* (2006)
- City of Phoenix, *Central City South Area Plan* (2004)
- City of Phoenix, *Estrella Village Brochure* (2004)
- City of Phoenix, *Downtown Phoenix: A Strategic Vision and Blueprint for the Future* (2004)
- City of Phoenix, *Downtown Area Redevelopment and Improvement Plan* (2001)
- City of Phoenix, *General Plan* (2001)
- City of Phoenix, *Estrella Village Plan* (1999)
- City of Phoenix, *Maryvale Village Brochure* (1998)
- City of Phoenix, *Central City Village Brochure* (1998)
- City of Phoenix, *Encanto Village Brochure* (1998)
- City of Phoenix, *Capitol District Development Guidelines* (1997)
- City of Phoenix, *Downtown Phoenix, A 25 Year Plan* (1991)
- City of Phoenix, *The Roosevelt Neighborhood Special District Plan* (1989)
- City of Phoenix, *Downtown Phoenix Urban Form Plan* (2008)
- Arizona State University, *Capitol Mall Centennial Plan* (2006)

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High-capacity transit is supported in several of the plans examined as part of the Tier 1 analysis; however, specific alignments in the downtown portion of the Study Area are neither explicitly identified nor discouraged. Therefore, this criterion does not result in the removal of Tier 1 alternative alignments from further consideration.

Although the I-10 alignment alternative does not serve the State Capitol, community stakeholders have indicated further analysis should be conducted on use of the Hance Park transit facility. Potential economic development opportunities have influenced the community's interest in the Hance Park transit facility.

5.2.5 Minimize Environmental Impacts

This section provides a qualitative assessment of impacts that Tier 1 alternatives could have on sensitive environmental issues and conditions within the I-10 West Study Area. For this screening criterion, alternative alignments impacts to cultural resources and environmental justice populations were examined.

In compliance with Section 106 of the National Historic Preservation Act, a cultural resource records and literature review was conducted for the I-10 West Study Area based on state, county, and local databases. The compiled information was evaluated to identify cultural resource constraints in the alternative routes for high-capacity transit service.

An initial screening-level socioeconomic assessment of communities that may be subject to environmental justice criteria was performed during the Tier 1 screening process. Environmental justice, as outlined in Executive Order 12898, signed in 1994, reaffirms Title VI of the Civil Rights Act that states public agencies must identify and address any disproportionately high and adverse human health or environmental effects from projects and programs on minority and low-income populations.

5.2.5.1 Mainline Section

According to the *I-10 West High-Capacity Transit Corridor Study: Tier 1 Cultural Resource Evaluation* (URS 2008), I-10 west of 27th Avenue crosses mapped alignments of Hohokam canals; however, due to the highly disturbed nature of the freeway impacts to existing cultural sites are anticipated to be minimal.

Environmental Justice populations are located north and south of the I-10 freeway alignment; however, since the proposed high-capacity transit improvements would remain in existing freeway right-of-way, no adverse impacts to these populations would occur. Therefore, the I-10 freeway alternative would meet the goal of minimizing environmental impacts.

5.2.5.2 Downtown Section

Due to the historical context of downtown Phoenix, each of the downtown section Tier 1 alignment alternatives (with the exception of I-10) falls within a historic district and is adjacent to properties listed in the National Register of Historic Places or the Phoenix Register. However, the numbers of adjacent historic properties do not directly indicate the impact the alignment alternatives would have on listed properties. Public transit service could be an amenity that promotes continued preservation of adjacent historic properties. If the alternative would require acquisition of additional right-of-way, however, it could adversely affect historic properties. Consequently, the historical/archaeological resources criteria may not be justified as a criterion that determines which alternatives should be removed from consideration based on the Tier 1 Analysis. A more detailed description during the Tier 2 evaluation will determine actual impacts on historic resources. A complete list of the cultural resources documented within the I-10 West Study Area is available in the attached *I-10 West High-Capacity Transit Corridor Study: Tier 1 Cultural Resource Evaluation* (URS 2008). Based on the inventory of cultural resources, no Tier 1 alignment alternatives would have cultural resource impacts that would constitute a fatal flaw.

Although several populations that meet the environmental justice criterion exist within the Study Area, in particular adjacent to the I-10 freeway and in downtown Phoenix, the specific type of impact the high-capacity improvements would have on these populations is unknown at this time. In certain instances, transit may have a positive effect in communities with predominately minority and/or lower-income populations. Because each of the proposed alignment alternatives would be located within existing street rights-of-way, the likelihood of property acquisition would be restricted to certain locations such as station areas, turn-outs, or other high-capacity transit-related facilities. Potential impacts to specific properties and environmental justice populations will be addressed in further detail during the Tier 2 process. As a result, the environmental justice criterion does not warrant the removal of any of the Tier 1 alternative alignments.

Therefore, this criterion does not result in the removal of Tier 1 alternative alignments from further consideration.

5.3 TIER 1 EVALUATION SUMMARY

As a result of the Tier 1 screening process, three alternatives should be removed from consideration in the downtown section of the Study Area. These are the I-10 freeway for LRT, 27th Avenue, and Grand Avenue.

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Because the I-10 alignment in the Downtown Section would not provide a direct connection with the CP/EV LRT Starter Line at the Hance Park transit facility, this goal would be unmet. Further, neither the LRT or BRT alignment alternatives would serve the State Capitol, identified as one of the goals of the I-10 West project. However, BRT service could be divided so that both the I-10 alignment and the State Capitol could be served directly. The 27th Avenue alignment would require substantial reconstruction of existing facilities and new right-of-way to be constructed. The BRT or LRT alignment would be much more complex than the alignments east of I-17. Therefore, the 27th Avenue alignment alternative fails to meet the goal of cost-effective improvements and should be eliminated.

The Tier 1 analysis also concluded that Grand Avenue would not serve the State Capitol; therefore this alignment alternative is recommended for removal. Table 9 summarizes each of the alternative alignments considered during the Tier 1 analysis and lists whether each option meets the project goals.

Table 9 Tier 1 Fatal Flaw Analysis

Alignment Alternatives	Goal 1: Improve regional mobility	Goal 2: Connect local and express bus and CP/EV LRT System with the West Valley	Goal 3: Provide cost-effective transit improvements	Goal 4: Serve major employment centers, including the State Capitol, and support economic development.	Goal 5: Minimize environmental impacts
Criteria					
	Transit Patron Travel Time Savings	Connections	Technical Feasibility	Consistency with Existing Plans and Studies and Connections to Existing and Planned Activity Centers, including the State Capitol	Irresolvable Environmental Impacts to Cultural Resources/ EJ Populations
Mainline Section					
I-10	Pass	Pass	Pass	Pass	Pass
Downtown Section East-West Alignment Alternatives					
I-10 (BRT)	Pass	**Fail***	Pass	Pass	Pass
I-10 (LRT)	Pass	**Fail**	**Fail**	Pass	Pass
Van Buren St.	Pass	Pass	Pass	Pass	Pass
Adams St.	Pass	Pass	Pass	Pass	Pass
Washington St.	Pass	Pass	Pass	Pass	Pass
Jefferson St.	Pass	Pass	Pass	Pass	Pass
Downtown Section North-South Alignment Alternatives					
27th Ave.	Pass	Pass	**Fail**	Pass	Pass
I-17	Pass	Pass	Pass	Pass	Pass
19th Ave.	Pass	Pass	Pass	Pass	Pass
17th Ave.	Pass	Pass	Pass	Pass	Pass
15th Ave.	Pass	Pass	Pass	Pass	Pass
Grand Ave.	Pass	**Fail**	Pass	**Fail**	Pass

*Community stakeholders have requested that an option to connect to the Hance Park transit facility be further analyzed.
Source: 2008 – METRO

6.0 RECOMMENDATIONS FOR TIER 2 ANALYSIS

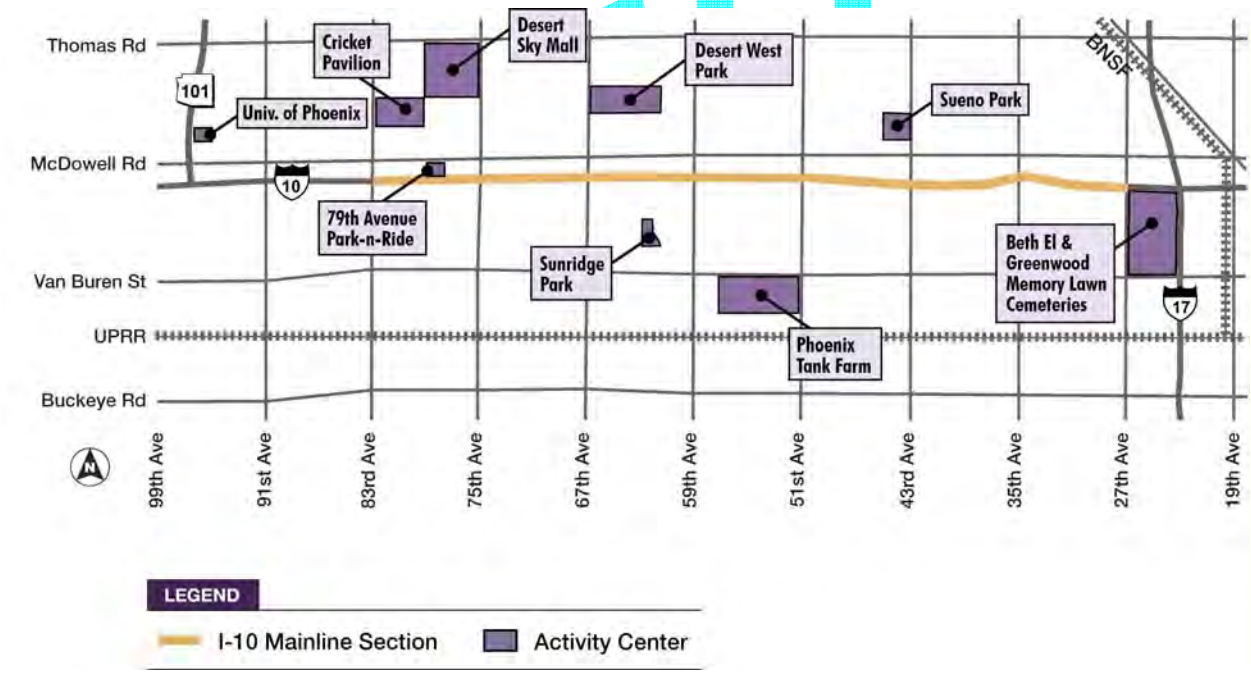
6.1 INTRODUCTION

The following section identifies the alignment and transit mode alternatives that are recommended for the Tier 2 evaluation process.

6.2 ALTERNATIVES RETAINED FOR TIER 2 EVALUATION

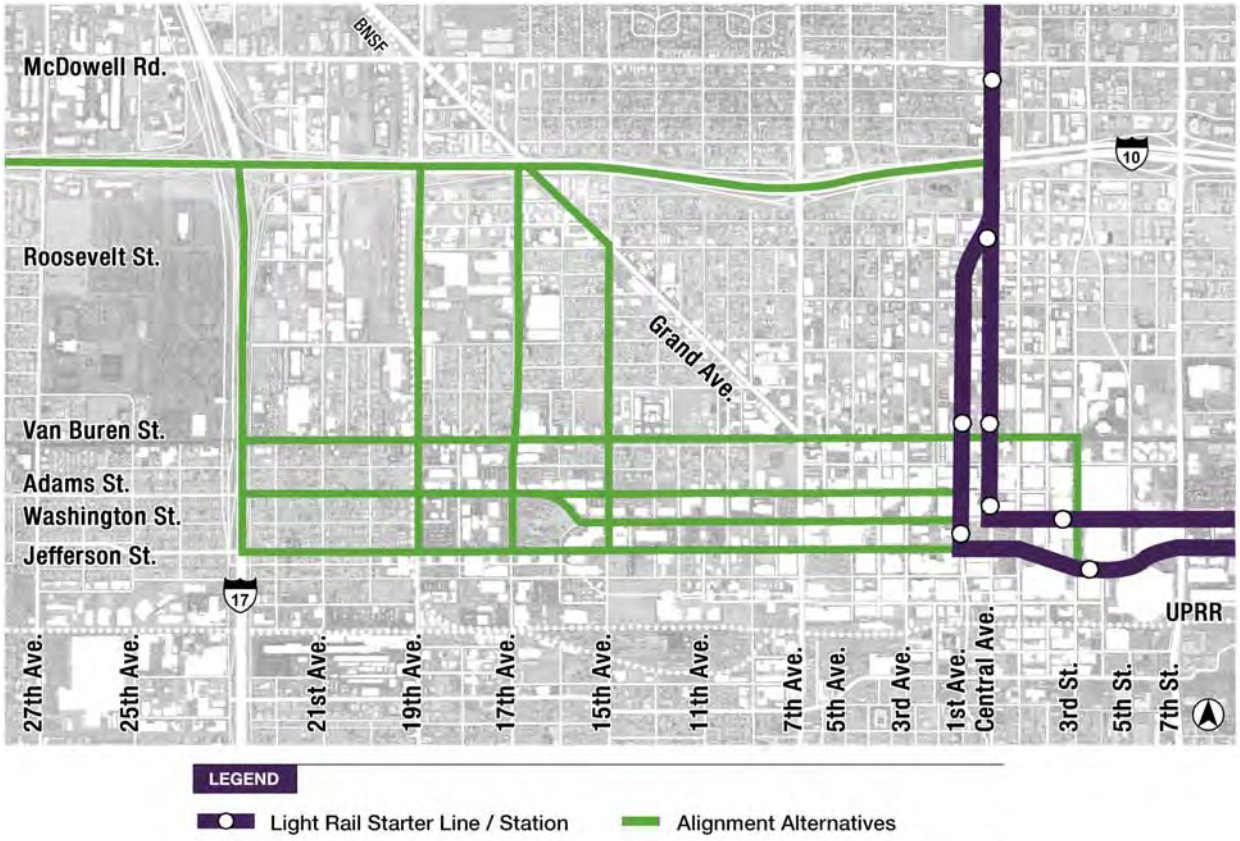
Based on the Tier 1 evaluation criteria, one Mainline Section alternative and several Downtown Section alternatives are recommended for the Tier 2 evaluation process. Figure 15 and Figure 16 identify the I-10 Mainline Alternative and the downtown route options that will be carried into the Tier 2 evaluation, respectively.

Figure 15 Mainline Section Alignment



Source: 2008 – METRO

Figure 16 Tier 2 Downtown Section Alignment Alternatives



Source: 2008 – METRO

The I-17 Connection was advanced for Tier 2 evaluation due to its potential for travel time savings through operating in the I-17 freeway system. This route option would not significantly impact nearby properties because it would operate in the I-17 right-of-way. Express bus (Baseline Alternative), BRT, and LRT are considered for this option.

Other north-south alignment alternatives advanced for Tier 2 screening include 19th Avenue, 17th Avenue, and 15th Avenue. These routes were recommended for Tier 2 evaluation because each route offers a connection near the Capitol Mall District. Express Bus (Baseline Alternative), BRT, and LRT are considered for these alternative alignments.

The Hance Park Station Connection includes operating along I-10 and terminating at the transit facility (currently not in use) under Hance Park. Express Bus and BRT are the only transit modes considered for this option because light rail transit would not be feasible as stated in 5.2.3.2. Community interest in developing an alternative served by the Hance Park transit facility is a direct result of identifying potential economic development opportunities near the connection to the CP/EV LRT Starter Line.

Other east-west route options include Van Buren Street (which could extend east to 3rd Street to connect to the CP/EV LRT Starter Line), Adams Street, Washington Street, and Jefferson Street. These options were advanced for Tier 2 evaluation because each option offers a connection to the Capitol Mall District and the CP/EV LRT Starter Line.

A summary of each route option and transit mode recommended for the Tier 2 evaluation is identified in Table 10.

Table 10 Alignments Recommended for Tier 2 Evaluation

Mainline Section Alternatives	**Transit Modes Considered**		
	Express Bus (Baseline Alternative)	**BRT**	**LRT**
I-10 (79th Avenue to I-17)	Yes	Yes	Yes
Downtown Section North-South Alternatives	**Transit Modes Considered**		
	Express Bus (Baseline Alternative)	**BRT**	**LRT**
I-17	Yes	Yes	Yes
19th Avenue	Yes	Yes	Yes
17th Avenue	Yes	Yes	Yes
15th Avenue	Yes	Yes	Yes
Downtown Section East-West Alternatives	**Transit Modes Considered**		
	Express Bus (Baseline Alternative)	**BRT**	**LRT**
I-10/Hance Park Transit Facility	Yes	Yes	No
Van Buren Street	Yes	Yes	Yes
Adams Street	Yes	Yes	Yes
Washington Street	Yes	Yes	Yes
Jefferson Street	Yes	Yes	Yes

Source: 2008 – METRO

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I-10 WEST

HIGH CAPACITY TRANSIT ALTERNATIVES ANALYSIS / ENVIRONMENTAL IMPACT STATEMENT

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TIER 2 EVALUATION REPORT

May 2009

METRO

I-10 West AA/EIS

Draft
Tier 2 Evaluation Report

Prepared for:

Valley Metro Rail, Inc.

Prepared by:

May 7, 2009

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LIST OF ACRONYMS

AA/EIS	Alternatives Analysis/Environmental Impact Statement
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
BNSF	Burlington Northern Santa Fe
BRT	Bus Rapid Transit
CHPO	City of Phoenix Historic Preservation Office
CP/EV	Central Phoenix/East Valley
CWG	Community Working Group
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FTA	Federal Transit Administration
FY	Fiscal Year
GIS	Geographic Information Systems
GWG	Government Working Group
HCT	High Capacity Transit
HOV	High Occupancy Vehicle
I-10	Interstate 10
Loop 101	State Route 101
LOS	Level of Service
LUST	Leaking Underground Storage Tank
LPA	Locally Preferred Alternative
LRT	Light Rail Transit
MAG	Maricopa Association of Governments
METRO	Valley Metro Rail, Inc.
NEPA	National Environmental Policy Act
NOI	Notice of Intent
PE	Preliminary Engineering
PnR	Park-and-Ride
ROD	Record of Decision
ROW	Right of Way
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHPO	Arizona State Historic Preservation Office
WQARF	Water Quality Assurance Revolving Fund
TSM	Transportation System Management
UST	Underground Storage Tank

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1.0 INTRODUCTION

This report presents the results of the I-10 West Alternatives Analysis/Environmental Impact Statement (AA/EIS) Study Tier 2 Evaluation and Screening that was performed for high capacity transit (HCT) alternatives. These alternatives were recommended based on Tier 1 fatal flaw analysis. The Tier 2 screening process is intended to result in a narrowed list of alternatives that will be further evaluated during the Final Definition of Alternatives phase, eventually leading to a recommended Locally Preferred Alternative (LPA) to be studied in detail in the subsequent environmental process. Section 1.5 describes the Tier 2 evaluation process as defined for the I-10 West AA/EIS Study. This report is organized as follows:

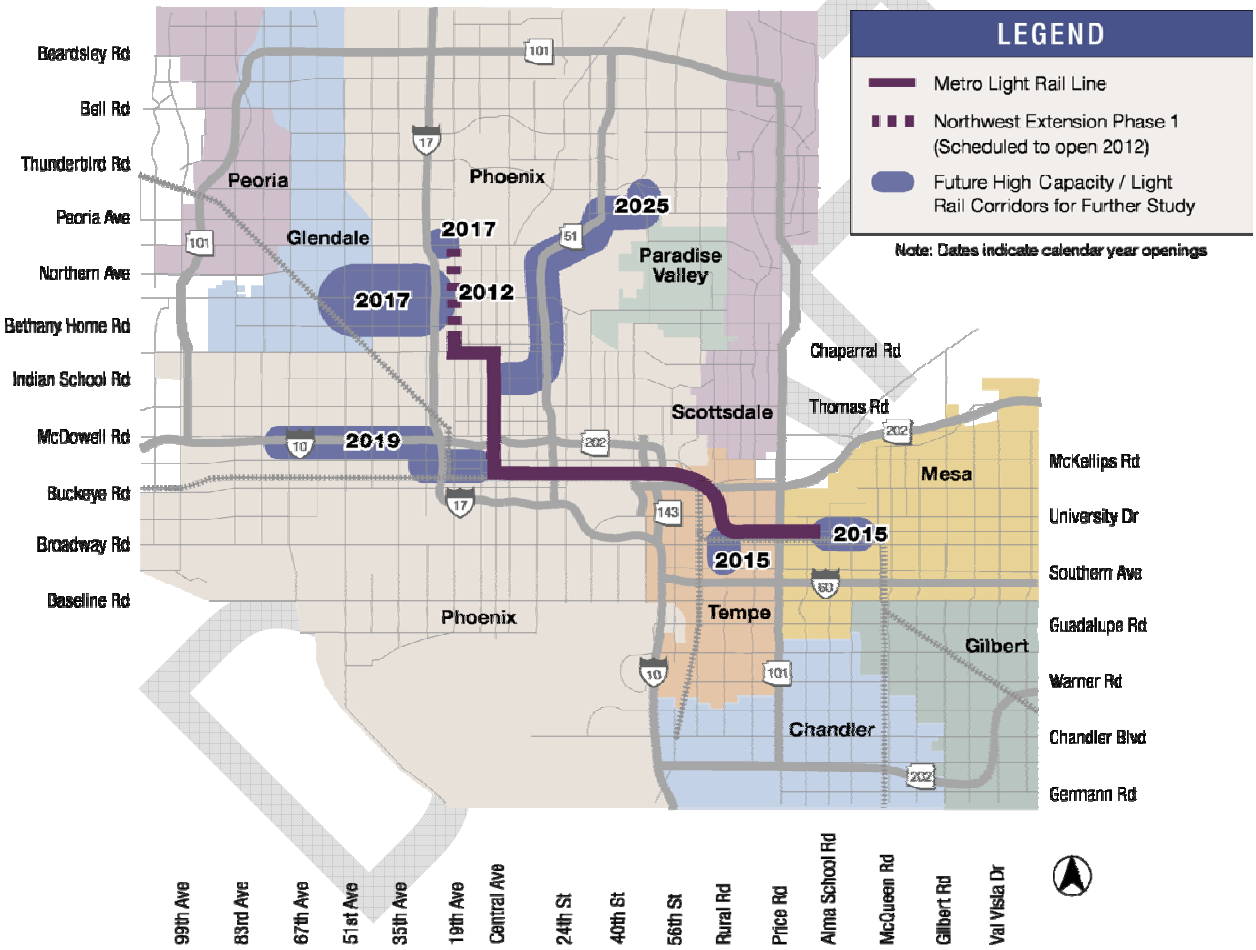
- Chapter 1 provides a brief description of the I-10 West AA/EIS Study background, the project study area, a description of the project development and Alternatives Analysis process, the purpose and need for the study, a summary of the Tier 1 screening, and the summary of the Tier 2 evaluation process.
- Chapter 2 describes the Tier 2 Conceptual Alternatives, or alternative transit modes and alignment alternatives remaining after the Tier 1 evaluation phase. These alternatives include the No-Build Alternative, the Baseline/Transportation System Management (TSM) Alternative and the Build Alternatives.
- Chapter 3 presents the evaluation and screening of the Tier 2 Conceptual Alternatives.
- Chapter 4 presents the Definition and Evaluation of Detailed Alternatives for light rail transit (LRT). LRT alignment alternatives were described as (1) North-South Alignment Alternatives, (2) East-West Alignment Alternatives and (3) Downtown Connection Options. A series of criteria that relate directly to the project goals were used to evaluate the LRT North-South Alignment Alternatives, East-West Alignment Alternatives and Downtown Connection Options that were then combined to create Packages of Alternatives based on evaluation results.
- Chapter 5 presents the Definition and Evaluation of Detailed Alternatives for bus rapid transit (BRT). BRT alignment alternatives are described as two distinct alignments with different service patterns, including Part “A” service and Part “B” service. Two north-south alignments are evaluated for Part “A” service.
- Chapter 6 presents the Packages of Alternatives for LRT and provides a preliminary ranking of the remaining Packages of Alternatives based on the evaluation and screening presented in Chapter 4. The recommended Detailed Alternatives for BRT to be carried forward for evaluation in the Final Definition of Alternatives phase are also presented in Chapter 6.
- Finally, Chapter 7 describes the next steps in the planning process for the I-10 West AA/EIS Study.

1.1 I-10 West AA/EIS Study Background

The passage of Proposition 400 by Maricopa County voters in November of 2004 signified a substantial increase in the amount of funding for public transit. Over the 20-year life of the one-half-cent sales tax, it is anticipated that about $4.7 billion will be raised for public transit projects (MAG 2007). Proposition 400 also represented the public’s interest to provide a transportation system that could accommodate regional growth.

Funds from the Proposition 400 half-cent transportation sales tax extension were allocated toward the 57.7-mile LRT system identified in the 2003 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP). The 20-mile Central Phoenix/East Valley (CP/EV) LRT Starter Line that serves the cities of Phoenix, Tempe, and west Mesa opened for passenger service in December of 2008. The MAG RTP identified an 11-mile extension along west I-10, from the CP/EV LRT Starter Line to the vicinity of 79th Avenue, as one of six additional LRT/HCT corridors within Maricopa County (MAG 2003). The corridors are illustrated in Figure 1-1. This segment of I-10, defined as the I-10 West Corridor is scheduled to be in operation by 2019, with the remaining system to be operational by 2025.

Figure 1-1 High Capacity/Light Rail Transit Corridors

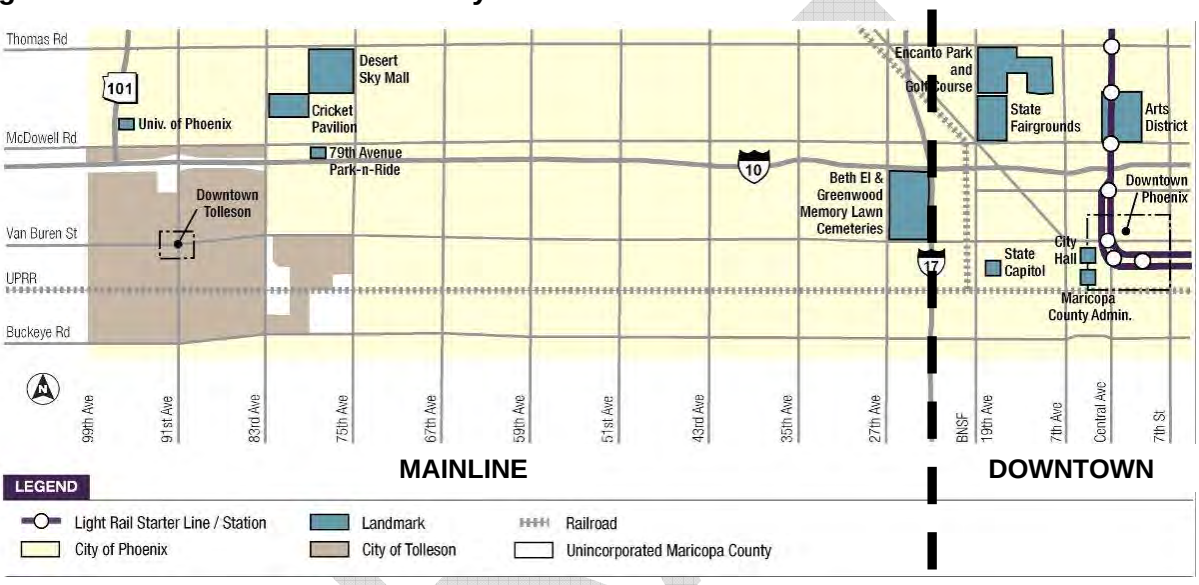


Source: MAG 2007

The I-10 West AA/EIS Study is being conducted in accordance with the project development process outlined by the Federal Transit Administration (FTA) for major transit capital investments (described in Section 1.2) and in accordance with the rules and regulations specified by the National Environmental Policy Act (NEPA). The I-10 West study area is bounded on the north by Thomas Road, on the south by Buckeye Road, on the west by State Route 101 (Loop 101), and on the east by 7th Street, as depicted in Figure 1-2.

For the purposes of alternatives development and analysis, the corridor was divided into two sections. The portion west of I-17 is referred to as the Mainline Section, while the portion east of I-17 is referred to as the Downtown Section. This division is helpful because the two sections differ in terms of alignment possibilities, station needs, key types of impact, and transit service needs. To the extent that the I-10 West Study is a commuter-oriented transit corridor study, the Mainline Section is generally where commuters would board the system on their way to work or school, while the Downtown Section contains most of the employment destinations in the corridor, and is therefore where most commuters would exit the system in the morning and board in the evening.

Figure 1-2 I-10 West AA/EIS Study Area



Source: METRO I-10 West Study Team 2008

1.2 Project Development Process

The I-10 West AA/EIS Study is proceeding in accordance with the project development process outlined by FTA for major transit capital investments and in accordance with the rules and regulations specified under the NEPA, as shown in Figure 1-3.

The steps from AA through Final EIS are considered to be the project planning phases. The AA process commenced with the publication of the Notice of Intent (NOI) in the Federal Register on October 2, 2007, which notified the public that an EIS would be prepared and considered for the I-10 West study. The publication of the NOI also signified the start of the "scoping" process. Scoping is an early and open interactive process that allows public participation in determining the scope of issues to be addressed and identifies significant issues related to the proposed project. Scoping is an ongoing process where input is received during public and agency meetings or through other forms of communication including submittals via the project website, letters, and emails.

During the AA phase, an analysis of various alternatives will be conducted while considering a variety of criteria. The Phoenix City Council and the Valley Metro Rail, Inc. (METRO) Board of Directors will identify an LPA based on the results of analysis and input received during agency

and public scoping meetings. The goal is then to conduct a detailed analysis of the LPA and No Build Alternative in the Draft EIS and to propose mitigation measures to address adverse impacts.

The draft Baseline/TSM Alternative developed for the I-10 West AA/EIS Study is described in Section 6.3. The final, recommended Baseline/TSM Alternative will be analyzed subject to FTA requirements. Upon completion of the Draft EIS, it will be circulated for public review and comment, and public hearings will be held at that time. FTA, the Phoenix City Council, and the METRO Board of Directors will adopt a refined LPA based on the findings of the Draft EIS and public comments.

Preliminary Engineering (PE) will then be conducted concurrently with preparation of the Final EIS that responds to public comments and commits to specific mitigation measures for adverse impacts. Upon completion of the Final EIS, it will be submitted to FTA for consideration, and FTA will then issue a Record of Decision (ROD) that provides environmental clearance to proceed.

Following issuance of a ROD, final design would be conducted, the financing plan would be finalized, and construction could begin. The start of operation along the I-10 West Corridor is projected for the end of 2019.

The Alternatives Analysis process, which is the first step in the Project Development Process shown in Figure 1-3, is depicted in detail in Figure 1-4. This chart differs slightly from previous depictions of the I-10 West AA process in that it shows the detailed evaluation of separate segments and technologies in Tier 2, whereas the previous depiction showed one comprehensive screening process for all Tier 2 alternatives. The Tier 2 process, which entails conceptual and detailed screening phases as summarized in this document, is described further in Section 1.5 of this chapter.

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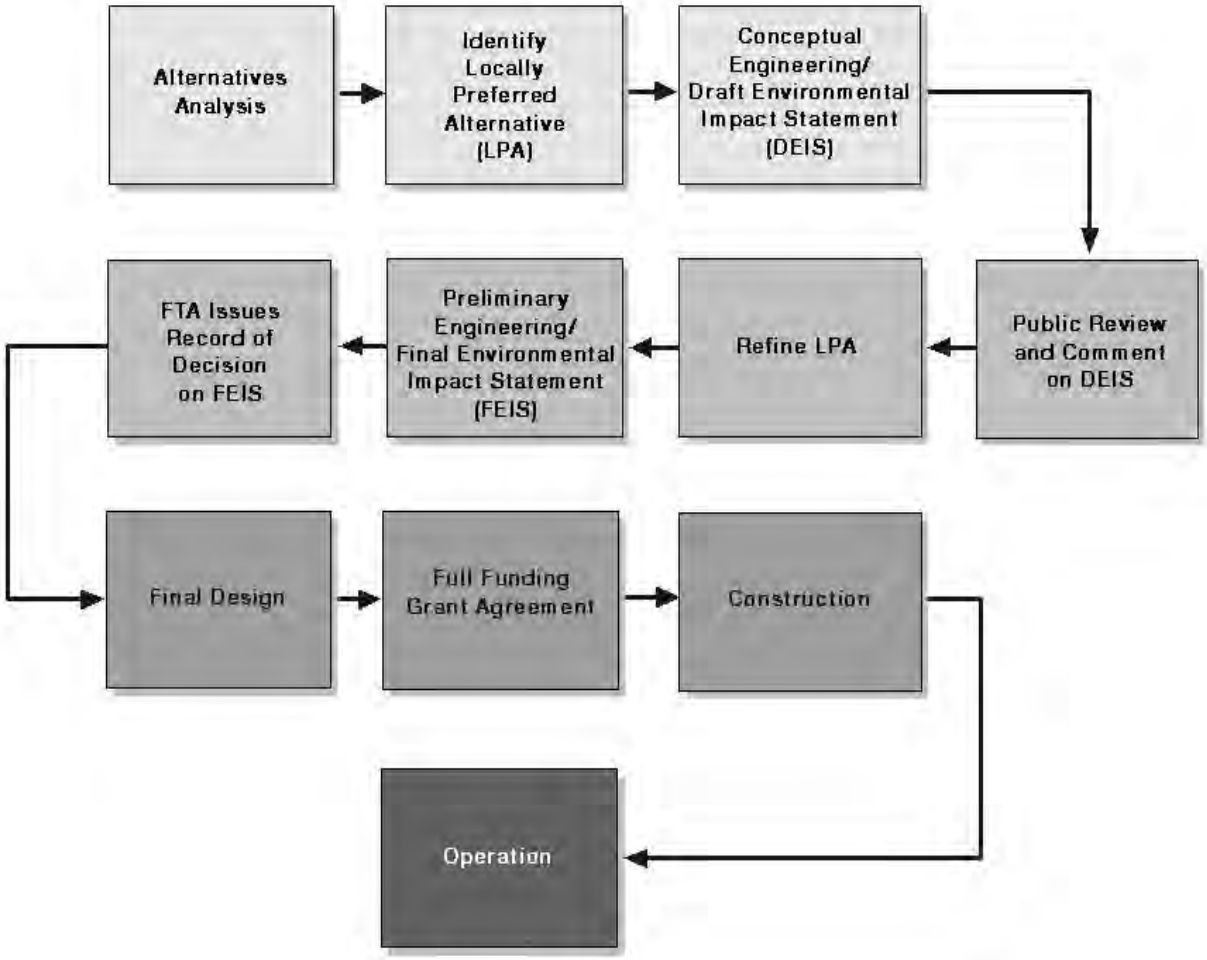
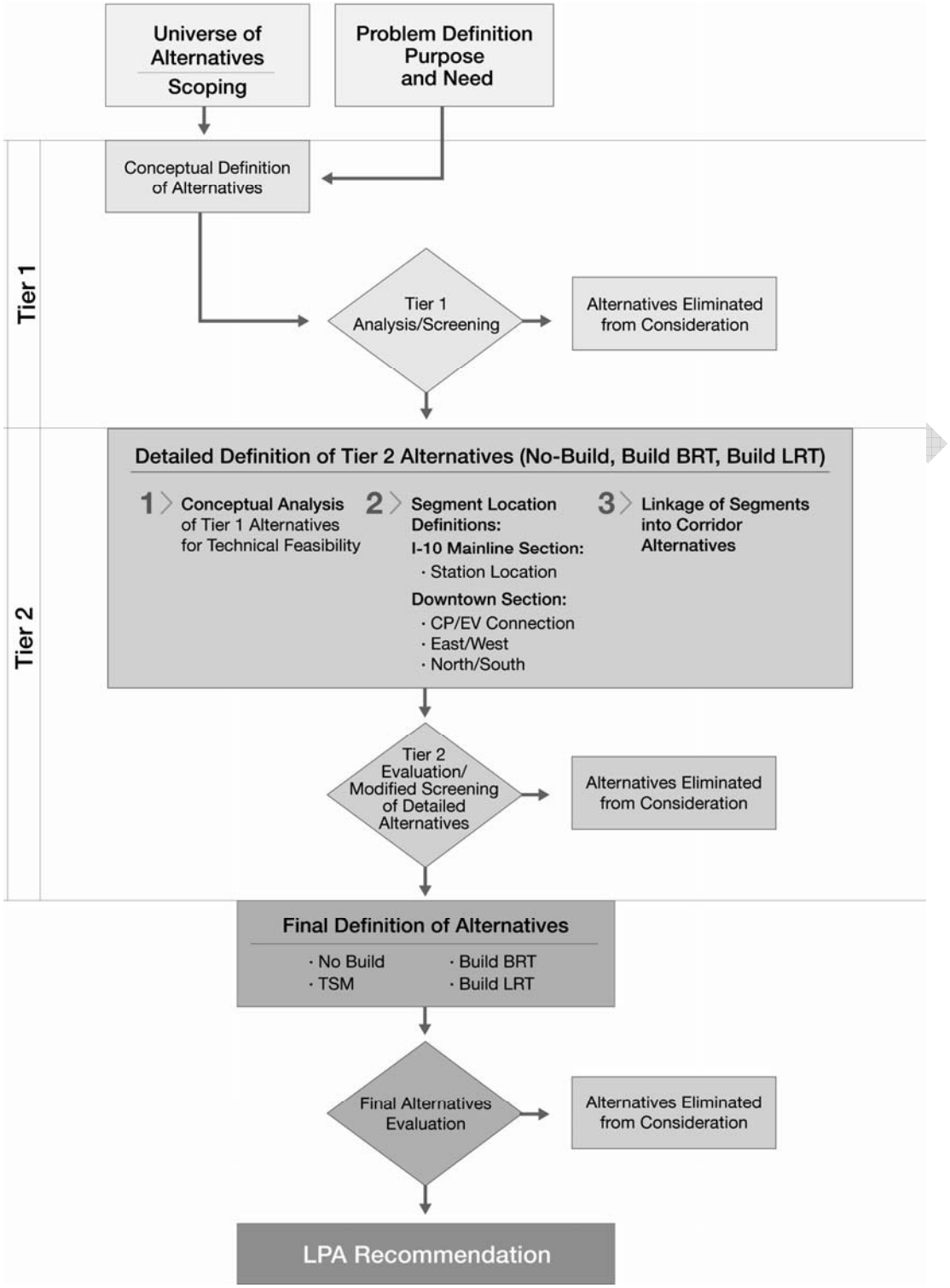
Figure 1-3 Project Development Process



Source: FTA 2008

Figure 1-4 Alternatives Analysis Process



Source: METRO I-10 West Study Team 2009

1.3 Purpose and Need

The first step of the I-10 West AA/EIS was to identify the transportation deficiencies and additional travel characteristics associated with the I-10 West Corridor and develop study goals to meet or alleviate travel demand in the corridor. As identified in the *I-10 West AA/EIS Draft Purpose and Need* (METRO 2008a), the purpose of the proposed I-10 West AA/EIS Study is to:

- Offer a viable transportation alternative that will facilitate the safe and efficient movements of people, particularly commuters, through and within the I-10 West Corridor;
- Provide efficient HCT service within the I-10 West Corridor;
- Provide additional capacity as part of a "shared solution" incorporating transit, highway improvements, and existing service such as high-occupancy vehicle (HOV) lanes and bus service along I-10 in the Southwest Valley that are currently operating at level of service (LOS) E-F and are anticipated to steadily deteriorate;
- Enhance economic development potential within the corridor by improving access to existing and planned employment and activity centers in both the West Valley and downtown Phoenix;
- Support regional plans and policies that reinforce an efficient transit system; and
- Support regional air quality goals.

Using the framework outlined in the project purpose, project needs were derived for the I-10 West AA/EIS Study to guide the evaluation process and development of alternatives. Developing an HCT option would help to satisfy the four following primary needs:

1) **A need for added peak period travel capacity as part of a balanced transportation system.** According to the *I-10 West Transportation Assessment* (METRO 2008b), congestion during both the AM and PM peak periods along I-10 within the study area is expected to become much worse by 2030, with HOV volumes expected to more than double. Transit improvements are needed to address the future demands as part of a "shared solution" to facilitate the safe and efficient movement of people and goods within the study area, specifically along the I-10 West Corridor.
2) **A need for increased transit system connectivity.** Transit service coverage in the study area is limited, especially for longer peak period commute trips. Improved services and connections are needed between and among the destinations within and connected to the study area.
3) **A need for improved access to corridor destinations.** Improved transit service should be implemented to provide safe and efficient access to numerous local and regional destinations within and adjacent to the I-10 West study area including the State Capitol, the City of Phoenix/Maricopa County Government Center, Phoenix Governmental Mall, and entertainment destinations including downtown Phoenix sports and arts venues and Cricket Pavilion located in western Phoenix.
4) **A need to reinforce economic development opportunities.** Investments in HCT should be leveraged to encourage more intensive transit oriented development in the study area consistent with prior planning studies and future development.

The Tier 2 screening process described in this document was intended to be responsive to the five project goals developed early on in the study process, which are:

1. Improve regional mobility along the I-10 West Corridor
2. Connect the local and express bus system and the CP/EV LRT Starter Line with the West Valley
3. Provide cost-effective transit improvements
4. Serve major employment centers, including the State Capitol, and support economic development
5. Minimize environmental impacts

Goals 1 and 2 generally describe what the study is trying to accomplish: improve mobility and connect to the existing transit system. Goals 3, 4, and 5 provide the basis for identifying crucial constraints that were examined for each Tier 2 build alternative.

1.4 Summary of Tier 1 Alternatives Evaluation

An initial screening of the "universe of alternatives" was conducted to identify conceptual alternatives. The purpose of the Tier 1 alternatives evaluation and screening was to assess the likely "fatal flaws" of these alternatives. The following section describes alternatives that were eliminated during the Tier 1 evaluation. Alternatives that were carried forward to the Tier 2 evaluation are discussed in Section 1.5.

1.4.1 Mainline Section

The availability of right-of-way (ROW) within the I-10 freeway corridor presented an opportunity to accommodate HCT. Prior to the Tier 1 Alternatives Evaluation, the following east-west arterials also were examined as potential HCT corridors: Thomas Road, McDowell Road, Van Buren Street, and Buckeye Road. The Pre-Tier 1 analysis concluded that each of the arterial alignments west of I-17 should be removed from further consideration because they did not meet the study Purpose and Need.

The Tier 1 Alternatives Evaluation examined whether the preferred Mainline Section alignment alternative along the I-10 ROW fulfilled the I-10 West AA/EIS study Purpose and Need. The I-10 Corridor was carried forward as the preferred HCT alignment option west of I-17, which represents a continuation of planning for such a corridor (including set-aside of ROW in the freeway median). In July 2008 the MAG Regional Council approved the I-10 ROW as the preferred HCT alignment option west of I-17 within the I-10 West study area.

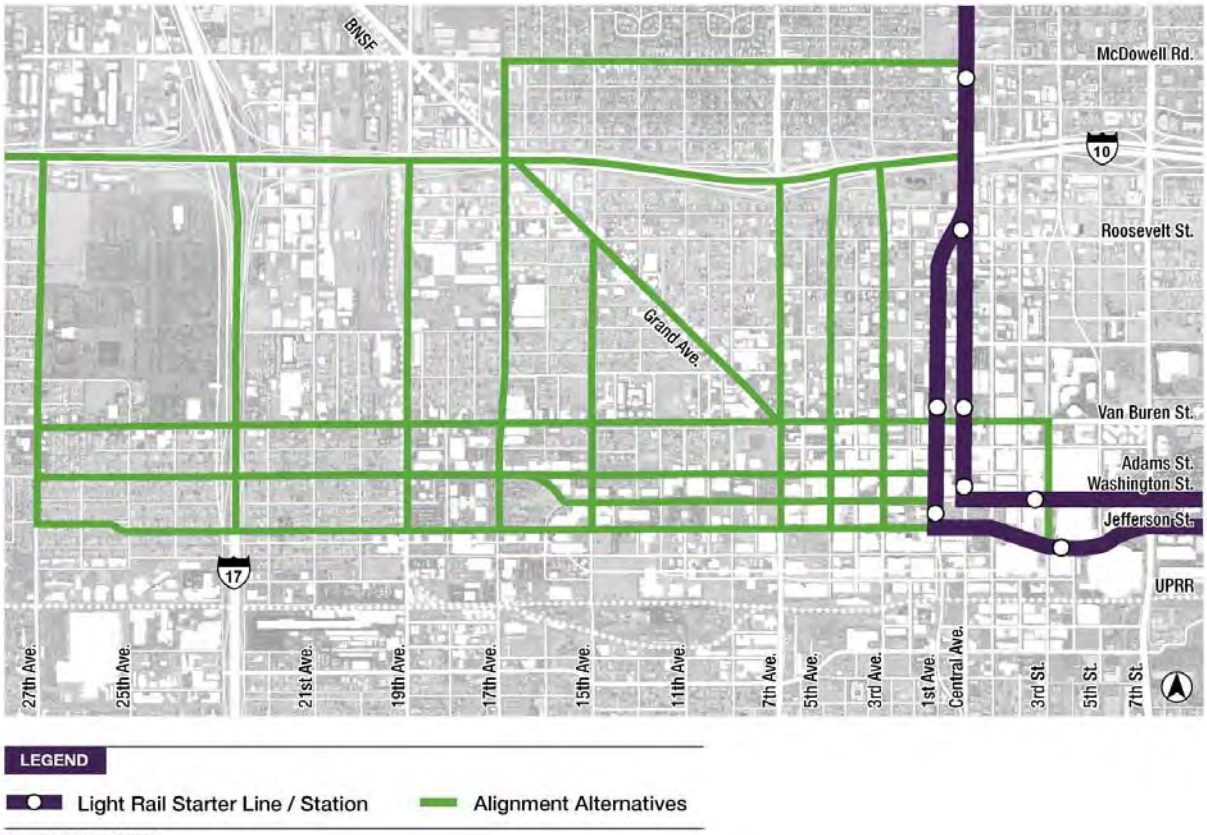
1.4.2 Downtown Section

The Tier 1 alternatives evaluation and screening focused on several alignment alternatives in the Downtown Section, shown in Figure 1-5. As a result of the Tier 1 screening process, three alternatives were removed from consideration in the Downtown Section of the study area. These were:

- I-10 freeway for LRT
- 27th Avenue

- Grand Avenue east of 15th Avenue

Figure 1-5 Downtown Section: Universe of Alignment Alternatives



The LRT alignment in the I-10 median would need to follow the grade of the freeway below the Margaret T. Hance Park (formerly Deck Park) deck to an on-line transit facility. As an additional improvement along I-10 in anticipation of future transit use, in 1988 the Arizona Department of Transportation (ADOT) began construction of an express bus "transit" facility located within the I-10 freeway median between 3rd Street and 3rd Avenue. This facility was designed to allow express buses to access the facility from exclusive bus-only entrance and exit (at 3rd Street and 3rd Avenue) lanes from the HOV lanes. During the construction of this facility, the station "shell" was completed and includes a partially completed station platform directly below Central Avenue, as well as three currently blocked off access points at the top of the structure to allow vertical circulation to Central Avenue.

The transit station would need to be at the level of the freeway requiring patrons to come up two levels to access the LRT line. Because an I-10 alignment for LRT in the Downtown Section would not provide a direct connection with the CP/EV LRT Starter Line at the Hance Park transit facility, Goal 2 (to provide a direct connection) would not be fulfilled. Further, neither the LRT or BRT alignment alternatives to the Hance Park transit facility would serve the State Capitol, identified as one of the goals of the I-10 West HCT option.

The Tier 1 analysis also concluded that Grand Avenue east of 15th Avenue would not serve the State Capitol area, and was recommended for removal. The 27th Avenue alignment was determined to be problematic from a ROW standpoint due in part to the two cemeteries (Beth El and Greenwood Memory Lawn) located east of 27th Avenue for most of the proposed alignment.

Table 1-1 summarizes each of the alignment alternatives considered during the Tier 1 analysis and lists whether each option met the study goals.

Table 1-1 Tier 1 Fatal Flaw Analysis

Alignment Alternatives	Goal 1: Increase Regional Travel and Mobility	Goal 2: Connect Local and Express Bus and LRT System with the West Valley	Goal 3: Provide Cost-Effective Transit Improvements	Goal 4: Support economic development and serve major employment centers, including the State Capitol. Also, enhance connectivity among existing and planned regional and local activity centers and attractions	Goal 5: Minimize Environmental Impacts
	Criteria				
	Transit Patron Travel Time Savings	Populations Served	Technical Feasibility	Consistency with Existing Plans and Studies and Connections to Existing and Planned Activity Centers, including the State Capitol	Irresolvable Environmental Impacts to Cultural Resources/EJ Populations
Mainline Section (West of 27th Avenue)					
I-10	Pass	Pass	Pass	Pass	Pass
Downtown Section East-West Alignment Alternatives (East of 27th Avenue)					
I-10 (BRT)	Pass	**Fail***	Pass	Pass	Pass
I-10 (LRT)	Pass	**Fail**	**Fail**	Pass	Pass
Van Buren Street	Pass	Pass	Pass	Pass	Pass
Adams Street	Pass	Pass	Pass	Pass	Pass
Washington Street	Pass	Pass	Pass	Pass	Pass
Jefferson Street	Pass	Pass	Pass	Pass	Pass
Downtown Section North-South Alignment Alternatives (East of 27th Avenue)					
27th Avenue	Pass	Pass	**Fail**	Pass	Pass
I-17	Pass	Pass	Pass	Pass	Pass
19th Avenue	Pass	Pass	Pass	Pass	Pass
17th Avenue	Pass	Pass	Pass	Pass	Pass
15th Avenue	Pass	Pass	Pass	Pass	Pass
Grand Avenue	Pass	**Fail**	Pass	**Fail**	Pass

*Community stakeholders had requested during the Tier 1 analysis that an option to connect to the Hance Park transit facility be further analyzed.
Source: METRO 2008c

1.5 Tier 2 Evaluation Process

The Tier 2 evaluation process started with the alternatives remaining from Tier 1 (fatal flaw screening). Those alternatives that were recommended in Tier 1 to be carried forward and any new alternatives not considered in Tier 1 but determined to be viable by METRO and the study team composes the Tier 2 Conceptual Alternatives. Tier 2 was separated into two parts for I-10 West: Conceptual Screening and Detailed Screening.

The Tier 2 Conceptual Screening process was conducted using a quantitative assessment of the alternatives with respect to a limited set of criteria. Specifically, those criteria that showed the most substantial performance differences between alternatives were considered. The focus of the assessment was on the relative differences between Conceptual Alternatives, and specifically geared toward removing from further consideration those alternatives that did not stand a reasonable chance of becoming the LPA (or part of the LPA). The Tier 2 Conceptual Alternatives are described in Chapter 2, and the Screening process and results are described in Chapter 3.

Alternatives carried forward from the Tier 2 Conceptual Screening form the basis of the Tier 2 Detailed Alternatives. For downtown LRT, these alternatives are specified in terms of "building blocks" consisting of:

- North-south alignments;
- East-west alignments; and
- CP/EV LRT Starter Line Connection Options

The development of the Tier 2 Detailed Alternatives described in Chapter 4 includes descriptions of the goal-based criteria and evaluation of the building block elements, as well as the final "packaging" of these building blocks into downtown LRT alternatives. Chapter 4 also describes the evaluation of downtown LRT alignment alternatives and Chapter 6 recommends preferred alignments to be carried forward for LPA refinement in preparation for the formal NEPA EIS process. The BRT alternatives are described in detail in Chapter 5.

The result of the Tier 2 analysis will be the selection of the following LPA elements:

- One or more preferred downtown LRT alignments that include a preferred CP/EV LRT Starter Line Connection Option;
- One or more preferred downtown BRT alignments;
- A list of HCT station locations along the Mainline Section (west of I-17) that are independent of the BRT/LRT decision, further described in the draft *I-10 Mainline Station Planning Report* (URS 2009) included as Appendix A.

The LPA will eventually be either a BRT or LRT option, but that decision will not be made during this Tier 2 process. Instead, Tier 2 will narrow the list of downtown alignments based on a specific set of evaluation criteria developed for the Tier 2 Evaluation Report; these alignments will be subject to further evaluation during the Final Definition of Alternatives phase. The LPA will be selected as the first step in preparation of a federal document.

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The Tier 2 Evaluation process for downtown Phoenix LRT alignment options was designed to maximize the efficiency of analysis by reducing the total number of alternatives as more detailed information becomes available. By reducing the number of alternatives as the process progresses, more analysis can be focused on a smaller number of alternatives to produce a preferred alternative at the end of the process.

1.6 Station Planning

With the selection of the I-10 Mainline as the preferred alternative west of I-17 for either LRT or BRT technology, the focus during the Tier 2 evaluation shifted from alignment consideration to developing station locations along the Mainline Section of the I-10 West Corridor. A separate technical memorandum summarizes the station planning process through the Tier 2 process, attached as Appendix A. A detailed evaluation of the proposed stations along the Mainline Section will occur in the subsequent Final Definition of Alternatives phase of the study.

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2.0 DESCRIPTION OF TIER 2 CONCEPTUAL ALTERNATIVES

2.1 Introduction

The purpose of this section is to summarize modal, alignment and mainline station alternatives remaining after the Tier 1 evaluation phase. The alternatives remaining as a result of the Tier 1 evaluation process included:

- No-Build Alternative
- Draft Baseline/TSM Alternative (required by FTA for comparison of "Build" alternatives)
- Build Alternatives (Mainline Section and Downtown Section), with either BRT or LRT technology

2.2 No-Build Alternative

The No-Build Alternative consists of all existing transportation facilities and services, as well as funded improvements expected to be in place by 2030 across the entire MAG region. In the I-10 West Corridor, the transit improvements associated with potential build alternatives were specifically excluded from the No-Build Alternative. The No-Build Alternative represents the potential future condition if no new transportation improvements are made beyond those currently able to be funded. Consideration of the No-Build Alternative is required as part of the NEPA study process.

2.3 Baseline/TSM Alternative

FTA Final Rule 49 CFR Part 611 requires grantees to request FTA approval of the Baseline/TSM Alternative to be used in the annual submittal of the Section 5309 New Starts Report as a comparison to the New Start Build Alternative. The Baseline/TSM Alternative is intended "to isolate the costs and benefits of the proposed major transit investment," and "must include in the project corridor all reasonable cost-effective transit improvements short of investment in the new start project."

The draft Baseline/TSM Alternative developed for the I-10 West AA/EIS Study provides an incremental expansion of transit services over the existing service levels in the study area. It includes reasonable cost-effective transit service improvements short of a major capital investment in fixed guideway. The Baseline/TSM Alternative implements all of the "committed" projects in the No-Build Alternative.

This alternative is usually considered a more realistic basis for measuring the effectiveness of the proposed Build alternatives than the No-Build Alternative. This is because the Baseline/TSM can be considered as the highest level of transit improvement without a major capital investment.

For the I-10 West AA/EIS Study, the draft Baseline/TSM alternative consists of additional bus service along the I-10 corridor using the existing HOV lanes. New on-line bus stations would be built in the median of I-10 with slip ramps to/from the HOV lanes for buses only. Parking areas and/or bus and auto drop off facilities would be provided adjacent for each station. Additional downtown-oriented bus service in the Baseline/TSM alternative would likely use the 3rd Avenue/

5th Avenue HOV ramps to access downtown Phoenix, consistent with current operations, as well as I-17.

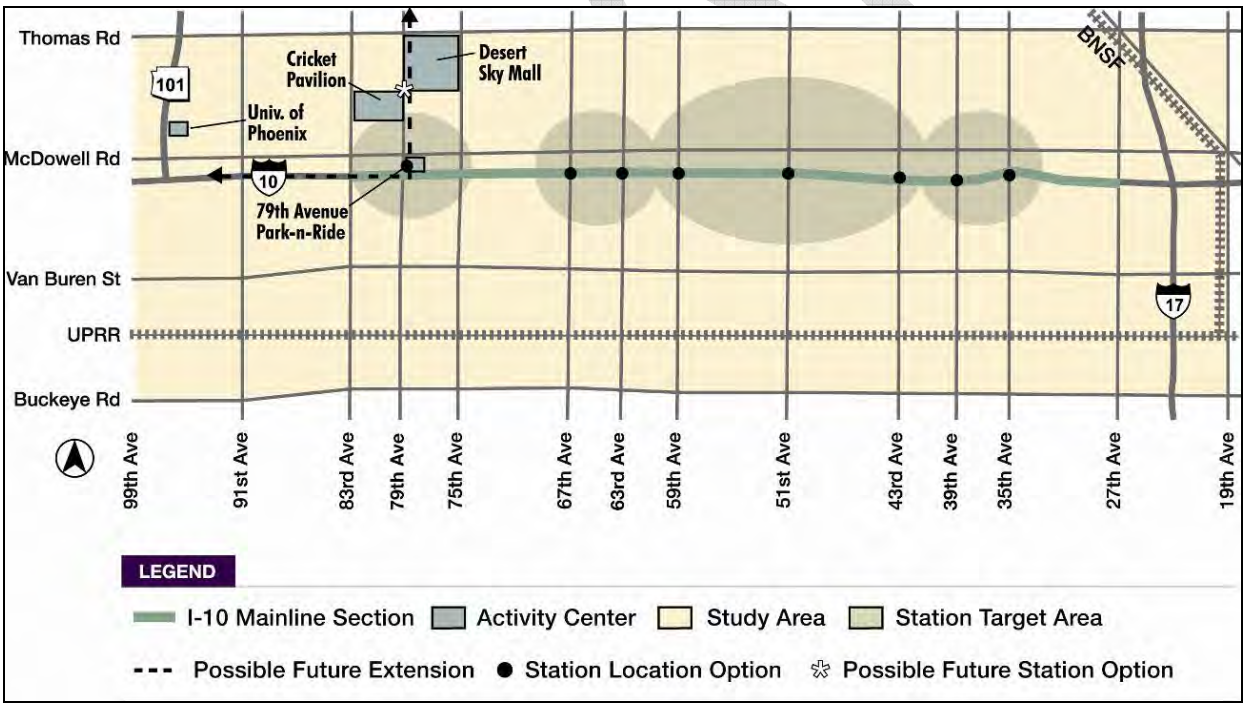
2.4 I-10 Mainline Section Alternatives

The I-10 median is the only alignment being considered in the I-10 Mainline section between I-17 and 83rd Avenue and therefore, the conceptual alternatives that are being evaluated vary only in terms of station location. Given that either transit technology under consideration, LRT or BRT, would work within the median of I-10, the station locations under consideration have been evaluated irrespective of the chosen transit technology.

2.4.1 I-10 Mainline Conceptual Station Target Areas

The I-10 West Study team identified four station target areas along the I-10 Mainline segment using a number of factors, including recommendations from the *I-10 West Alternative Alignments Technical Report*; site visits and aerial photography; individual Urban Village plans; and input received from stakeholder groups. Alternative station target areas along the I-10 Mainline Section are shown in and described in terms of the nearest arterial street to which they are located. Possible future extensions are shown in Figure 2-1 as considerations; however, these conceptual extensions are not part of the I-10 West Corridor identified in the MAG RTP.

Figure 2-1 I-10 Mainline Section Station Target Areas



Source: METRO I-10 West Study Team 2008

The following bullet points provide descriptions of the four station target areas.

- **35th – 39th Avenue Station Target Area**: The purpose of this station would be to serve as a neighborhood walk-up and bus/auto drop-off station. Given the higher density of development within the station target area, its proximity to downtown Phoenix, and the lack of available land for a parking area, this station was considered most suited for walk-up and drop-off access.
- **43rd – 59th Avenue Station Target Area:** The purpose of this station would be to serve as a mid-corridor park-and-ride (PnR) and bus/HCT transfer point to capture commuters from the south via the proposed South Mountain Freeway and to serve commuters from residential areas to the north.
- **63rd – 67th Avenue Station Target Area**: The purpose of this station would be to serve as another mid-corridor PnR, as well as bus/HCT transfer point and pedestrian-accessible station for surrounding residential areas.
- **End-of-Line/79th Avenue Station Target Area:** The purpose of this station would be as an end-of-line PnR and/or bus/HCT transfer facility. It is intended as a commuter station for those transit patrons coming from the west as well as a pedestrian-accessible station for surrounding residential areas.

2.4.2 I-10 Mainline Conceptual Station Sites

The study team identified potential station sites within each target area as listed in Table 2-1. Sites were identified using preliminary ridership estimates to determine station size requirements, vacant land availability and auto and bus ingress and egress needs. Potential station sites are located at either an I-10 interchange (spaced 1 mile apart along I-10) or at an I-10 overpass (spaced 0.5-mile from an interchange).

Table 2-1 I-10 Mainline Section Station Target Areas and Potential Station Sites

Station Target Area	Potential Station Site
35th – 39th Avenue Station Target Area	• I-10/35th Avenue Station • I-10/39th Avenue Station
43rd – 59th Avenue Station Target Area	• I-10/43rd Avenue Station • I-10/51st Avenue Station • I-10/59th Avenue Station
63rd – 67th Avenue Station Target Area	• I-10/63rd Avenue Station • I-10/67th Avenue Station
End-of-Line/79th Avenue Station Target Area	• I-10/ 79th Avenue, which would allow for future HCT extensions to the west or north.

Source: METRO I-10 West Study Team 2008

Each station site would include a station platform located within the median of I-10 and supporting station elements such as pedestrian access ways, stairs and elevators for access to the station platforms, PnR's (with the exception of 35th Avenue and 39th Avenue station concepts), bus drop off areas, and auto drop off areas (referred to as kiss-and-rides). Based on this information, hand-drawn alternative station concept plans at 1"=100' plan view for each station site were developed. In some cases, more than one PnR location is considered at any given station site.

Descriptions and illustrations of each candidate station concept plan are presented in more detail in Appendix A.

2.5 Downtown Section Alternatives

The alignment alternatives in the Downtown Section were developed with the aim of connecting the I-10 Mainline Section from I-17 to the CP/EV LRT Starter Line opened in December 2008. The downtown alignment alternatives remaining after Tier 1 screening were still separated into North-South alignment alternatives and East-West alignment alternatives, and with one exception, any East-West alignment alternative could be paired with any North-South alignment alternative to complete the desired connection. Prior to initiating the Tier 2 Evaluation process, the following modifications to the remaining North-South and East-West alignment alternatives were made based on either community input or connection to existing infrastructure:

- As shown in Figure 2-2, an alignment extension exists north of I-10 between 19th and 17th Avenues that was not originally considered during the Tier 1 analysis. This 19th Avenue alignment alternative modification, which resulted in a loop that extends northwest of I-10 from approximately 17th Avenue before heading south along 19th Avenue, resulted from the community's recommendation to serve the Arizona State Fairgrounds.
- As discussed in Section 1.4, the I-10 median alignment alternative was removed from consideration for LRT; however, as shown in Figure 2-2, a BRT transit mode option was considered for the Tier 2 evaluation partially resulting from the existing HOV direct connection at 5th and 3rd Avenues in the center of I-10.
- Washington and Jefferson Streets currently operate as one-way arterials within the downtown Phoenix portion of the I-10 West study area. Washington Street accommodates westbound traffic from the CP/EV LRT Starter Line to Wesley Bolin Memorial Plaza, where the road diverts north to connect to Adams Street to continue one-way westbound and also diverts south to connect to Jefferson Street, which offers east-bound travel only. Therefore, the Washington/Jefferson Couplet was recommended as a potential alignment alternative in downtown to correspond with existing east/west traffic flow.
- Subsequent to the completion of the Tier 1 evaluation process, the I-10 West study team was asked to examine HCT alignment alternatives along two additional east-west arterials: Madison and Jackson Streets. These two alignment alternatives were examined based on the same qualitative criterion used for the Tier 1 evaluation, described in Section 3.3.2.2.

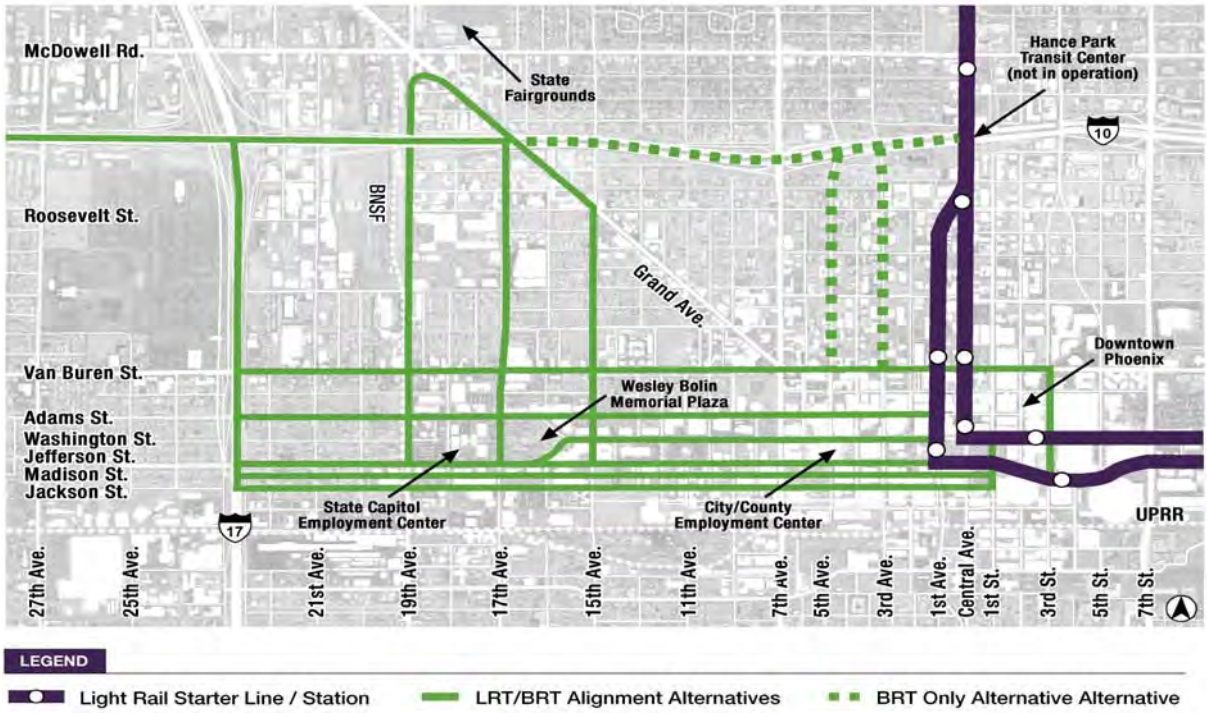
The downtown alignment alternatives considered in Conceptual Screening are listed in Table 2-2 and shown in Figure 2-2.

Table 2-2 Tier 2 Conceptual Screening – Downtown Alignment Alternatives

North-South Alignment Alternatives	East-West Alignment Alternatives
• I-17	• I-10 to Deck Park (BRT Only)
• 19th Avenue	• Van Buren Street
• 17th Avenue	• Adams Street
• Grand Avenue/15th Avenue	• Washington/Jefferson Couplet
• 3rd/5th Avenue (BRT only)	• Jefferson Street
	• Madison Street
	• Jackson Street

Source: I-10 West Study Team 2009

Figure 2-2 Downtown Alignment Alternatives for Conceptual Screening



Source: METRO 2008c

An HCT option along the Grand Avenue/15th Avenue alternative would come out of I-10 on Grand Avenue between I-10 and the Grand/15th Avenue/Roosevelt Street intersection and divert south along 15th Avenue.

The I-10 to Hance Park transit facility alternative was considered only for BRT, as previously discussed in Section 1.4. BRT, however, could theoretically serve both the Hance Park transit facility and the State Capitol because the route could be split, with some buses using the I-10 to Hance Park transit facility alignment and some going directly south to the State Capitol from I-10.

The Washington/Jefferson Couplet Alignment Alternative would use Washington Street for westbound transit vehicles only as far west as Wesley Bolin Memorial Plaza from the CP/EV LRT Starter Line. If this alignment alternative was paired with a North-South alignment

alternative west of the park (i.e., any North-South alignment alternative other than Grand Avenue/15th Avenue), westbound vehicles would transition south to Jefferson Street to join eastbound vehicles just west of 15th Avenue, and both tracks would run on Jefferson west of the park. This configuration was considered strongly preferable to an Adams/Jefferson Couplet for the following reasons:

- A two-block separation was considered undesirable when locating a transit guideway, and Adams and Jefferson Streets are two blocks apart.
- It reduces the length of couplet track required, thereby reducing the number of track miles of construction impacts, signaling and communication infrastructure, and other duplicative costs.

A variation on the Washington/Jefferson Couplet Alignment Alternative was evaluated that would only use Jefferson Street. This variation initially was not considered viable because it was thought to require either substantial displacement of travel and turning lanes on Jefferson Street or prohibitive ROW acquisition. However, subsequent analysis resulted in a design concept with the potential to limit travel lane displacement somewhat while avoiding ROW acquisition.

Figure 2-3 shows how the remaining alignment alternatives were grouped into “route option” areas. The Route Options were established to show that the ability to “interline” LRT trains, or move trains in revenue service from the I-10 West Corridor to both North Central and Mesa/Tempe, was an important operational consideration for fulfillment of study goals. All of the LRT-compatible East-West alignment alternatives would encounter substantial physical constraints associated with the connection to the CP/EV LRT Starter Line tracks at 1st Avenue (southbound tracks) and Central Avenue (northbound tracks). As such, the use of other streets for LRT tracks was considered at the eastern end of the East-West alignment alternatives presented here. The details of those LRT connections were not considered in Conceptual Screening, but were addressed during the next phase of the study in Chapter 4 (Detailed Evaluation). The North-South alignment alternatives were also grouped in case other streets were deemed appropriate during Conceptual Screening.

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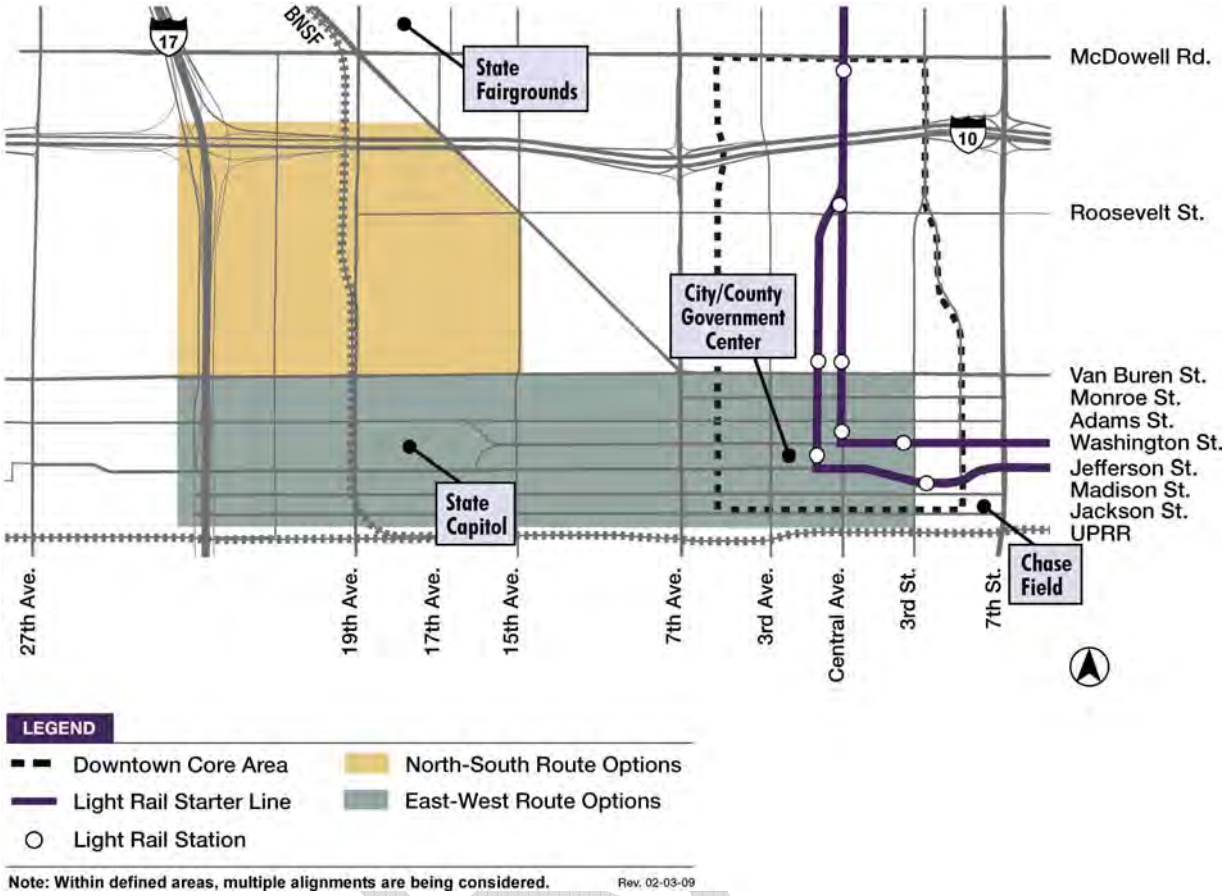
Figure 2-3 Tier 2 Downtown LRT Route Options



Source: METRO I-10 West Study Team 2009

2.6 LRT vs. BRT

Modal options were considered in the analysis of station configuration for the I-10 Mainline Section. At this point in the study, modal options were not considered for the Downtown Section. The decision on whether LRT or BRT will be used on the I-10 West Corridor will be evaluated in detail in the next phase of the study (Final Definition of Alternatives).

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3.0 TIER 2 CONCEPTUAL ALTERNATIVES EVALUATION

3.1 Introduction

This conceptual alternatives evaluation was conducted for the purpose of narrowing the list of alternatives on which detailed information must be gathered, in the interest of avoiding the expenditure of unnecessary effort evaluating alternatives that should not reasonably be expected to become part of the LPA.

Because the No-Build and Baseline/TSM Alternatives are required to be included in the EIS, they cannot be eliminated from consideration during this Alternatives Analysis process. Therefore, these two alternatives are defined in Chapter 6 in combination with the Build LRT and Build BRT alternatives carried forward based on the Tier 2 Evaluation and Screening process.

3.2 I-10 Mainline Section

3.2.1 I-10 Mainline Section Conceptual Station Site Evaluation Criteria

The study team developed a set of evaluation criteria by which to assess each station site. The criteria included both qualitative and quantitative factors, as shown in Table 3-1. Evaluation matrices were prepared to provide both qualitative and quantitative assessments and ratings of how well each station site met each of the sixteen criteria. Station sites that were rated significantly lower than one or more of the other options were not recommended for further evaluation. These evaluation matrices are presented in more detail in Appendix A.

Table 3-1 Evaluation Criteria for Station Concept Plans

Category of Criterion	Criteria
Mobility	• Projected daily station boardings (2030) • Proximity to regional north-south arterials • Number of bus routes serving the station • Number of bus routes requiring diversion to the station • Proximity to existing or planned bicycle/pedestrian routes
Traffic	• Ease of traffic ingress/egress • Existing traffic congestion in station area
Community	• Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses • Vacant land available within a ½ mile to meet parking requirements, bus facilities and transit-oriented development potential
Demographics	• Future population within ½ mile of station (2030) • Future employment within ½ mile of station (2030) • Percentage of households that are transit dependent within a ½ mile of station (zero car households)
Station Costs	• Station development/property acquisition costs
Environmental	• Impacts to historic structures/buildings • Proximity to sensitive land uses (e.g., schools, parks, churches, residential, and hospitals)
Public Input	• Support of station concept received at stakeholder meetings

Source: METRO I-10 West Study Team 2008.

3.2.2 I-10 Mainline Section Conceptual Station Site Evaluation Results

Based on the application of the conceptual station evaluation criteria described above, key discriminators between station sites within each station target area became evident. The following subsections provide the results of the conceptual station site evaluation by describing these key discriminators. Note that each subsection concludes with preliminary station site recommendations, but current gaps in information preclude the selection of final station sites. Both ridership forecasting and station cost estimates, which are key determinants in the evaluation and selection of station sites have yet to be completed at this time. Therefore, those station sites that were determined to warrant further evaluation are recommended to be carried forward for a more detailed evaluation in the Final Definition of Alternatives phase of the Alternatives Analysis. In some instances, more than one station site per station target area was recommended to be carried forward for a more detailed station site evaluation.

3.2.2.1 35th/39th Avenue Station Sites

The evaluation of these two station options indicated that locating a station at the arterial street interchange (35th Avenue) rather than the collector crossing (39th Avenue) would provide better regional mobility and result in fewer potential compatibility issues and property impacts. Specifically, 35th Avenue provides greater regional access by connecting north Phoenix to South Mountain and Laveen. By locating a station at a congested freeway interchange, it will be important to design the station and associated roadway improvements to mitigate potential traffic impacts. Another key discriminator would be the need for property acquisition. While the 35th Avenue station option would require the partial acquisition of the Navy Marine Corps Reserve Center, this facility has been partially vacated and therefore may become an ideal site for joint development. On the other hand, the 39th Avenue station option would require the acquisition of three residential parcels. The third key discriminator was compatibility with surrounding uses. The 35th Avenue station option would be immediately surrounded by business uses that would buffer potential traffic and noise impacts from surrounding neighborhoods and would likely serve high school students from nearby Carl Hayden High School. Conversely, the 39th Avenue station option would be surrounded by existing and planned residential areas that may be impacted by an increase in traffic.

Preliminary Recommendation: Carry forward the **35th Avenue station** for further refinement and evaluation.

3.2.2.2 43rd/51st/59th Avenue Station Sites

The evaluation of these three station options revealed that regional mobility was the primary discriminator among the options. Specifically, the 51st Avenue and 59th Avenue station options would have the advantage of being located along longer north-south arterials than the 43rd Avenue station option and would potentially intercept traffic and attract commuters from the proposed South Mountain Freeway. The primary disadvantage of the 43rd Avenue station option is that it would be unlikely to intercept eastbound South Mountain Freeway commuters as they would drive approximately one mile on I-10 before accessing a park-and-ride at 43rd Avenue. Both 51st Avenue and 59th Avenue station options would also provide connections to Urban Village Cores (secondary Maryvale Urban Village Core to the north and Estrella Secondary Urban Village Core to the south), whereas a station at 43rd Avenue would require a longer distance to travel to these destinations. While the 59th Avenue station option has large

tracts of vacant land available for a park-and-ride, the 51st Avenue station option would likely require business acquisitions

Preliminary Recommendation: Carry forward **both the 51st Avenue and 59th Avenue stations** for further refinement and evaluation.

3.2.2.3 63rd/67th Avenue Station Sites

The evaluation of these two station options revealed that the two key discriminators were regional mobility and compatibility of a PnR with surrounding uses. While 63rd Avenue is intermittent both north and south of I-10, 67th Avenue is one of the area's longest north-south regional arterials. Further, while the 67th Avenue station option would be surrounded on one side by industrial uses and on another by planned residential development, the 63rd Avenue station option is entirely surrounded by existing and planned residential uses, as well as an elementary school that may be impacted by increased traffic associated with a large PnR. In addition, the Fowler School district has stated that it is planning to develop an elementary school park on the vacant property immediately west of Sunridge Elementary School and is also requesting that 63rd Avenue be vacated north of Roosevelt.

Preliminary Recommendation: Carry forward the **67th Avenue** station for further refinement and evaluation.

3.2.2.4 79th Avenue/End-of-Line Station Sites

An evaluation of end-of-line station options was not conducted as part of the Tier 2 conceptual alternatives evaluation. Instead, all end-of-line options will continue to be carried forward for a more detailed evaluation in the Final Definition of Alternatives phase of the Alternatives Analysis. The alignment and station options would allow for future HCT extensions to the west or north.

Preliminary Recommendation: Carry forward **all end-of-line station options** for further refinement and evaluation

3.3 Downtown Section

3.3.1 Downtown Section Conceptual Evaluation Process

The Tier 2 Conceptual Evaluation process for Downtown Section subjected the alternatives to the following two basic tests:

- Would the subject alternative have substantial construction or operational costs or complexities that would be notably greater than other conceptual alternatives, such that the subject alternative is not likely to become part of the LPA; and
- Would the subject alternative perform the same or similar transportation function as the other conceptual alternatives, but with obviously greater impacts, such that the subject alternative is not likely to become part of the LPA.

The basic questions were applied within the framework of the five project goals to the Downtown Section alignment alternatives as shown in Table 3-2.

Table 3-2 I-10 West AA/EIS Study Goals and Conceptual Screening Criteria

Project Goal	Conceptual Screening Application
1. Improve regional mobility	How does the alignment alternative compare to the others in its potential to improve regional mobility, with respects to traffic impacts and rider travel time?
2. Connect the west valley to the CP/EV LRT Starter Line system	How well does the alignment alternative connect to the CP/EV LRT Starter Line compared to other alignment alternatives?
3. Provide cost-effective transit improvements	Does the alignment alternative feature substantially more complex engineering challenges than other alignment alternatives while providing similar benefit?
4. Serve corridor destinations, including the State Capitol, and support economic development	How well does the alignment alternative serve corridor employment destinations and support economic development compared to other alignment alternatives?
5. Minimize environmental impacts	Does the alignment alternative feature substantially greater visual, cultural, and property acquisition impacts than other alignment alternatives while providing similar benefit?

Each Downtown Section alignment alternative was evaluated with respect to these questions and assigned a qualitative rating of good, fair, or poor. The focus in assigning these ratings is not necessarily the standalone merit of an alternative, but its suitability **relative to other alternatives** as a potential candidate to be part of the LPA. Ratings were assigned by the study consultant team staff in a workshop setting, with the information available as of July 2008. Goals were not weighted, and no numerical values were assigned in the aggregation of ratings to results.

The downtown alternatives were evaluated only as locations for a dedicated HCT guideway. Transit vehicles sharing the street ROW with cars, referred to as “operating in mixed traffic” was not being considered for LRT on this study, except under specific conditions as a potential way to avoid property impacts. Therefore, the conceptual evaluation of downtown alignment alternatives considers the possibility of either LRT or BRT vehicles operating in their own dedicated guideway. BRT buses operating in mixed traffic was not considered in this evaluation, but will be evaluated later. As mentioned earlier, the BRT station configurations in the I-10 Mainline Section (west of I-17) were evaluated irrespective of location.

3.3.2 Downtown Section Conceptual Evaluation Results

The results of the Downtown Section alignment alternatives are shown in Table 3-3. Ratings that were particularly useful in determining the recommended disposition of an alternative are shown in **bold** in the table. The conceptual screening of each alignment alternative is also summarized in subsection 3.3.2.1.

3.3.2.1 North-South Alignment Alternatives

I-17 was recommended to be carried forward on the basis of its strong expected performance with respect to travel time, as well as its potential to be the most cost-effective of the North-South alignment alternatives. At this level of detail, it was assumed that the I-17 Alignment Alternative would have the least amount of its length requiring elevated structure, or grade separation. Whereas the other North-South alignment alternatives continue east along the I-10 median for approximately another 0.5-mile on an elevated structure, the I-17 guideway alignment alternative would reach grade level just south and east of the I-10/I-17 interchange.

However, this advantage would be nullified somewhat by the fact that if LRT is the preferred technology, use of the I-17 Alignment Alternative would require that the LRT trackway go over or under the Burlington Northern Santa Fe (BNSF) track just west of 19th Avenue. Although this structure (underpass or overpass) would technically be located along an east-west alignment, it was considered a feature of the I-17 Alignment Alternative because it distinguishes I-17 from the other North-South alignment alternatives.

19th Avenue was recommended to be carried forward because it would best serve the State Capitol and it is the only north-south alternative that would allow for a station that would serve the McDowell Road/State Fairgrounds area via a loop north of I-10. However, 19th Avenue would exhibit the longest travel time of the north-south alternatives, because it would require 0.5 to 1 mile of additional transit guideway to transition from the I-10 median to 19th Avenue and to serve the potential station area north of I-10.

17th Avenue was removed from consideration for several reasons. First, the narrow ROW along 17th Avenue would require substantial property acquisition to accommodate a transit guideway. Second, vehicle travel along 17th Avenue north of Van Buren requires travel speeds lower than adjacent roadways due to the heavy truck volume, narrow ROW, and proximity to an elementary school, which have the potential to impact transit travel times. Third, Capitol Elementary is located along 17th Avenue between Van Buren and Polk Streets, and transit traffic would bisect an important walk-to-school route. Additionally, property impacts would have been particularly sensitive along 17th Avenue since the properties on both sides of 17th Avenue, south of Fillmore Street, are part of the Oakland Historic District.

Grand Avenue/15th Avenue was carried forward for detailed evaluation primarily on the basis of its projected superior travel time performance between I-10 and downtown. However, potential concerns about property impacts in the residential historic district north of Van Buren Street would need to be considered in more detail.

3.3.2.2 East-West Alternatives

I-10 to the Hance Park Transit Facility for BRT was removed from consideration because it would be inferior compared to other conceptual East-West alignment alternatives in several key areas, including connecting to LRT, cost-effectiveness due to capital costs necessary for operation of the Hance Park transit facility, and serving employment destinations. A more detailed review of the Hance Park transit facility and the challenges to its suitability for use as part of I-10 West HCT improvements is documented in a separate technical memorandum titled *I-10 West Alternatives Analysis Deck Park Facility Assessment* (I-10 West Study Team 2008a), attached as Appendix B.

Van Buren Street did not perform well in the Conceptual Evaluation due to its distance from employment destinations along Washington and Jefferson Streets, the alignment's potential adverse traffic impacts, and the alignment's relative inefficiency in connecting to the CP/EV LRT Starter Line. For this evaluation, the Study Team assumed that if the existing travel lane capacity were to be preserved, the ROW required all along the Van Buren corridor would clearly be cost-prohibitive and represent an unreasonable impact relative to other alignment alternatives. Therefore, the Van Buren alignment was evaluated assuming that one travel lane in each direction would be required to accommodate a transit guideway. Because Van Buren Street is a long continuous arterial roadway and carries substantial traffic volume (over 22,000 per day in 2005) (METRO 2008b), a reduction in travel lanes (from 2 per direction to 1) would

represent a substantial impact. The Study Team determined a direct connection to the CP/EV LRT Starter Line would be infeasible for three of the four connections (all but northbound to westbound).

Because many of the strongest physical constraints associated with Van Buren Street for a dedicated transit guideway were east of 7th Avenue, the Van Buren Street alignment alternative was recommended to be carried forward in a revised form. The alignment alternative would not use Van Buren east of 7th Avenue, but would instead turn south and run along 7th Avenue to a Monroe/Adams Couplet alignment, and would from that point basically be identical (east of 7th) to the Monroe/Adams Alignment Alternative.

Adams Street was recommended to be carried forward on the basis of its lack of traffic impacts and reasonable proximity to the Washington/Jefferson employment core. Based on the current preliminary information available, it was the only East-West alignment alternative that would not require a reduction in travel lanes to accommodate a transit guideway between 17th and Central Avenues. It was envisioned that the connection to the CP/EV LRT Starter Line at 1st Avenue/ Central Avenue and Washington/Jefferson Streets would be accomplished by bringing the alignment south, such as on either 4th or 2nd Avenues. As previously mentioned, these considerations were not part of Conceptual Evaluation, but were addressed in the next phase of Tier 2 evaluation (Chapter 4, Detailed Evaluation of Downtown LRT Alternatives).

The Washington/Jefferson Couplet was recommended to be carried forward because it would provide the most direct connection to the CP/EV LRT Starter Line and, along with the Jefferson alternative, the best connection to employment destinations. However, the qualitative analysis suggested that a connection to the CP/EV Starter Line from this alternative may require additional evaluation of potential engineering and ROW constraints. This alternative was ranked “poor” for the cost-effectiveness goal (see Table 3-3) to reflect these concerns. The “poor” rating for the cost-effectiveness goal also was based on the consideration that HCT elements (e.g., catenary poles, stations, systems connections, etc.) would be required on two separate arterials as opposed to the other, single-arterial alternatives. The rating of “poor” in the ‘Cultural’ category shown in Table 3-3 was based on the presence of potentially historic streetscape elements along Washington Street between 1st and 15th Avenues that could be impacted by a transit guideway. It is separate from the impact represented in the ‘visual’ category, which was based on the potential for station shade structures or the overhead catenary system for LRT to block westward views of the State Capitol dome.

Jefferson Street was recommended to be carried forward, despite preliminary concerns over the more substantial reduction in travel lanes, because supplemental analysis indicated that three travel lanes could remain in place for the entire length of this LRT alternative.

Madison Street was removed from further consideration because it was not within close proximity to many major entertainment and employment destinations in downtown Phoenix. An HCT option along Madison Street was also expected to have fairly substantial impacts to property and/or travel lanes. Additionally, the study team learned that existing plans for substantial modification to Madison Street near the new County government complex (near 3rd Avenue) would not be compatible with LRT.

Jackson Street was removed from further consideration at this time for multiple reasons. First, an HCT option would not get riders as close to most of the major downtown entertainment and

employment destinations as the other east-west alignment alternatives. Second, Jackson Street was not a continuous street in the downtown/Capitol area due to the presence of the cemeteries located between 15th and 13th Avenues. Finally, it would be expected to have substantial property impacts if the two existing travel lanes (one in each direction) would be preserved after LRT construction. A positive feature is this alignment would provide service to a potential future commuter rail station at the former Union Depot at 4th Avenue and Harrison Street.

The results of the subsequent analysis comparing Madison and Jackson Street are summarized in the *Tier 2 Downtown: Madison/Jackson LRT Alternatives Technical Memorandum* (URS 2008), attached as Appendix C. It is important to note that although the Jackson Street Alignment Alternative was not carried forward as a standalone east-west alternative, it was examined further as part of a potential downtown LRT Connection Option, as described in Chapter 4. The use of Jackson Street to help LRT connect to the CP/EV LRT Starter Line would only occur east of the cemeteries.

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Table 3-3 Results of Downtown Alignment Alternative Conceptual Screening

Alignment Alternative	Goal 1: Improve Mobility		Goal 2: Connect the West Valley to CP/EV LRT	Goal 3: Provide Cost-Effective Transit	Goal 4: Serve Destinations and Support Economic Development	Goal 5: Minimize Environmental Impacts			Initial Recommendation
	Travel Time	Traffic Impacts				Visual	Cultural	Property	
North-South Alignment Alternatives									
I-17	**Good**	Fair	na	**Good**	Fair	Fair	Good	Poor	**Carry Forward**
19th Avenue	Poor	Fair	na	Poor	**Good**	Fair	Fair	Poor	**Carry Forward**
17th Avenue	Poor	Fair	na	Fair	Fair	Fair	**Poor**	Poor	**Remove from Consideration**
Grand/15th Avenue	**Good**	Poor	na	Fair	Fair	Fair	Poor	Poor	**Carry Forward**
East-West Alignment Alternatives									
I-10 Hance Park	**Poor**	Fair	**Poor**	**Poor**	**Poor**	Fair	Good	Fair	**Remove from Consideration**
Van Buren Street	Fair	**Poor**	**Poor**	Good	**Poor**	Poor	Fair	Fair	**Revise and Carry Forward**
Adams Street	Fair	Fair	Fair	Fair	**Good**	Fair	Fair	Fair	**Carry Forward**
Washington/Jefferson Streets	Good	Fair	**Good**	Poor	**Good**	Poor	Poor	Fair	**Carry Forward**
Jefferson Street	Fair	Poor	Good	Fair	**Good**	Fair	Poor	Fair	**Carry Forward**
Madison Street	Poor	Fair	**Poor**	Poor	Fair	Fair	**Poor**	Fair	**Remove from Consideration**
Jackson Street	Poor	Fair	Fair	Fair	Poor	Fair	**Poor**	**Poor**	**Remove from Consideration***

*With the exception of a short stretch as part of potential CP/EV LRT Starter Line connection.
Source: I-10 West Study Team July 2008

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4.0 DEFINITION AND EVALUATION OF TIER 2 DETAILED LRT ALTERNATIVES

4.1 Introduction

LRT technology uses electrically powered vehicles with steel wheels on steel rails to move large numbers of people efficiently in high-demand urban corridors. LRT typically operates in an exclusive guideway, meaning no other vehicles travel on the same tracks or occupy the same space as LRT. Either traditional railroad gates or traffic signals control roadway crossings for the LRT guideway.

An LRT HCT option along the I-10 West Corridor would begin at 79th Avenue and travel east within the median of I-10. Once the alignment reaches downtown, multiple alignment alternatives would need to be considered. The downtown LRT alignment alternatives were developed with a "building block" approach. The components of the downtown LRT alignment are shown in Figure 4-1 and are listed below in relation to the three separate "transition areas" that are separate components of the Downtown Section alignment alternatives:

- **North-South Alignment Alternatives** that require a connection to the I-10 median (Transition A): I-17, 19th Avenue, and Grand Avenue/15th Avenue;
- **East-West Alignment Alternatives** that serve downtown Phoenix activity centers (Transition B): Van Buren Street (to 7th Avenue from I-17), Adams Street, Washington/ Jefferson Couplet, Jefferson Street; and,
- **A connection** to the CP/EV LRT Starter Line that opened in December 2008 (Transition C). The connection alternatives identified based on the east-west alignments included: Adams-Monroe Couplet, Washington/Jefferson direct connection (with the possibility of using a 1st Street turnaround if a connection along Central Avenue is not feasible), Jackson Street/1st Street, and Harrison Street/1st Street.

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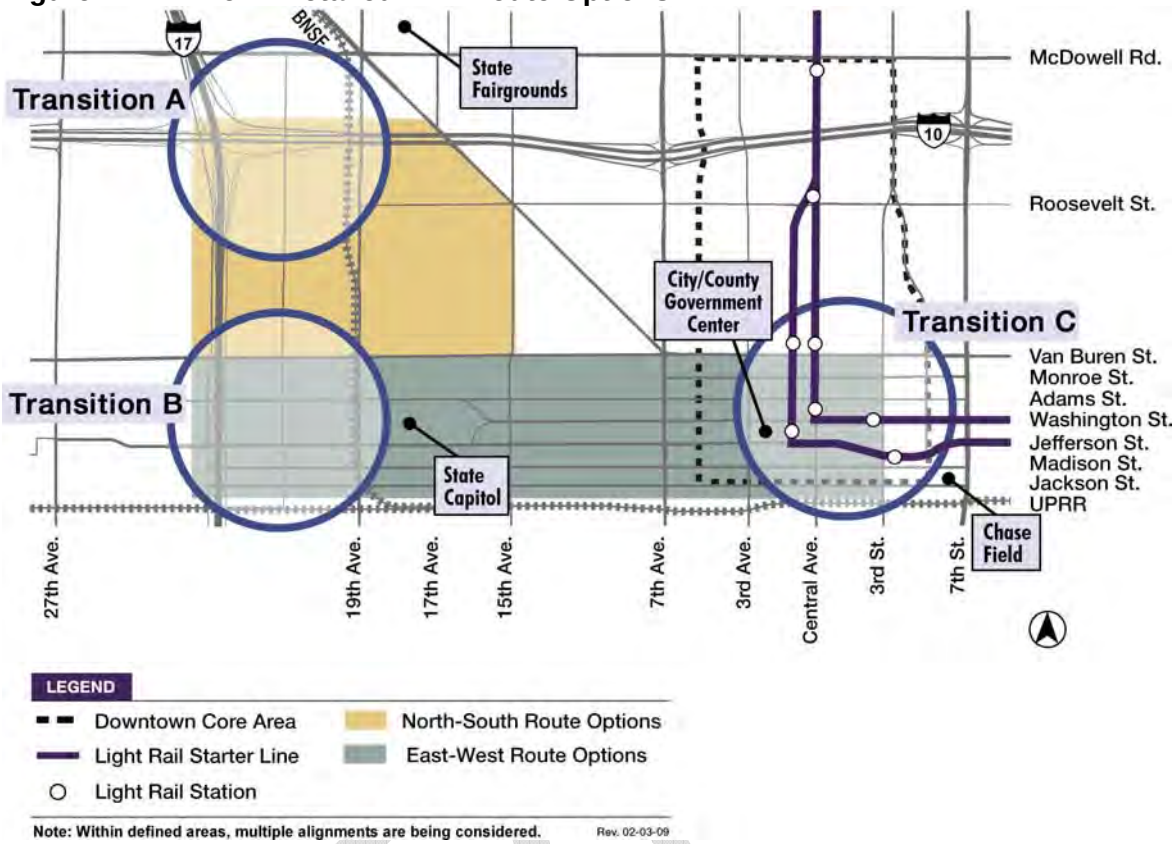
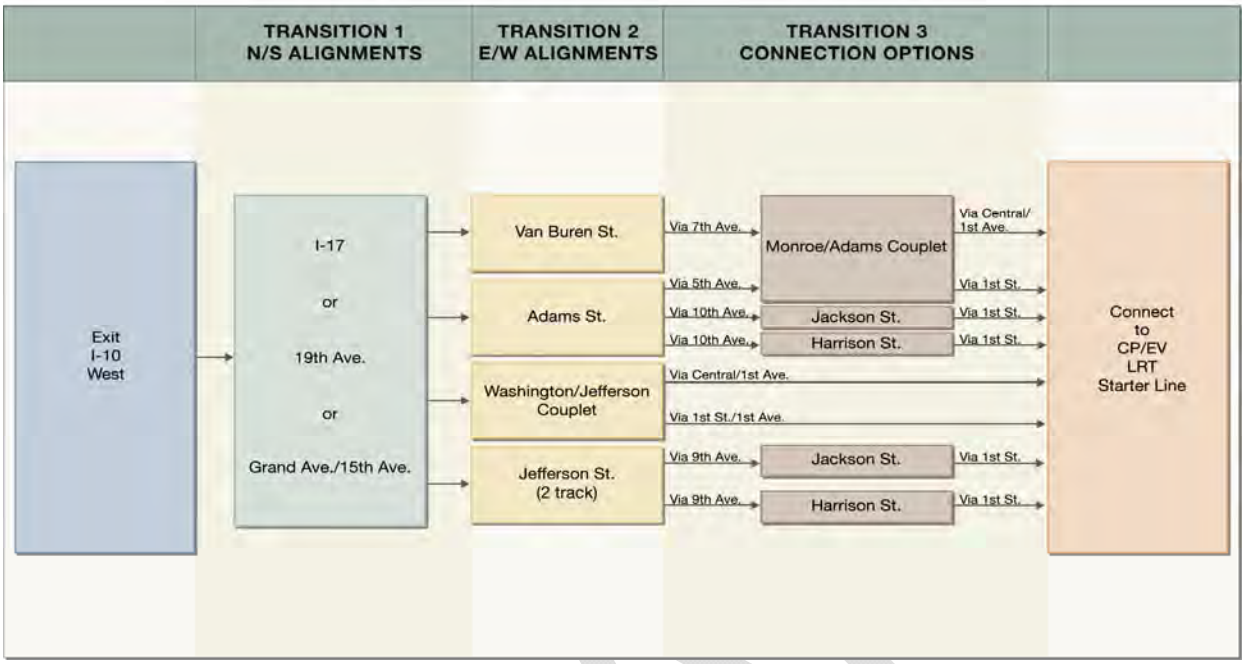
Figure 4-1 Tier 2 Detailed LRT Route Options



Source: I-10 West AA/EIS Study Team 2009

The flowchart depicted in Figure 4-2 demonstrates the initial set of building blocks that were evaluated in this chapter based on the alignment alternatives recommended after Tier 1 analysis and feasible Connection Options to the CP/EV LRT Starter line based on the *Tier 2 Downtown LRT Connection Options Review* (attached as Appendix D).

Figure 4-2 Range of Downtown LRT Alignment Alternatives and CP/EV LRT Starter Line Connections under Detailed Tier 2 Evaluation



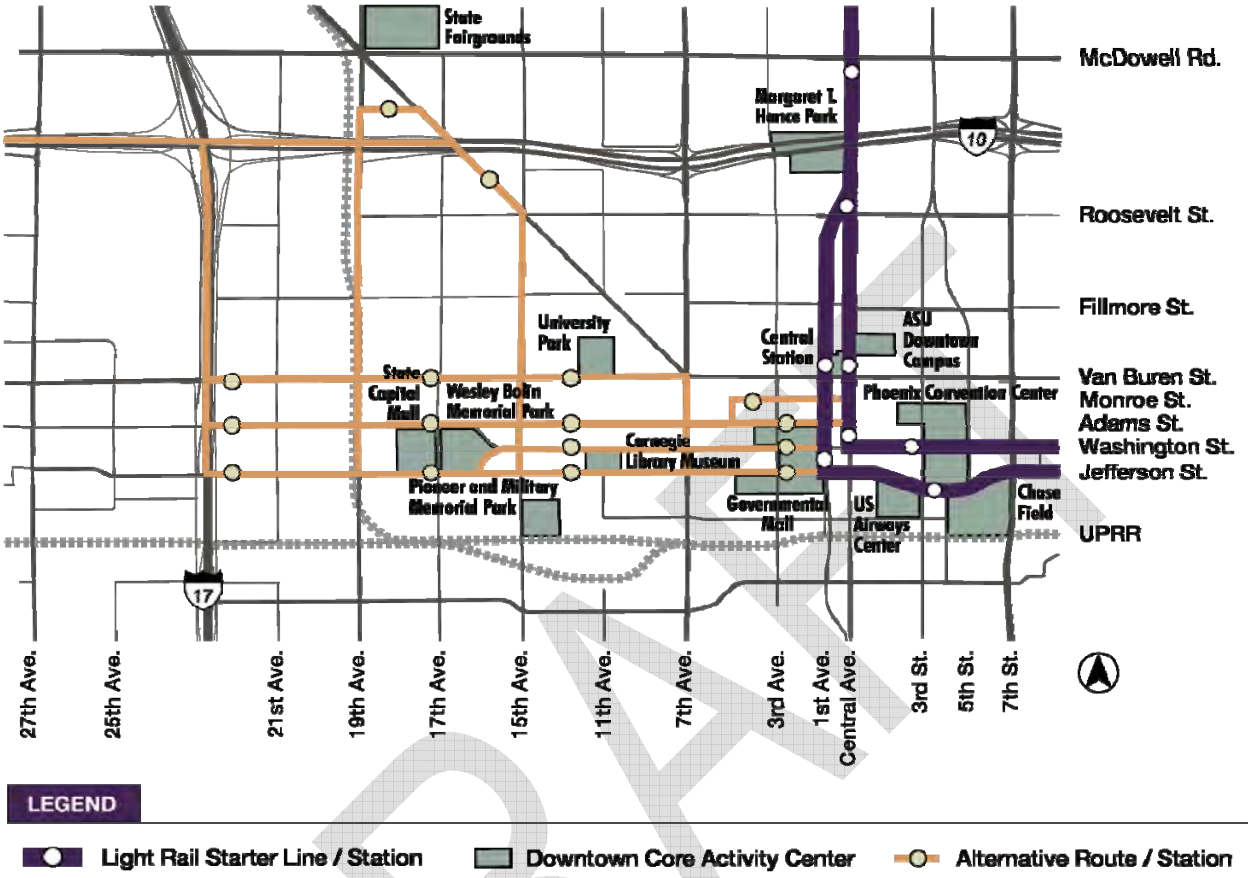
Source: I-10 West AA/EIS Study Team 2009

Three building block areas were identified **separately** to define the most feasible elements to carry forward for possible alignment packaging in a Locally Preferred LRT Alternative. Because the north-south and east-west elements were entirely independent of each other, they were examined in parallel. However, the East-West alignment alternatives were not independent of the Connection Options. For example, the Jefferson Street 2-Track Alignment Alternative was not considered in conjunction with the Adams-Monroe Couplet Connection Option. As such, the Connection Options were analyzed in combination with their respective compatible East-West alignment alternatives. Further, the corridor associated with Washington Street for the Washington/Jefferson Couplet Alignment Alternative, for this analysis, was assumed to extend from 1st Avenue to Wesley Bolin Plaza.

Because the connection to the CP/EV LRT Starter Line would be the most difficult of the three building blocks to engineer and construct, it is described first. The subsequent discussion of North-South and East-West alignment alternatives includes a description of the evaluation criteria, how they relate to the project goals, how they were measured, and the building block evaluation results.

For purposes of the Tier 2 Detailed Evaluation, potential station locations were identified in downtown Phoenix based on factors such as areas with high employment, popular activity centers, and the physical ability to accommodate stations without major modifications to adjacent land uses. Figure 4-3 shows the potential LRT station locations along the downtown LRT alignment alternatives evaluated in this chapter.

Figure 4-3 Potential LRT Station Locations in Downtown Phoenix



Source: I-10 West AA/EIS Study Team 2008

Downtown Connection Options

A separate analysis was performed to evaluate the Connection Options listed as Transition 3 in Figure 4-2. Twelve Connection Options were evaluated based on criteria such as cost/ engineering constraints, ease of operation (transit and traffic), destinations served and the ability to make connections to future LRT corridors. The 12 Connection Options were identified in the *Tier 2 Downtown LRT Connection Options Review* memorandum (METRO 2009) attached as Appendix D.

Overall, the Monroe/Adams Couplet outperformed all other Connection Options, particularly in terms of ease of operation and destinations served. Other top performers that were recommended for further evaluation included: Washington/Jefferson Couplet with both the Central Avenue connection (Washington/Jefferson) as well as the 1st Street turnaround option (Washington/Jefferson Streets/1st Street) and the Jackson/Adams Connection Option. The eventual choice of a Connection Option could depend to some degree on the choice of the selected East-West downtown LRT alignment alternative.

Connection options that were recommended for elimination included:

- Washington/Jefferson Couplet (with forced transfer required to go North Central and 11th Street turnaround)
- Washington/Jefferson Couplet (with forced transfer required to go North Central and 1st Street turnaround)
- Van Buren Street with an Monroe/Adams Street connection
- Harrison Street – Jefferson connection
- Harrison Street – Adams connection

Connection options that were recommended for further evaluation included:

- Monroe/Adams Couplet
- Jackson Street (via a Jackson/Jefferson or Jackson/Adams connection)
- Washington /Jefferson Couplet (direct connection)
- Washington/Jefferson Couplet (with a 1st Street turnaround option)

As demonstrated in the *Tier 2 Downtown LRT Connection Options Review Technical* Memorandum (METRO 2009), the Jefferson Street to Jackson Street Connection Option was assigned a medium overall rating; however; this Connection Option was carried forward due to a high rating assigned to Jefferson Street as an East-West alternative, as demonstrated in the following evaluation of Tier 2 LRT alignment alternatives.

4.2 Downtown North-South and East-West Alignment Alternative LRT Evaluation

The definition of the North-South and East-West LRT alignment alternatives in downtown Phoenix was addressed using a series of evaluation criteria that relate directly to the I-10 West AA/EIS Study goals, as follows:

1. **Improve regional mobility along the I-10 West Corridor**
   - <u>Traffic Circulation</u>
     - Left Turns
     - Roadway Capacity Impacts
     - Traffic Operational Impacts
2. **Connect the local and express bus system and the CP/EV LRT system with the West Valley**
   - <u>Populations Served within a 0.5-Mile Radius of Stations</u>
     - Total Persons
     - Total Workers

- Minority Population
- Low-Income Households
- Zero-Car Households

3. **Provide cost-effective transit improvements**
   - Design and Constructability Issues
     - Utility Conflicts
4. **Serve major employment centers, including the State Capitol, and support economic development**
   - Land Use
     - Consistency with Adopted Plans
     - Access to Employment Centers
     - Proximity to Activity Centers
     - Recreational Opportunities
5. **Minimize environmental impacts**
   - Environmental Issues
     - Property Acquisitions
     - Potential Impacts to Historic and Park Resources
     - Hazardous Material Contamination Sites
   - General Impact to the Community
     - Landscape/Streetscape Elements
     - Signalized Pedestrian Crosswalks Affected
     - Bicycle Lanes Removed
     - On-Street Parking Displaced
   - Community Support
     - Responsiveness to Community Needs

The following subsections provide the results and favorability ratings for each of the detailed evaluation criteria (where applicable) for each of the Tier 2 Detailed LRT Alignment Alternatives. A brief summary of the tables is included in Section 4.3 to show the variations in values of each criterion based on the separate alignment alternatives.

A ranking of High (+), Moderate (O), and Low (–) indicate generally the relative performance of each downtown alternative based on the specific criterion identified in the *I-10 West AA/EIS Draft Evaluation Methodology Report* (METRO 2007). The *Evaluation Methodology* details the manner in which each individual evaluation criterion was measured. As the I-10 West AA/EIS Study has progressed, several of the evaluation criteria will be deferred to the Final Definition of Alternatives phase to evaluate the remaining alternatives. Therefore, the evaluation criterion

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identified in Table 4-1, although originally identified as criteria that would be evaluated during the Tier 2 evaluation process, instead will be used in the identification of the LPA in the next phase of the I-10 West AA/EIS Study.

Table 4-1 Evaluation Criterion to be used in the Next Phase of the I-10 West AA/EIS Study

Categories	Criterion
Transit Performance	• Ridership Potential • Transit Patron Travel Time Savings • User Benefits • New Riders by Auto Ownership • Transit Dependent Riders Benefits • Transit Service Efficiency • Number of Transfers • Riders per Service Hour or Mile • Population Served
Transportation System Impacts	• Vehicle Miles of Travel Savings • Changes in Vehicle Miles Traveled • Number of Travel Lanes Removed • Bulb-Outs • Curbs and Sidewalks
Complexity of Construction	• Grade Separations Required • Contractor Access During Construction • Road Closures
Costs	• Capital Costs • Operating and Maintenance Costs • Economic Development Potential
Environmental Constraints	• Environmental Justice • Endangered and Threatened Species • Floodplains and Riparian Areas • Visual Impacts

Source: I-10 West AA/EIS Study Team 2007

The No-Build and Baseline/TSM Alternatives will be analyzed in the Draft EIS and are further defined in Chapter 6.

4.2.1 Goal 1: Improve Regional Mobility Along the I-10 West Corridor

4.2.1.1 Left Turns

Left turn lanes assist in ensuring sufficient and safe traffic flow at intersections by providing turning pockets separated from through lanes for automobiles turning left across oncoming traffic. Implementation of a fixed guideway LRT service would force some existing left turn lanes that cross oncoming traffic to also cross LRT trackway which increases potential vehicle collision risks associated with this movement. The signal timing for intersections would also experience changes in timing that would affect vehicles utilizing left turn lanes at signalized intersections. The number of left turn lanes across oncoming traffic, for each alignment alternative that would be impacted by the implementation of a fixed guideway LRT service is numbered in Table 4-2. Ratings were assigned as follows:

+ = Anticipate fewer than 6 left turn lanes impacted.

0 = Anticipate 6-12 left turn lanes impacted.

– = Anticipate more than 12 left turn lanes impacted.

Table 4-2 Impacts to Existing Left Turn Lanes

Alternative	Impacts to Existing Left Turn Lanes	Rating
North-South Alternatives		
I-17	3 Left Turn Lanes Impacted*	+
19th Avenue	4 Left Turn Lanes Impacted	+
Grand Avenue/15th Avenue	1 Left Turn Lane Impacted	+
East-West Alternatives		
Van Buren Street (to 7th Avenue)	17 Left Turn Lanes Impacted	–
Adams Street	6 Left Turn Lanes Impacted	0
Washington/Jefferson Street	none	+
Jefferson Street (two-track option)	none	+

Source: I-10 West AA/EIS Study Team 2008
*Note: Left turn lane impacts are based on impacts along the I-17 frontage road revealed in the conceptual engineering for the I-17 alignment alternative.

4.2.1.2 Roadway Capacity Impacts

Implementation of fixed guideway LRT service often requires removal or diversion of traffic lanes for operation, thus reducing the amount of roadway capacity for existing through lanes, and potentially impacting traffic flow. Roadway capacity impacts associated with each alignment alternative were identified by measuring the roadway lane miles removed with the implementation of each alignment alternative, and are listed in Table 4-3. Ratings were assigned as follows:

+ = No lane-miles removed.

0 = Anticipate less than 2 lane-miles removed.

– = Anticipate more than 2 lane-miles removed.

Table 4-3 Roadway Lane Miles Removed with Alternative Implementation

Alternative	Roadway Lane Miles Removed	Rating
North-South Alternatives		
I-17	0.0	+
19th Avenue	0.0	+
Grand Avenue/15th Avenue	0.8	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	2.9	–
Adams Street	0.7	0
Washington/Jefferson Street	3.1	–
Jefferson Street (two-track option)	2.2	–

Source: I-10 West AA/EIS Study Team 2008

4.2.1.3 Traffic Operational Impacts

<u>Left Turn Access Impacts</u>

An LRT guideway that uses existing ROW could result in the diversion of left-turning traffic from commercial and residential establishments along each alignment alternative and elimination of left turns at non-signalized intersections and driveways. Only right turns would be permitted in and out of these roadways and driveways unless design features such as frontage road access or direct left turn access are implemented. The elimination of traffic lanes and the prohibition of turns across the fixed guideway between signalized intersections may affect how motorists access adjacent properties and non-signalized cross-streets.

The turn restrictions are anticipated to increase U-turns and left-turn movements at signalized intersections along semi-exclusive transit alignments. This criterion accounts for the impact to existing commercial and residential driveways located along the alignment alternative.

Potential impacts to existing left turns to and from properties were evaluated using preliminary conceptual-level design drawings for each of the alignment alternatives. Left turn impacts were not assumed for properties that required complete acquisition since the light rail ROW would occupy these properties. The range used to evaluate this criterion in Table 4-4 included:

+ = 9 or fewer left-turn access impacts.

0 = 10-15 left-turn access impacts.

– = More than 15 left-turn access impacts.

Driveway Impacts

Potentially affected driveways were counted during a field reconnaissance and potential impacts were determined using preliminary conceptual-level design drawings. The range used to evaluate this criterion in Table 4-4 included:

+ = 10 or fewer driveways.

0 = 11-25 driveways.

– = More than 25 driveways.

Traffic Signals

Location of the fixed guideway in the center of arterial ROW would also require construction of a new, separated median within an existing, generally undivided street cross-section. The location of the semi-exclusive transit facilities in the median of these streets would result in the elimination of any existing center-turn lanes. This street modification would be necessary to provide a safe interface between transit vehicles and vehicular and pedestrian traffic that would cross the fixed guideway. New median openings would be located at signalized intersections only, where left turns and U-turns would be allowed under a protected turning phase. Each crossing of the HCT at locations without existing signalization would require the installation of a traffic signal.

Since all grade crossings of fixed guideway segments must be signalized or provided with crossing gates, the number of new traffic signals along each alignment was estimated. The range used to evaluate this criterion included:

+ = Anticipate fewer than 3 new additional traffic signals required.

0 = Anticipate 3-6 new additional traffic signals required.

– = Anticipate more than 6 new additional traffic signals required.

The ratings were consolidated and the Tier 2 alignment alternatives were assigned an overall Traffic Operational Impacts Rating. These ratings are listed in Table 4-4:

Table 4-4 Traffic Operational Impacts and Ratings

Alternative	Approximate # of Diminished Left-Turn Access	Approximate # of Driveways Affected	Approximate # of Additional Traffic Signals Required
North-South Alternatives			
I-17	Residential – 0 Commercial – 0 Rating (+)	0 Rating (+)	0 Rating (+)
19th Avenue	Residential – 0 Commercial – 2 Rating (+)	5 Rating (+)	1 Rating (+)
Grand Avenue/15th Avenue	Residential – 4 Commercial – 15 Rating (-)	21 Rating (0)	3 Rating (0)
East-West Alternatives			
Van Buren Street (to 7th Avenue)	Residential – 2 Commercial – 29 Rating (-)	22 Rating (0)	3 Rating (0)
Adams Street	Residential – 0 Commercial – 10 Rating (0)	32 Rating (-)	6 Rating (0)
Washington/Jefferson Street	Residential – 0 Commercial – 12 Rating (0)	3 Rating (+)	8 Rating (-)
Jefferson Street (two-track option)	Residential – 3 Commercial – 6 Rating (+)	44 Rating (-)	4 Rating (0)

Source: I-10 West AA/EIS Study Team 2008

4.2.2 Goal 2: Connect the Local and Express Bus System and the CP/EV LRT Starter Line with the West Valley

4.2.2.1 Populations Served

Populations served within 0.5-mile from stations located along each alignment alternative were analyzed using a Geographic Information Systems (GIS) analysis of data from the 2000 U.S. Census and 2004 MAG data. As a result of the close proximity of the stations there exists an overlap of data that affects the total counts for each alignment alternative. This overlap of data was considered when assigning ratings to each alignment alternative. Since there are no stations identified along the I-17 alternative, a total population of 0 and a ranking of (–) will be given to reflect the inaccessibility of surrounding areas.

For each of the population categories analyzed, a rating system was developed that assigns ratings to each alignment alternative based on the findings of the GIS analysis. The combined ratings from each population category contribute to the rating for each respective alignment alternative. Ratings were assigned as follows, with results presented in Table 4-5:

	Total Population	Total Workers	Minority Population	Low-Income Population	Zero-Car Households
– =	0-5,000	0-2,500	0-3,500	0-3,000	0-1,750
0 =	5,001-15,000	2,500-5,000	3,501-7,000	3,001-6,000	1751-3,500
+ =	15,001+	5,001+	7,001+	6,001+	3,500+

Table 4-5 Populations Served by Each HCT Alternative

Alternative	Population Located within 0.5 mile					
	Total Population	Total Workers	Minority Population	Low-Income Population	Zero-Car Households	Overall Rating
North-South Alternatives						
I-17 (no stations)	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)	–
19th Avenue						–
Culver Street/19th Avenue	2,289 (–)	1,243 (–)	797 (–)	1,039 (–)	190 (–)	
Grand Avenue/15th Avenue						–
Grand Avenue/Roosevelt	4,632 (–)	1,900 (–)	1,302 (–)	1,758 (–)	323 (–)	
East-West Alternatives						
Van Buren Street (to 7th Avenue)						+
2nd Avenue (on Adams)	3,241	785	1,410	722	1,888	
7th Avenue	3,449	1,221	1,278	1,204	759	
12th Avenue	2,937	1,172	1,023	1,216	521	
17th Avenue	3,281	1,283	1,209	1,376	320	
22nd Avenue	2,273	698	1,140	892	111	
Total	15,181 (+)	5,159 (+)	6,060 (0)	5,410 (0)	3,599 (+)	
Adams Street						0
2nd Avenue	3,241	785	1,410	722	1,888	
7th Avenue	3,436	1,001	1,455	1,106	951	
12th Avenue	2,702	1,000	1,080	1,218	457	
17th Avenue	3,478	1,277	1,443	1,603	304	
22nd Avenue	2,892	876	1,537	1,143	111	
Total	15,749 (+)	4,939 (0)	6,925 (0)	5,792 (0)	3,711 (+)	
Washington/Jefferson Street						0
2nd Avenue	3,112	682	1,507	837	1,713	
7th Avenue	2,624	706	1,219	956	577	
12th Avenue	2,627	889	1,178	1,318	402	
17th Avenue	3,504	1,157	1,656	1,808	263	
22nd Avenue	3,133	909	1,775	1,234	102	
Total	15,000 (0)	4,343 (0)	7,335 (+)	6,153 (+)	3,057 (0)	
Jefferson Street* (two-track option)						0
2nd Avenue	3,112	682	1,507	837	1,713	
7th Avenue	2,624	706	1,219	956	577	
12th Avenue	2,627	889	1,178	1,318	402	
17th Avenue	3,504	1,157	1,656	1,808	263	
22nd Avenue	3,133	909	1,775	1,234	102	
Total	15,000 (0)	4,343 (0)	7,335 (+)	6,153 (+)	3,057 (0)	

*Jefferson Street totals were identical to the Washington/Jefferson Street alternative
Source: U.S. Census 2000

4.2.3 Goal 3: Provide Cost-Effective Transit Improvements

4.2.3.1 Utility Conflicts

Utility relocations are one of the most challenging elements in LRT construction. The service provided to residents and businesses for water, sewer, electrical, and communication are vital, and their disruption due to construction should be minimized. The alignment alternatives were examined with respect to existing major utilities in the area that reasonably could be impacted. Utility conflicts are considered major for the purposes of this analysis if they involve the potential disruption of more than 100 lineal feet of a storm drain, water supply line, or sanitary sewer line over 36 inches in diameter. Those alignment alternatives with fewer utilities in their path are considered preferable because they would exhibit less potential for utility disruption and likely cost less in the area of utility relocation.

The potential utility conflicts along the downtown LRT alignments alternatives are as follows:

- **I-17:** No major utility conflicts.
- **19th Avenue:** 75-inch storm drain in the 19th Avenue ROW.
- **Grand Avenue/15th Avenue:** A 96-inch storm drain in the Grand Avenue ROW and 60-inch sanitary sewer line in the 15th Avenue ROW.
- **Van Buren Street:** A 36-inch water line crossing, two 75-inch and a 96-inch storm drain crossings, and a 54- and 60-inch sanitary sewer line crossing.
- **Adams Street:** A 36-inch water line crossing, two 75-inch and a 96-inch storm drain crossings, and a 54- and 60-inch sanitary sewer line crossing.
- **Washington/Jefferson Street:** A 36-inch water line crossing, a 42-inch water line in the Jefferson Street ROW, three 75-inch and two 96-inch storm drain crossings, and a 54-inch and two 60-inch storm drain crossings.
- **Jefferson Street (two-track option):** A 36-inch water line crossing, a 42-inch water line in the Jefferson Street ROW, two 75-inch and a 96-inch storm drain crossings, and a 54- and 60-inch sanitary sewer line crossing.

Ratings were assigned as follows and results are presented in Table 4-6:

+ = Fewer than 2 major utility conflicts identified.

0 = 2-6 major utility conflicts identified.

– = More than 6 major utility conflicts identified and/or relocation of a major utility may be required.

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Table 4-6 Utility Impacts

Alternative	Major Utility Impacts Identified	Rating
North-South Alternatives		
I-17	0	+
19th Avenue	1	+
Grand Avenue/15th Avenue	2	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	6	0
Adams Street	6	0
Washington/Jefferson Street	10	–
Jefferson Street (two-track option)	7	–

Source: I-10 West AA/EIS Study Team, 2008

It is important to note that this was a very preliminary analysis of existing utilities based on utility purveyor survey maps and the comprehensive examination of specific utility conflicts associated with the engineering stages of this study likely will reveal many other utility conflicts not shown here.

4.2.4 Goal 4: Serve Major Employment Centers, Including the State Capitol, and Support Economic Development

4.2.4.1 Land Use

4.2.4.1.1 Consistency with Adopted Plans

Table 4-7 summarizes the relevance of each downtown LRT alignment alternatives as they pertain to adopted plans within the region. As summarized in Table 4-7, some of the downtown alignment alternatives were identified in planning documents as supportive of future HCT. Documents such as the *Arizona State Capitol Centennial 2012 Plan/2020 Vision* (ASU, et al. 2007) and the *Fixed Guideway System Study* (MAG 1999) offer support for the remaining alignment alternatives. Additional planning documents including the Phoenix General Plan and the Capital Business Development Plan were also examined.

> *Note: The "Arizona State Capitol Centennial 2012 Plan/2020 Vision" document has not officially been adopted by the City of Phoenix; however, the recommendations were considered for the I-10 West AA/EIS Study.*

Ratings were assigned as follows:

+ = Strongly promotes/supports the intent of the planning documents.

0 = Relatively consistent with planning documents or does not apply.

Table 4-7 Consistency with Adopted Plans

Alternative	Relevance to Adopted Plans	Rating
North-South Alternatives		
I-17	• LRT along I-17 has not been identified in previous studies or city adopted plans as an option for HCT through downtown Phoenix.	0

Alternative	Relevance to Adopted Plans	Rating
19th Avenue	• In the 1999 Fixed Guideway System Study, 19th Avenue was identified as a "High Demand Corridor" and cites LRT as a possible future transit mode.	+
Grand Avenue/15th Avenue	• In the 1999 Fixed Guideway System Study, 15th Avenue was identified as a "High Demand Corridor" that warrants fixed guideway technology such as LRT. • In an initial Light Rail Feasibility Study completed in September 2006, 15th Avenue was considered a viable LRT option to serve the State Capitol. • The Light Rail Feasibility Study (2006) cites 15th Avenue as the best North/South alignment available to serve the State Capitol because it requires the least amount of property acquisitions to implement LRT.	+
East-West Alternatives		
Van Buren Street (to 7th Avenue)	• LRT along Van Buren Street has not been identified in previous studies or city adopted plans as an option for HCT through downtown Phoenix.	0
Adams Street	• In the 1999 Fixed Guideway System Study, Adams Street was identified as a "High Demand Corridor" that warrants fixed guideway technology such as LRT. • In the Light Rail Feasibility Study (2006), Adams Street was considered a viable LRT option to serve the State Capitol. • The Light Rail Feasibility Study (2006) depicts an Adams Street LRT alignment within the street ROW utilizing the existing bridge over I-17, but it would require a new bridge to accommodate the BNSF Railroad tracks at 19th Avenue. • The Arizona State Capitol Centennial 2012 Plan/2020 Vision identifies Adams Street, paired with Washington Street, as a potential streetcar alignment in downtown Phoenix.	+
Washington/Jefferson Street, or Jefferson Street (two track)	• In the 1999 Fixed Guideway System Study, Washington and Jefferson Streets were identified as "High Demand Corridors" that warrant fixed guideway technology such as LRT. • In the Light Rail Feasibility Study (2006), Washington and Jefferson Streets were considered viable LRT options to serve the State Capitol. • The Light Rail Feasibility Study (2006) shows an LRT option along Washington/Jefferson Streets within the street ROW. • The Arizona State Capitol Centennial 2012 Plan/2020 Vision identifies Washington Street, paired with Adams Street, as a potential streetcar alignment in downtown Phoenix	+

Source: METRO 2006, Arizona State University (ASU) 2007, MAG 1999

Adopted in July 2008, The *Downtown Phoenix Urban Form Project* provides a sustainable development vision for downtown Phoenix and illustrates the need to improve pedestrian access to transit as a whole. The *Downtown Phoenix Urban Form Project* states that the

existing transit network should be enhanced to meet the demands for alternative modes of transportation in an effort to decrease traffic congestion, while not explicitly offering specific transit routes as a part of the plan.

4.2.4.1.2 Access to Employment Centers

Employment centers are major contributors to the success of LRT systems and often produce high numbers of riders. Downtown Phoenix has multiple areas with high densities of employment. Access to employment centers was measured by assessing the employment densities along each alignment alternative within 0.25-mile. An explanation of the performance of each alignment alternative in relation to its proximity to employment centers is discussed in Table 4-8. Ratings were assigned as follows:

+ = Employment densities greater than 20,001 employees per square mile.

0 = Employment densities ranging from 8,001 to 20,000 employees per square mile, and/or serves the Capitol Mall area, a key destination.

– = Employment densities less than 8,000 employees per square mile.

Table 4-8 Access to Employment Centers

Alternative	Is Access to Employment Centers Improved?	Rating
North-South Alternatives		
I-17	The I-17 alignment alternative travels mostly through areas of low employment ranging from 0 to 2,000 employees per square mile. The area of highest employment density along the I-17 alignment alternative is at the intersection with Van Buren Street, where employment ranges from 2,001 to 8,000 employees per square mile.	–
19th Avenue	This alignment alternative travels through areas with employment densities in the range of 2,001 to 8,000 employees per square mile. The nearest major employment center is the Capitol Mall area, which has higher employment densities and is approximately two blocks to the east at its closest point.	0
Grand Avenue/15th Avenue	The northern portion of the Grand Avenue/15th Avenue alignment alternative travels through primarily low density employment areas ranging from 0 to 2,000 employees per square mile. As the route travels south near the Capitol Mall, the employment densities increase to 20,001 to 40,000 employees per square mile. However, the alignment passes more than two blocks to the east of several major employers, including the State Capitol.	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	This alignment alternative is located furthest from the State Capitol. The Van Buren Street alignment alternative travels through employment densities ranging from 0 to 2,000 employees per square mile to 2,001 to 8,000 employees per square mile.	–

Alternative	Is Access to Employment Centers Improved?	Rating
Adams Street	This alignment alternative passes directly north of the State Capitol, where employment densities range from 20,001 to 40,000 employees per square mile and passes through the more heavily concentrated employment centers in downtown. It is further to the north of the City/County government center, which is a major contributor to the heavily populated employment in the area, ranging from 120,001 to 180,000 employees per square mile compared to the Washington and Jefferson Streets alignment alternatives. West of 19th Avenue the employment densities are low (ranging from 0-2,000 employees per square mile).	+
Washington/Jefferson Street	This alignment alternative is within close proximity to the City/County Government Center, which ranges from 120,001 to 180,000 employees per square mile, and also directly serves the State Capitol, which has 20,000 to 40,000 employees per square mile. West of 19th Avenue the employment densities are low (ranging from 0-2,000 employees per square mile).	+
Jefferson Street (two-track option)	This alignment alternative is within close proximity to the City/County Government Center, which ranges from 120,001 to 180,000 employees per square mile, and also directly serves the State Capitol, which has 20,000 to 40,000 employees per square mile. West of 19th Avenue the employment densities are low (ranging from 0-2,000 employees per square mile).	+

Source: MAG 2005

4.2.4.1.3 Proximity to Activity Centers and Recreational Opportunities

Destinations that attract large groups of people for reasons other than employment were divided into three categories as shown in Table 4-9. Activity centers, public facilities and recreational destinations were identified within 0.5-mile of station locations for each LRT alignment alternative under evaluation. Each of these destinations has the potential to add ridership and act as trip generating destinations. The ratings of each alignment alternative were based on the total number of destinations for each alignment alternative. Since there are no stations identified along the I-17, no activity centers were identified and a ranking of (–) was given to reflect inaccessibility to and from surrounding areas. Ratings were assigned as:

+ = 20 destinations or more.

0 = 11-20 destinations.

– = 0-10 destinations.

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Table 4-9 Opportunity to Access Activity Centers and Recreational Opportunities

Alternative	Destinations within 0.5-mile of HCT Stations			Rating
	Activity Centers	Public Facilities	Recreational Destinations	
North-South Alternatives				
I-17 (no stations)	None	None	None	–
19th Avenue				–
Culver Street/19th Avenue	• Arizona Veterans Memorial Coliseum • Arizona State Fairgrounds	None	None	
Grand Avenue/15th Avenue				–
Grand Avenue/Roosevelt	• Arts District	None	None	
East-West Alternatives				
All four of the East-West Alignment Alternatives are similarly proximate, in general, to the following activity centers and are therefore given a (+) rating: **Activity Centers**: Phoenix College, Downtown, ASU Downtown Phoenix Campus, Arizona Center, Herberger Theatre, St. Mary's Basilica and Diocesan Pastoral Center, Phoenix Convention Center West, North, & South, Symphony Hall, Renaissance Square, Orpheum Theatre, Dodge Theatre, U.S. Airways Center. **Public Facilities**: U.S. Post Office, Central Station, Phoenix City Hall, Historic Phoenix City Hall/County Courthouse, Maricopa County Superior Court, Maricopa County Administration Building, Sandra Day O'Connor Federal Courthouse, City Council Chambers, Phoenix Municipal Court, Carnegie Library Museum, Capitol Elementary School, State Capitol Mall. **Recreational Destinations**: Wesley Bolin Memorial Plaza, Pioneer and Military Memorial Park, University Park, Patriots Square Park, Grant Park.				

Source: I-10 West AA/EIS Study Team 2007

4.2.4.1.4 Proximity to Medium- and High-Density Residential Areas

Medium density residential areas were defined as those areas where zoning permits densities ranging from 10 to 20 units per acre. High density areas were defined as those which allow for densities over 20 units per acre. Data presented in this table represent the calculation of total acres of zoning that meets this criterion as determined from GIS analysis. Because of the close proximity of stations, there existed an overlap in data when creating a total acreage number for each alignment alternative. This overlap was taken into account in the assignment of ratings. The proximity of stations to medium and high density residential areas is examined in Table 4-10. Since there are no stations identified along the I-17 alternative from which to collect data, 0 residential acres were recognized and a ranking of "–" was given to reflect the inaccessibility of surrounding areas. Ratings were assigned as follows:

+ = More than 800 acres of medium/high density zoning.

0 = 400-800 acres of medium/high density zoning.

– = Less than 400 acres of medium/high density zoning.

Table 4-10 Residential Areas within Proximity to HCT Stations

Alternative	Approximate Acreage of Residential Areas within 0.5 miles of Stations			Rating
	Medium Density	High Density	Total Acres	
North-South Alternatives				
I-17 (no stations)	0	0	0	–
19th Avenue (Culver Street/19th Avenue)	3	46	49	–
Grand Avenue/15th Avenue (Grand Avenue/ Roosevelt Street)	5	134	139	–
East-West Alternatives				
Van Buren Street (to 7th Avenue)				+
2nd Avenue (on Adams)	0	277	277	
7th Avenue	2	176	178	
12th Avenue	1	124	126	
17th Avenue	45	156	201	
22nd Avenue	84	143	228	
Total	132	876	1,010	
Adams Street				+
2nd Avenue	0	277	277	
7th Avenue	0	75	75	
12th Avenue	1	87	88	
17th Avenue	38	146	184	
22nd Avenue	84	113	197	
Total	123	698	821	
Washington/Jefferson Street				0
2nd Avenue	0	11	11	
7th Avenue	0	72	72	
12th Avenue	0	63	63	
17th Avenue	38	111	149	
22nd Avenue	87	72	158	
Total	125	329	453	

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Alternative	Approximate Acreage of Residential Areas within 0.5 miles of Stations			Rating
	Medium Density	High Density	Total Acres	
Jefferson Street (two-track option)				0
2nd Avenue	0	11	11	
7th Avenue	0	72	72	
12th Avenue	0	63	63	
17th Avenue	38	111	149	
22nd Avenue	87	72	158	
Total	125	329	453	

*Jefferson Street results were identical to the Washington/Jefferson Street alternative
Source: City of Phoenix 2007

4.2.5 Goal 5: Minimize Environmental Impacts

4.2.5.1 Environmental Issues

METRO conducted a qualitative energy and air quality analysis for the Tier 2 alternatives that is attached as Appendix E. A review of existing data on floodplains and special status species was completed to identify potential fatal flaws. Based on this cursory review, no fatal flaws were identified. A 100-year floodplain traverses the downtown study area, and it is not considered to be a distinguishing factor among the alternatives. However, if an underpass is constructed per the I-17 Alignment Alternative, additional assessment would be required to determine any impacts to the floodplain.

In addition, because of the heavily developed nature of the study area, no impacts are expected on threatened and endangered species and this consideration is not a distinguishing factor among the alignment alternatives. More detailed impact analyses of these and other environmental resources, including an assessment of hazardous materials sites, will be conducted during the Final Definition of Alternatives phase.

4.2.5.1.1 Property Acquisitions

The number of property acquisitions required with each alignment alternative is shown in Table 4-11. This table reflects the number of parcels along each alignment alternative that would experience a property take in some form. This analysis did not determine whether a full or partial take would occur. Ratings were assigned as follows:

+ = Full or partial property acquisitions of 0-15 parcels along the respective alignment.

0 = Full or partial property acquisitions of 16-25 parcels along the respective alignment.

– = Full or partial property acquisitions of 26 or more parcels along the respective alignment.

Table 4-11 Property Acquisitions Required for Each Alternative

Alternative	Number of Property Acquisitions	Rating
North-South Alternatives		
I-17	27 Parcels	–
19th Avenue	49 Parcels	–
Grand Avenue/15th Avenue	18 Parcels	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	48 Parcels	–
Adams Street	8 Parcels	+
Washington/Jefferson Street	3 Parcels	+
Jefferson Street (two-track option)	3 Parcels	+

Source: METRO I-10 West Study Team 2008

4.2.5.1.2 Potential Impact to Historic Resources

The Tier 2 downtown North-South and East-West Alignment Alternatives were evaluated with respect to potentially adverse effects on significant archaeological, historical, and traditional cultural resources. The analysis used information compiled during prior records and literature review conducted for the *Draft I-10 West High-Capacity Transit Corridor Study: Tier 1 Cultural Resources Evaluation* (2008). Potential "adverse effects" to listed or previously determined eligible properties were defined as:

- Acquisition and alteration, or demolition of property; and/or
- Changes to the setting resulting from acquisition of right-of-way and resulting street modifications and construction of facilities.

Table 4-12 identifies the number of these properties adjacent to each alignment alternative that has the potential to be affected by an LRT option in Downtown Phoenix. Further information on these sites is available in the *Tier 1 Cultural Resources Evaluation* document and the *Tier 2 Analysis of Downtown Alternative Alignments - Cultural Resources Evaluation Rating Justification* document attached as Appendix F. Ratings were assigned as follows:

+ = High performance: alignment alternative has little or no potential for adverse effects.

0 = Moderate performance: alignment alternative has some potential for adverse effects from visual impacts due to grade separation structure over the BNSF and 19th Avenue, but there also is potential to avoid or satisfactorily mitigate those impacts through sensitive design, and they may not be considered Section 4(f) constructive uses.

– = Low performance: alignment alternative is likely to result in a total property acquisition that almost certainly would result in adverse effects and Section 4(f) uses.

Curb setbacks that would occur within existing rights-of-way, adjacent to historic houses, were evaluated as **unlikely** to result in adverse effects.

Table 4-12 Downtown Alignment Alternative Ratings for Potential Impacts to Cultural Resources

Alternative	Potential Impacts on Historical Properties Listed in or Eligible for the National Register or Phoenix Register	Potential Impacts on Historical Properties Preliminarily Evaluated as Potentially Eligible for the National Register	Potential Impacts on Archaeological Sites
North-South Alternatives			
I-17	-	+	0
19th Avenue	-	+	0
Grand Avenue/15th Avenue	-	+	0
East-West Alternatives			
Van Buren Street (to 7th Avenue)	-	-	0
Adams Street	0	-	0
Washington/Jefferson Street*	0	0	0
Jefferson Street (two-track option)*	0	0	0

*The streetscapes of Washington and Jefferson Streets also have historic values that could be adversely affected by any curb modifications, and the view corridor of the capitol building along Washington Street could be adversely affected by the light rail catenary.
Source: URS 2008

4.2.5.1.3 Parklands or Other Section 4(f) Resources

As defined in Section 4(f) of the Department of Transportation Act of 1966, the use of any publicly owned park, wildlife or waterfowl refuge, recreation area, or historical property on or eligible for the National Register of Historic Places is restricted for use for a transportation project unless: (1) there is no feasible and prudent alternative to the use of such land; and (2) the project includes all possible planning to minimize harm. Implementing a fixed guideway LRT service has the potential to impact these resources. Section 4(f) resources located adjacent to the alignment alternatives are listed in Table 4-13. Ratings were assigned as follows;

+ = 0-4 Section 4(f) Resources likely impacted by the alignment.

0 = 5-8 Section 4(f) Resources likely impacted by the alignment.

– = 9 or more Section 4(f) Resources likely impacted by the alignment.

Table 4-13 Impacts to Section 4(f) Resources

Alternative	Number of Section 4(f) Resources Likely Impacted by the Alignment	Rating
North-South Alternatives		
I-17	• Parks: None • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 1	+
19th Avenue	• Parks: None • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 1	+

Alternative	Number of Section 4(f) Resources Likely Impacted by the Alignment	Rating
Grand Avenue/15th Avenue	• Parks: None • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 7	0
East-West Alternatives		
Van Buren Street	• Parks: University Park located between 12th Avenue and 10th Avenue north of Van Buren, Woodland Parkway located between 15th Avenue and 9th Avenue south of Van Buren (closed to public use) • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 9	-
Adams Street	• Parks: Wesley Bolin Memorial Plaza located between 18th Avenue and 16th Avenue • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 28	-
Washington/Jefferson Street	• Parks: Wesley Bolin Memorial Plaza located between 18th Avenue and 16th Avenue, may result in an impact to existing access and require an easement with the selection of this alternative • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 45	-
Jefferson Street (two-track option)	• Parks: Wesley Bolin Memorial Plaza located 18th Avenue and 16th Avenue may result in an impact to existing access with the selection of this alternative • Recreation Areas: None • Wildlife and Waterfowl Refuges: None • Public/Private Historical Sites and/or Historic Districts: 44	-

Source: URS 2008; *Cultural Resources Rating Justification Memorandum* (Appendix E)

4.2.5.2 General Impact to Community

4.2.5.2.1 Landscaping/Streetscape Elements

Vegetation and landscape design that is maintained in the road ROW are considered landscaping, or streetscape elements. The significance of these areas differs throughout the I-10 West Downtown Section based on the proposed alignment alternatives. Landscape and streetscape elements were inventoried during a field reconnaissance. Table 4-14 summarizes the impacts on landscaping and streetscape elements along each alignment alternative.

Ratings were assigned as follows:

+ = No significant impact to a maintained landscape or streetscape design or the landscape is not maintained.

0 = Visible impact to a maintained landscape or streetscape design.

– = Potential to significantly impact a maintained landscape or streetscape design.

Table 4-14 Impacts to Landscaping and Streetscape Elements

Alternative	Impacts to Landscaping/Streetscape Elements	Rating
North-South Alternatives		
I-17	• The west side of the frontage road on I-17 has mature landscape just south of the I-10 interchange. This area could potentially be impacted as the guideway transitions from the I-10 median with implementation of this alternative. • Further south along the I-17 alignment the amount of landscaping decreases in significance and becomes less maintained. There would be little impact to any landscaping/ streetscape elements in this section.	0
19th Avenue	• The west side of the 19th Avenue alignment includes the BNSF railroad tracks. Therefore, there is limited landscaping along the entire west side of 19th Avenue, south of I-10. • The east side of the 19th Avenue alignment alternative north of Adams Street has minimal landscaping. • 19th Avenue south of Adams Street has minimal landscaping due to existing parking lots. There would be no significant impact to landscaping/streetscape elements with implementation of this alternative	+
Grand Avenue/15th Avenue	• Grand Avenue has mature landscaping that is located on both sides of the street between I-10 and 15th Avenue. This section of the alignment would loose all existing landscaping/streetscape elements. • There are no significant landscape or streetscape elements along the 15th Avenue alignment.	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	• Van Buren from I-17 to 7th Avenue has some significant landscaping elements being maintained on both the north and south sides of the street. These landscaping elements include some small bushes and trees. This section would incur minor impacts to existing landscaping/streetscape elements with implementation of this alternative.	0
Adams Street	• Adams Street between Central and 19th Avenues include significant mature landscape on both sides of the street. • Adams Street at the State Capitol has very significant landscape and streetscape elements. • West of 19th Avenue along Adams Street, minimal significant landscape exists (some mature trees). • The greatest potential impact would occur between Central Avenue and 19th Avenue along Adams Street. This section would experience significant impact to existing landscaping/ streetscape elements with implementation of this alternative.	–
Washington/Jefferson Street	• There is very significant mature landscape along both sides of Washington Street from Central Avenue through Wesley Bolin Memorial Plaza at the State Capitol. • There is significant landscape along both sides of Jefferson Street as well from Central Avenue extending	–

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Alternative	Impacts to Landscaping/Streetscape Elements	Rating
	west to 19th Avenue. • Jefferson Street west of 19th Avenue has mature landscaping that is not maintained well and is much less significant. • The greatest potential impact would occur between Central Avenue and 19th Avenue along both Washington and Jefferson Street. This section would experience significant impact to existing landscaping/streetscape elements on Washington Street; however, to lesser degree on Jefferson Street.	
Jefferson Street (two-track option)	• There is significant landscape along both sides of Jefferson Street from Central Avenue extending west to 19th Avenue. From 4th Avenue to 17th Avenue the majority of the landscaping/streetscape elements would be preserved, thus reducing impact to these elements. • Jefferson Street west of 19th Avenue has mature landscaping that is not maintained well and is much less significant.	0

Source: METRO I-10 West Study Team 2008

4.2.5.2.2 Signalized Pedestrian Crosswalks

Pedestrian crosswalks are necessary to ensure safe interaction between automobile and pedestrians. Implementation of a fixed guideway LRT service would affect pedestrians using these crosswalks as a result of changes in signal times, and increased risk associated with the crossing of LRT trackway. An inventory was taken of all signalized crosswalks that would be impacted by a fixed guideway LRT service. All crosswalks at signalized intersections were inventoried regardless of whether they would cross the LRT trackway. This is because of the impact that the change in signal times would have on these crosswalks. The numbers of signalized crosswalks impacted are numbered in Table 4-15. Ratings were assigned as follows:

+ = Anticipate fewer than 25 signalized crosswalks impacted.

0 = Anticipate 25-50 signalized crosswalks impacted.

– = Anticipate more than 50 signalized crosswalks impacted.

Table 4-15 Impacts to Downtown Phoenix Signalized Pedestrian Crosswalks

Alternative	Impacts to Signalized Downtown Crosswalks	Rating
North-South Alternatives		
I-17	8 Crosswalks Impacted*	+
19th Avenue	12 Crosswalks Impacted	+
Grand Avenue/15th Avenue	18 Crosswalks Impacted	+
East-West Alternatives		
Van Buren Street (to 7th Avenue)	32 Crosswalks Impacted	0
Adams Street	34 Crosswalks Impacted	0
Washington/Jefferson Street	67 Crosswalks Impacted	–
Jefferson Street (two-track option)	41 Crosswalks Impacted	0

Source: METRO I-10 West Study Team 2008

*Note: Impacts to signalized pedestrian crosswalks are based on impacts to the I-17 frontage road revealed in the conceptual engineering for the I-17 alignment alternative.

4.2.5.2.3 Bicycle Lanes Removed

Bicycle lanes provide alternative means of transportation and provide a safe environment for those who travel by bicycle. Implementation of fixed guideway LRT service often requires the use of existing traffic lanes, thus reducing the amount of roadway capacity available for automobile travel and bicycle lanes. Impacts to existing bicycle lanes were identified by measuring bicycle lane miles likely removed along each alignment alternative. The results of this analysis are summarized in Table 4-16. Ratings were assigned as follows:

+ = No Impact.

0 = Anticipate 0-1 lane mile removed.

– = Anticipate more than 1 lane mile removed.

Table 4-16 Impacts to Downtown Bicycle Lanes

Alternative	Bicycle Lane Impact by Alternative	Rating
North-South Alternatives		
I-17	No Impact	+
19th Avenue	No Impact	+
Grand Avenue/15th Avenue	0.6 Lane Miles	0
East-West Alternatives		
Van Buren Street (to 7th Avenue)	No Impact	+
Adams Street	No Impact	+
Washington/Jefferson Street	1.9 Lane Miles	–
Jefferson Street (two-track option)	1.1 Lane Miles	–

Source: METRO I-10 West Study Team 2008

4.2.5.2.4 On-Street Parking

On-street parking provides additional parking capacity for local businesses and creates a buffer between pedestrians and traffic lanes, thus creating a pleasant urban environment for the pedestrian. Implementation of fixed guideway LRT service often requires the use of existing traffic lanes, thus reducing the amount of roadway capacity available for automobile travel and on-street parking. Impacts to on-street parking were identified by calculating the number of spaces removed with each alignment alternative. Where existing parking spaces were not identified by meters, 25 feet per parking space was assumed for this assessment. The results of this analysis are listed in Table 4-17. Ratings were assigned as follows:

+ = Anticipate fewer than 50 on-street parking spaces removed.

0 = Anticipate 50-150 on-street parking spaces removed.

– = Anticipate more than 150 on-street parking spaces removed.

Table 4-17 On-Street Parking

Alternative	Impacts to On-Street Parking	Rating
North-South Alternatives		
I-17	0 Spaces Removed	+
19th Avenue	0 Spaces Removed	+
Grand Avenue/15th Avenue	0 Spaces Removed	+

Alternative	Impacts to On-Street Parking	Rating
East-West Alternatives		
Van Buren Street (to 7th Avenue)	0 Spaces Removed	+
Adams Street	240 Spaces Removed	–
Washington/Jefferson Street	234 Spaces Removed	–
Jefferson Street (two-track option)	120 Spaces Removed	0

Source: METRO I-10 West Study Team 2008

4.2.5.3 Community Support

4.2.5.3.1 Responsiveness to Community Needs

Table 4-18 summarizes input received from the Downtown Community Working Group (CWG). The Downtown CWG was established to ensure public participation in the study process that helped develop and assess the alignment alternatives, transit technology and station locations for the Downtown Section. The CWG is comprised of neighborhood residents and representatives from the Village Planning Commission and business organizations.

Ratings were assigned as follows:

+ = Strong support of potential alignment alternative, with little to no opposition.

0 = Somewhat supportive of potential alignment alternative with slight opposition.

– = Strong opposition of potential alignment alternative, with little to no support.

Table 4-18 Community Support of Alternatives

Alternative	Input Received from the Community	Rating
North-South Alternatives		
I-17	• There were concerns about the impact a possible transition from I-17 would have on the historic neighborhoods in the area. • There were concerns about potential impacts to the residential properties that exist between I-17 and 19th Avenue. • There were issues concerning the surrounding structures and the impacts/costs associated with an I-17 alignment. • The I-17 option was noted as a commuter system. • I-17 appears to be faster and more cost effective. • LRT near the highway would be positive	0
19th Avenue	• There were concerns about the possible impact a 19th Avenue alignment would have on the Oakland Historic District, and the amount of homes that would be impacted. • There was a concern about the curbs that would be included with a 19th Avenue alignment. • This alignment would affect Steele Commons which has just expanded their facility and is an apartment complex seen as a community asset in the neighborhood.	0

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Alternative	Input Received from the Community	Rating
	• The 19th Avenue corridor serves the State Capitol. • The possibility of a station and alignment that will serve the fairgrounds located at 19th Avenue and McDowell is well received. • A 19th Avenue alignment will not disrupt a neighborhood. • There is significant opportunity for revitalization along 19th Avenue compared to the other North-South alternatives.	
Grand Avenue/ 15th Avenue	• There were concerns about the possible impact a 15th Avenue alignment would have on the Oakland Historic District. • The 15th Avenue corridor serves the Capitol, but not as direct as other North-South Alignment Alternatives. • There was concern regarding the impact a 15th Avenue alignment might have on new infrastructure such as the 15th Avenue sewer line improvements. • 15th Avenue is narrow; LRT would be centered on the street creating a right turn only scenario.	–
East-West Alternatives		
Van Buren Street (to 7th Avenue)	• Van Buren Street alignment was not a popular option for residents. It would be a major disruption and would not be supported by the community. • The location of University Park, St. Matthews, and Capitol Elementary School would be problematic. • It is difficult to envision a Van Buren Alignment Alternative turning south on 7th Street and continuing to Washington and Jefferson Streets. • There was concern regarding the distance from Van Buren Street to the State Capitol. • There were better opportunities for private investment in the Van Buren Corridor.	–
Adams Street	• Adams Street is a reasonable connection to the CP/EV LRT Starter Line with close proximity to the State Capitol and Government Center. • Adams Street is more of a back door entrance to downtown. Tourists and residents would prefer to be in the middle of the attractions. • Adams Street compliments the Capitol Mall Centennial Plan. • Adams Street shows potential for redevelopment in the Capitol Mall area, although much of the land is State owned.	+
Washington/Jefferson Street	• Washington Street is a potential view corridor and parade route. It is not seen as a favorable LRT alignment alternative. • Washington/Jefferson is not supported by the Capitol Mall Centennial Plan. • Most of the land surrounding the Capitol Mall is State owned and would be difficult to privately develop.	–
Jefferson Street (two-track option)	• A Jefferson Street alignment was well received. Putting both tracks on Jefferson Street would eliminate the concern about a view corridor on Washington Street and would increase the future development potential to the South. • Most of the land surrounding the Capitol Mall is State owned and will be difficult to privately develop.	+

Source: METRO 2008d

The following general comments were registered as input was gathered from the public and Downtown CWG:

- The community was interested in the impacts new development would have in the Grand Avenue corridor. Some common viewpoints throughout the community regarding the Grand Avenue corridor include; slowing traffic, on-street parking and traffic flow.
- The art district centered around Roosevelt Street (between Central Avenue and 7th Avenue) would be a good location for LRT stations.
- It is important that LRT is incorporated into the fabric of the community and not just used as a tourist attraction.
- The I-10 extension should be seen as a commuter connector as opposed to the CP/EV LRT Starter Line that connects activity centers.
- Incorporating shade on the paths that lead to stations and at the station itself needs to be a priority.
- LRT is a smoother transition for travelers for connecting to other lines as opposed to BRT.
- The alignment needs to serve the Arizona State Fairgrounds.
- A seamless integration with the CP/EV LRT Starter Line is important.
- A bus circulator service could be utilized to compliment the system.
- The community would like to see Hance Park transit facility integrated/realized.
- There was a community perception that buses were less reliable than light rail.
- Modes should be considered to complement whatever system is developed. Planning now for the future is important.

4.3 Detailed Downtown LRT Evaluation Summary

Table 4-19 demonstrates the summarized ratings of the separate north-south and east-west downtown LRT alignment alternatives based on a compilation of the evaluation results presented in this chapter. As demonstrated in Table 4-19, the **Grand Avenue/15th Avenue** North-South alignment alternative and the **Van Buren Street** East-West alignment alternative did not perform as well as other alignment alternatives and were not carried forward for additional analysis.

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Table 4-19 Results of Tier 2 Downtown LRT Alternatives Definition Process

Tier 2 Evaluation Criteria	North-South Alternatives			East-West Alternatives			
	I-17	19th	Grand/ 15th	Van Buren	Adams	Wash/ Jeff	Jeff
Goal 1: Improve Regional Mobility Along the I-10 West Corridor							
Traffic Issues							
Impacts to Left Turn Lanes	+	+	+	–	0	+	+
Roadway Lane Miles Removed	+	+	0	–	0	–	–
Diminished Left Turn Access	+	+	–	–	0	0	+
Driveway Impacts	+	+	0	0	–	+	–
Additional Signalization Required	+	+	0	0	0	–	0
Goal 2: Connect to the Local and Express Bus System and the CP/EV LRT System with the West Valley							
Populations Served within a 0.5-Mile Radius of Stations							
Total Population	–	–	–	+	+	0	0
Total Workers	–	–	–	+	0	0	0
Minority Population	–	–	–	0	0	+	+
Low-Income Households	–	–	–	0	0	+	+
Zero-Car Households	–	–	–	+	+	0	0
Goal 3: Provide Cost-Effective Transit Improvements							
Design and Constructability Issues							
Utility Conflicts	+	+	0	0	0	–	–
Goal 4: Serve Major Employment Centers, Including the State Capitol, and Support Economic Development							
Land Use							
Consistency with Adopted Plans	0	+	+	0	+	+	+
Access to Employment Centers	–	0	0	–	+	+	+
Proximity to Activity Centers and Recreational Opportunities	–	–	–	+	+	+	+
Proximity to Medium & High-Density Residential Areas	–	–	–	+	+	0	0
Goal 5: Minimize Environmental Impacts							
Environmental Issues							
Property Acquisitions	–	–	0	–	+	+	+
Listed/Eligible Historic Properties	–	–	–	–	0	0	0
Potentially Eligible Historic Properties	+	+	+	–	–	0	0
Archaeological Sites	0	0	0	0	0	0	0
Parklands/Other Section 4(f) Resources	+	+	0	–	–	–	–
General Impact to Community							
Landscaping/ Streetscape Elements	0	+	0	0	–	–	0
Pedestrian Crosswalks Affected	+	+	+	0	0	–	0
Bicycle Lanes Removed	+	+	0	+	+	–	–
On-Street Parking Displaced	+	+	+	+	–	–	0
Community Support							
Responsiveness to Community Needs	0	0	–	–	+	–	+

Source: METRO I-10 West Study Team 2008

4.4 Tier 2 Summary of Downtown LRT Evaluation

The table above shows all alignments evaluated against the same criteria. For purposes of the Tier 2 evaluation, the criteria were not weighted. The results from the quantitative analysis determined that the **Grand Avenue/15th Avenue** North-South Alignment Alternative and the **Van Buren** East-West Alignment Alternative did not perform as well as other Alignment Alternatives and were not carried forward for additional analysis.

Grand Avenue/15th Avenue was removed from consideration based on a comparison with the I-17 and 19th Avenue Alignment Alternatives because Grand Avenue/15th Avenue would result in greater traffic issues and more utility conflicts. Grand Avenue/15th Avenue was also removed from consideration because it did not directly serve the State Capitol and was not a favorable option with members of the Downtown CWG.

The **Van Buren Street** Alignment Alternative was the only east-west option removed from further consideration because it resulted in greater traffic conflicts, a higher number of property acquisitions and impacts to historic properties. In comparison to the Washington/Jefferson Couplet, Jefferson Street 2-Track, and Adams Street options, Van Buren Street did not directly serve the State Capitol. Additional adverse design and operational considerations associated with the Van Buren Street Alignment Alternative are provided in the *Tier 2 Downtown: Van Buren LRT Alternative – Design and Operation Considerations* memorandum attached as Appendix G.

The Detailed Alignment Alternatives Evaluation presented in Section 4.2 concluded the following downtown LRT alignment alternatives and CP/EV LRT Starter Line Connection Options should be carried forward in the I-10 West AA/EIS Study process:

North-South Alignments	East-West Alignments	Connection Options
I-17*	Adams Street	Monroe/Adams Couplet
19th Avenue	Washington/Jefferson Couplet	Washington/Jefferson – 1st Avenue/Central Avenue
	Jefferson Street (two-track option)	Jackson-1st Street

Downtown LRT Alternatives Carried Forward

Figure 4-4 shows the range of alignment alternatives and CP/EV LRT Starter Line Connection Options considered at the beginning of the Tier 2 Detailed Evaluation process and demonstrates which alignment alternatives and connections were removed from consideration based on the Tier 2 LRT Detailed Evaluation.

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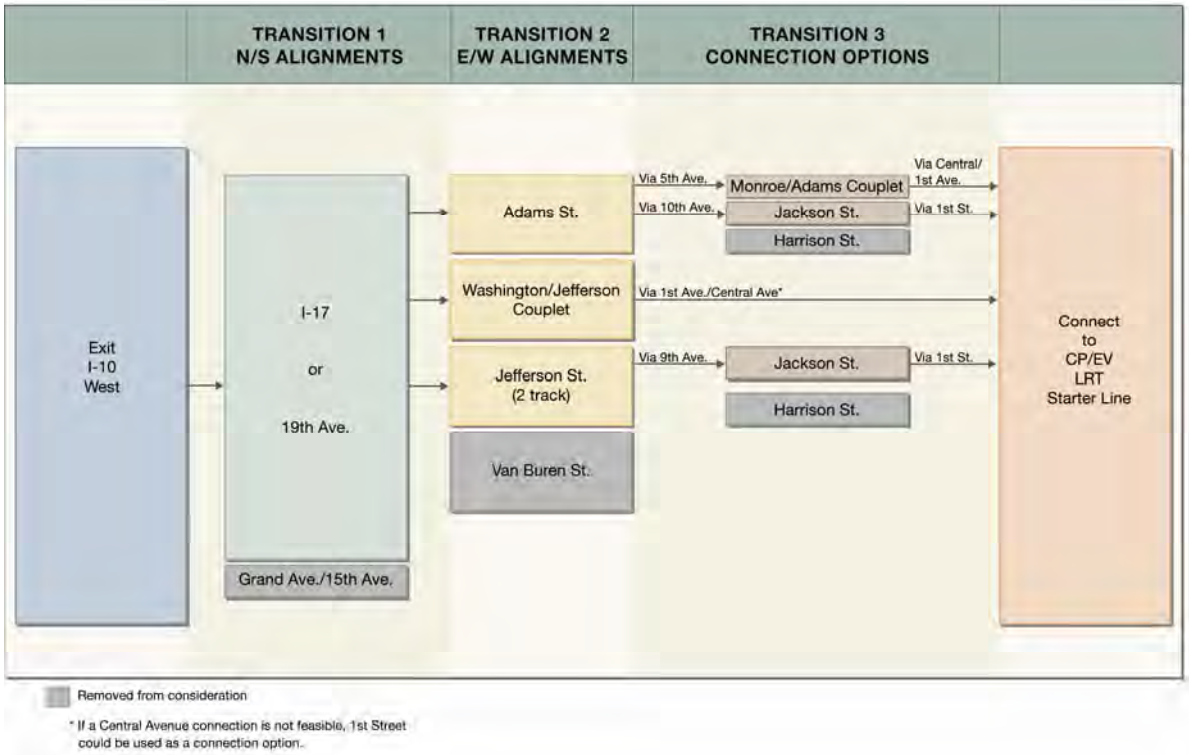
Figure 4-4 Downtown LRT Alignment Alternatives and CP/EV LRT Starter Line Connection Options Recommended for Further Evaluation



Source: I-10 West AA/EIS Study Team, 2009

4.5 Preliminary Evaluation of Downtown LRT Alignment Alternatives

The following discussion provides a preliminary assessment of the alternatives that will be carried forward for further evaluation and provides an initial comparison of these remaining alternatives.

4.5.1 I-17 versus 19th Avenue Alignment Alternatives

The detailed Tier 2 Evaluation resulted in carrying forward two remaining North-South LRT Alignment Alternatives in the Downtown Section: I-17 and 19th Avenue. Results of a preliminary comparison of these two remaining alternatives are presented in Table 4-20. Further analysis will be conducted during the Final Definition of Alternatives phase to identify the recommended North-South Alignment Alternative using quantitative criteria including travel time, property acquisition requirements, and costs of both Alignment Alternatives.

Table 4-20 North-South LRT Alignment Alternatives – Preliminary Comparison

I-17	19th Avenue
Better travel time due to being adjacent to the freeway and able to abide by higher posted speed limits.	Slower travel time resulting from vehicles operating within an elevated structure north of I-10 that turns to connect via a clover-leaf structure at-grade to 19th Avenue via Grand Avenue. Additionally, trains would be subject to a lower posted speed limit along 19th Avenue and may require a stop at a station serving the State Fairgrounds.
No major utility impacts have been identified along the I-17 alignment.	Potential conflict with a 75-inch underground storm drain within the 19th Avenue right-of-way.
Would not serve the Arizona State Fairgrounds along the I-17 portion of the alignment.	Serves the Arizona State Fairgrounds, identified as a prominent activity center near downtown Phoenix
May present redevelopment opportunities if a station is located as the alignment heads east into downtown, before accessing the State Capitol.	May present redevelopment opportunities along 19th Avenue.
Requires coordination with ADOT on the future expansion of I-17 within the study area, which has the potential to adversely affect the I-10 West Corridor schedule.	This alignment would avoid paralleling the I-17 right-of-way; therefore, the project schedule does not hinge on ADOT's plans to widen I-17. However, coordination with BNSF and the Federal Railroad Administration would be necessary.
Potential to adversely affect individual properties potentially eligible for the National Historic Register within the St. Matthews Neighborhood between I-17 and 19th Avenue; however, avoids impact to the Oakland Historic District.	The St. Matthews Neighborhood would not be impacted by the 19th Avenue alignment; however, individual properties potentially eligible for the National Historic Register within the Oakland Historic District could be adversely affected.
Requires either an overpass or underpass along Adams Street or Jefferson Street to avoid impacts to the BSNF railroad.	Requires an overpass constructed to span the BNSF railroad tracks along I-10 would avoid impacting downtown east-west arterials.
In terms of structural costs associated with a grade separation feature, I-17 costs would be lower compared to 19th Avenue.	In terms of structural costs associated with a grade separation feature, 19th Avenue costs would be higher compared to I-17.
Potential storm drainage issues associated with the Cave Creek 100-year floodplain if an underpass is constructed to cross the BNSF railroad tracks along Adams Street or Jefferson Street.	An I-10 median alignment between 27th Avenue and 17th Avenue interferes with ADOT's ability to add needed freeway lane capacity from the I-17 / I-10 stack interchange through central Phoenix.

Source: METRO I-10 West AA/EIS Study Team, 2009

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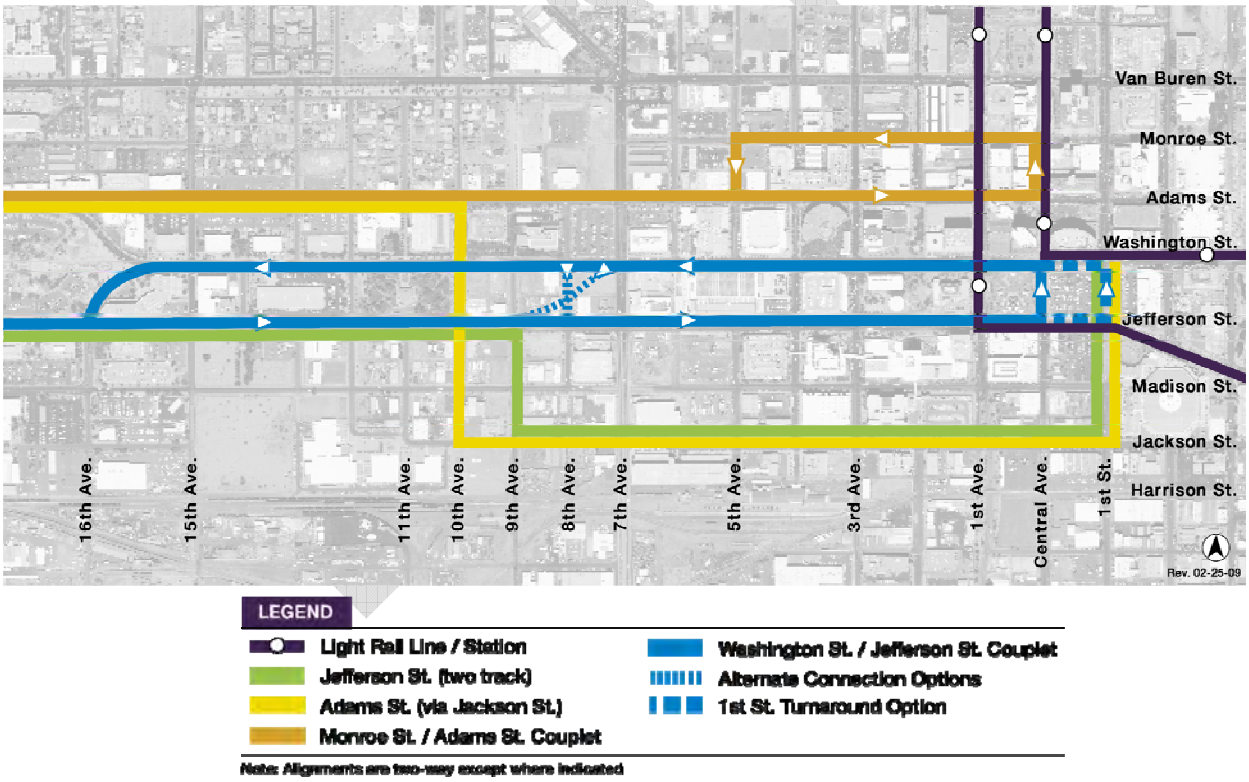
4.5.2 Preliminary Evaluation of Downtown East-West Alignment Alternatives and Connection Options

The Tier 2 Evaluation resulted in the three East-West Alignment Alternatives from the State Capitol area to west of the downtown area. A separate analysis was performed to evaluate all potential Downtown Connection Options to the METRO Starter Line based on the remaining East-West Alignment Alternatives that included Adams Street, the Washington/Jefferson Couplet, and the Jefferson 2-Track Alignment Alternatives.

Four Connection Options, shown in Figure 4-5, were recommended for further evaluation based on the remaining East-West Alignment Alternatives. Two Connection Options were identified for the Adams Street Alignment Alternative (Monroe/Adams Street Couplet and the Jackson Street via 10th Avenue option), one for the Jefferson Street 2-Track Alignment Alternative (Jackson Street via 9th Avenue), and a direct connection to the METRO Starter Line using the Washington/Jefferson Couplet.

Further evaluation of the remaining downtown LRT alignment alternatives will be conducted during the subsequent Final Definition of Alternatives phase of the I-10 West AA/EIS Study.

Figure 4-5 Downtown East-West LRT Alignment Alternatives and Connection Options



Source: METRO I-10 West AA/EIS Study Team, 2009

A preliminary evaluation determined the pros and cons of each of the East-West Alignment Alternatives paired with their respective METRO Starter Line Connection Options is provided in Table 4-21.

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Table 4-21 Preliminary Comparison of Remaining Downtown LRT East-West Alignment Alternatives and Connection Options

East-West Alignment Alternatives and Connection Options	Pros	Cons
Washington/ Jefferson Couplet – 1st/Central Avenues	• Direct connection to METRO Starter Line would result in fewer right-of-way impacts and reduces travel time. • Removal of one or two lanes along either five-lane roadway is less problematic compared to lane reduction along Adams, Monroe, or Jackson Streets.	• Results in the removal of traffic lanes. • Construction of light rail along two arterials has the potential to be more costly. • Potential historic preservation issues.
Jefferson Street 2-Track – Jackson Street (via 1st Street)	• Least amount of impact to existing landscape and streetscape elements. • Potential connection to future commuter rail. • Would not result in the removal of travel lanes along Jackson Street; however, existing lane widths would be reduced.	• Results in the removal of two traffic lanes along Jefferson Street. • Narrow lanes required along Jackson Street could impact larger vehicles. • Out of direction travel required to access Jackson Street adversely affects travel time along the corridor compared to Washington/Jefferson direct connection.
Adams Street – Jackson Street (via 1st Street)	• Potential connection to future commuter rail. • Would not result in the removal of existing travel lanes; however, existing lane width would be reduced.	• The narrow roadway along Adams Street could result in greater construction impacts to adjacent properties. • Out of direction travel required to access Jackson Street adversely affects travel time along the corridor compared to Washington/Jefferson direct connection.
Adams Street – Monroe/Adams Street Couplet	• Would not result in the removal of existing travel lanes; however, existing lane width would be reduced. • Direct connection to the METRO Starter Line.	• Narrow roadway along Adams Street could result in greater construction impacts to adjacent properties compared to other East/West Alignment Alternatives. • Narrow street width required along Monroe Street would impede emergency vehicle access.

* Each of the East-West Alignment Alternatives would remove on-street parking and adversely impact streetscapes and landscaping.

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5.0 DEFINITION AND EVALUATION OF TIER 2 DETAILED BRT ALTERNATIVES

5.1 Introduction

Bus Rapid Transit (BRT) provides a fast, reliable transit service by providing limited stops through the possible use of bus-only lanes and/or signal priority systems. These and other key features allow BRT to operate with rail-like efficiency. Other key features include:

- **Off-line fare payment**. Riders do not pay the driver, so stops do not take as long. Instead, riders pay their fare at a fare vending machine on the platform and are issued a ticket for validation, which is then randomly checked by an enforcement officer while the bus is in motion.
- **Special vehicles**. BRT vehicles look different when compared to local and express vehicles and could include a more elaborate paint scheme as well as different seating and door arrangements to facilitate faster loading and unloading.
- **Special stations**. BRT stations are similar to rail stations rather than local and express bus stops. These stations include fare vending machines and amenities such as seats, canopies, and enhanced passenger information.
- **Branded service**. BRT service often comes with special names, similar to the current RAPID service on I-10. Names that convey speed and reliability are used on schedules, buses, promotional materials, and websites to indicate that the BRT service is different from standard local and express bus service.

As with the LRT Alternatives, the I-10 alignment for BRT would begin at 79th Avenue and travel within the median of I-10. Once the alignment reaches downtown Phoenix, there would be multiple alignment alternatives operating in mixed traffic.

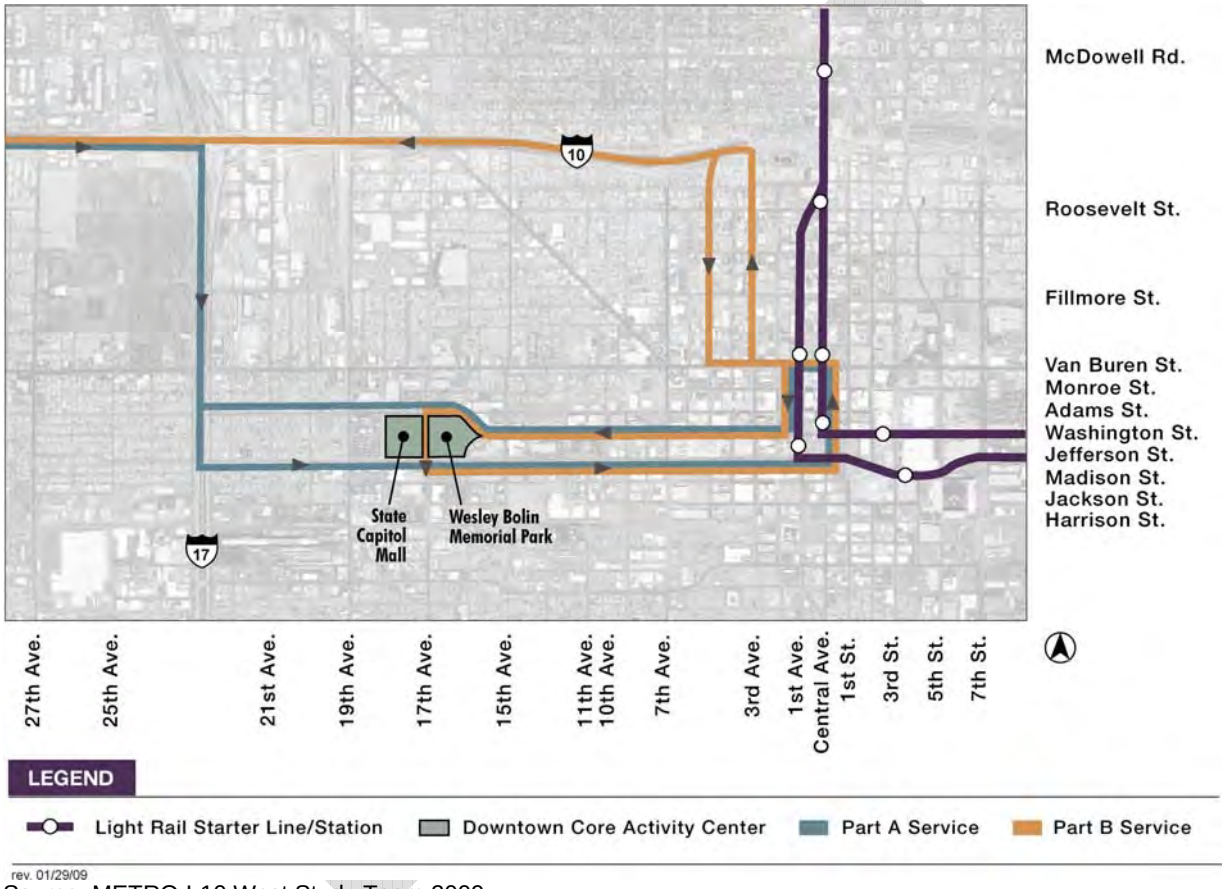
5.2 BRT Alternatives

The BRT Alternatives would include the RAPID/express bus routes that operate along I-10 and Loop 101, west of the I-10 West study area. Once these routes approach 79th Avenue and I-10, they would operate in an exclusive guideway within the I-10 median. When the vehicles exit the I-10 median, they would operate in mixed traffic. Origin-Destination information from the I-10 West RAPID Survey (2007) determined that approximately 25 percent of transit riders that board the I-10 West RAPID at the 79th Avenue PnR were destined for the State Capitol. Given this information, the BRT Alternatives would operate a two-part service, where the Part "A" service would offer transit riders in the West Valley improved direct mobility to the State Capitol, and ultimately service would end in downtown Phoenix. Part "B" service would deliver transit riders directly to downtown Phoenix, before terminating at the State Capitol. For Part "A" service, two North-South alignments and one East-West alignment were considered. The Part "A" service would exit the I-10 median at either I-17 or 19th Avenue via a connecting busway, then travel south and connect to the East-West alignment. The East-West alignment would be located on the Washington/Jefferson Couplet (which is the Adams/Jefferson Street Couplet west of 16th Avenue).

The Part "B" service would maintain the same general routing as the No-Build and Baseline/ TSM Alternatives, but BRT vehicles would use the exclusive guideway in the I-10 median between 79th Avenue and the 5th/3rd Avenue HOV ramps. In the off-peak, a new route would be used to provide service within the I-10 West study area by following the Part "A" route alignment. Part "B" service would be discontinued during the off-peak hours.

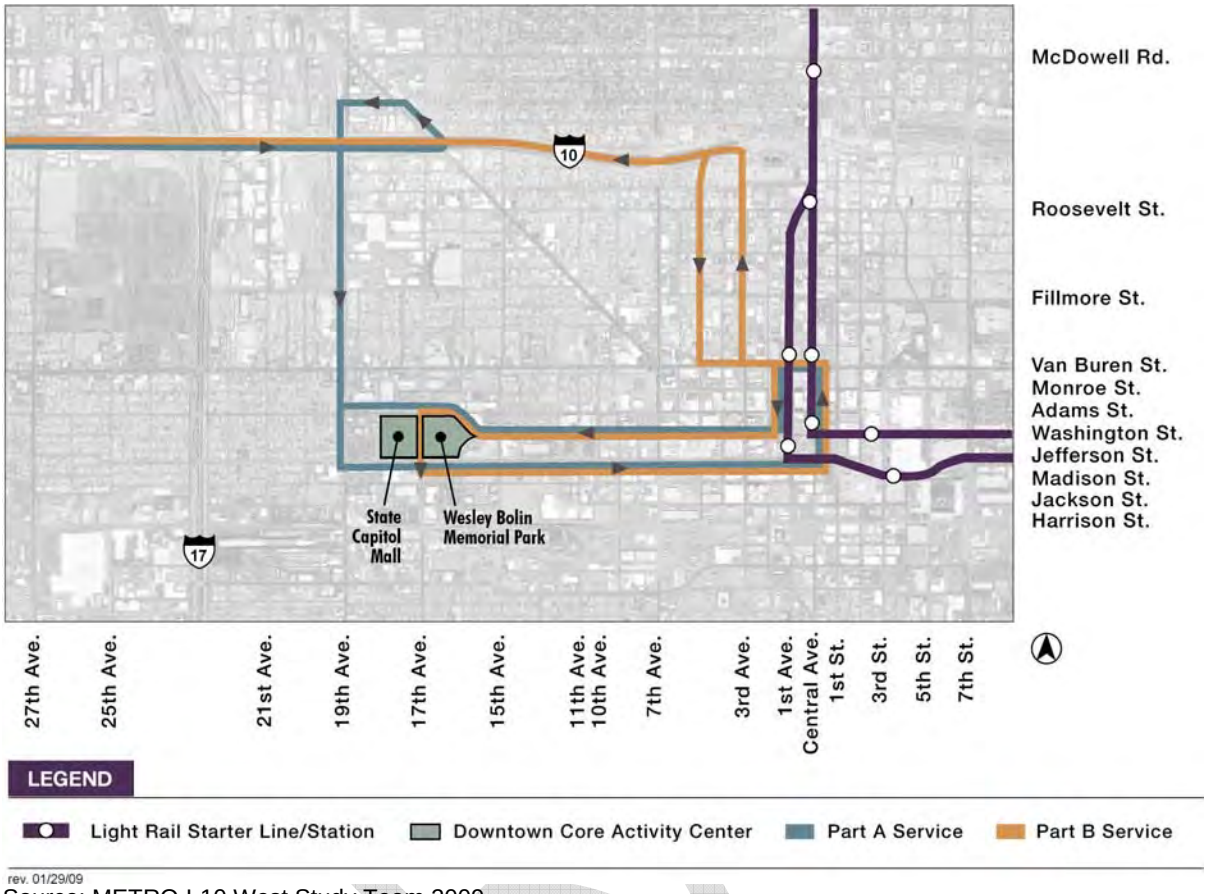
The only difference between the two BRT alternatives examined was in how the Part "A" service would be routed between the I-10 median and the State Capitol area. Figure 5-1 and Figure 5-2, identify the Part "A" and Part "B" routing for the I-17 and 19th Avenue BRT alternatives.

Figure 5-1 I-17 Alternative Part "A" and Part "B" Routing



Source: METRO I-10 West Study Team 2009

Figure 5-2 19th Avenue Alternative Part "A" and Part "B" Routing



Source: METRO I-10 West Study Team 2009

5.2.1 BRT on I-17

Utilizing the I-17 alignment, BRT vehicles operating Part "A" service would exit the exclusive guideway within the I-10 median via a connecting overpass serving as a busway at I-17, then travel south to operate in mixed traffic along Jefferson Street (eastbound) and Washington Street (westbound).

Buses using the Adams/Jefferson Street interchange under the existing I-17 configuration would be likely to experience some congestion if the vehicles mix with general traffic as they negotiate the interchange signals. Possible remedies include special bus-only lanes or the use of the I-17 frontage road system rather than the mainline general purpose lanes.

Buses operating Part "B" service in this alternative would stay in the exclusive guideway until the buses reach the 5th/3rd Avenue HOV ramps. Buses in the exclusive guideway east of I-17 would not need to cross the HOV lanes into the I-10 general purpose lanes, but would instead be forced to exit at 5th Avenue. Future analysis during the engineering phase of the project could indicate cost savings by terminating the exclusive guideway farther west and having the Part "B" service use the I-10 HOV lanes to complete the route. This would eliminate the need to construct a guideway on structure once the I-10 median ends west of I-17.

5.2.2 BRT on 19th Avenue

Utilizing the 19th Avenue alignment, BRT vehicles operating Part "A" service would remain in the exclusive guideway within the I-10 median until 19th Avenue, where at that time, the vehicles would exit the median via a connecting busway to ground level around 17th Avenue. The BRT vehicles would then circle back to 19th Avenue utilizing a local street, either Culver Street to the north or Latham Street to the south. In either case, a BRT station would be located at ground level near 19th Avenue and I-10. The Part "A" service buses would then operate in mixed traffic on 19th Avenue to Jefferson Street.

Another feature of the 19th Avenue alignment operating Part "A" service would be that the structure down to ground level would likely represent the eastern terminus of the exclusive guideway. After providing sufficient width for the structure to descend to ground level, there would not be sufficient width in the median to continue eastward toward the 5th/3rd Avenue ramps for Part "B" service. As such, Part "B" service would operate in the I-10 HOV lanes between 19th Avenue and the 5th/3rd Avenue ramps.

Buses utilizing 19th Avenue could benefit from one or more bus "queue jump" lanes, allowing the buses to bypass traffic in the general purpose lanes. While specific locations for such treatments have not been evaluated at this stage of the process, they could benefit arterial BRT operations during peak hours. Queue jump treatments could also be applied at signalized intersections along portions of the BRT alignment, such as along 5th/3rd Avenue (for Part "B" service) or the Washington/Jefferson Couplet. Queue jump lanes could require additional ROW wherever they are installed.

5.3 Detailed Evaluation of BRT Alternatives

As previously described, the two BRT Alternatives differ only in terms of how the Part "A" service, which serves the State Capitol prior to continuing into downtown Phoenix and Central Station, would travel between the exclusive guideway and the State Capitol. The primary differences between the two BRT Alternatives were in the following areas:

- Cost
- Safety
- Peak Period Travel Time and Reliability
- Areas Served between I-10 and the State Capitol

For each of these discriminators, the two alternatives were evaluated to assist in the identification of the most optimal alignment.

5.3.1 Cost

While the cost of each BRT alternative was not computed in detail, there were fundamental differences with respect to the engineered components that should indicate a clear difference in cost once actual estimates are made.

The I-17 Alternative would include an exclusive guideway within the I-10 median to approximately the I-10/I-17 interchange. Buses would exit the exclusive guideway via a connecting overpass serving as a busway to reach southbound I-17. Once on I-17, the buses would exit at the Adams/Jefferson Street interchange. In addition to the exclusive guideway, this alternative requires the construction of the connecting busway.

The 19th Avenue Alternative would also require a new structure at I-10 and 19th Avenue for buses to travel between the exclusive guideway and ground level, a difference of about 25 feet. While the engineering of this structure is not complex, it comes with a cost for an additional engineered roadway to exit the freeway. Also, new pavement could be required for buses to travel between the end of this ramp (at ground level) and 19th Avenue, either on the local streets near I-10 (such as Culver Street to the north or Latham Street to the south) that might not have been designed to carry the weight of the buses. This structure would extend a further distance compared to the busway in the I-17 Alternative, therefore resulting in a higher cost for the 19th Avenue option.

The cost of the exclusive guideway between I-17 and 19th Avenue was not considered an additional cost to the 19th Avenue Alternative (compared to the I-17 Alternative) because that portion of the exclusive guideway would presumably still be constructed to accommodate the Part “B” service, regardless of which North-South alignment is chosen.

As a result of these considerations, **the I-17 Alternative has a slight cost advantage** over the 19th Avenue Alternative.

5.3.2 Safety

This brief safety evaluation was based on the premise that a busway within the I-10 median presents a safer operating environment for BRT operators and transit riders than the HOV and general purpose lanes. This premise was further founded on the facts that the busway is a barrier-separated environment which reduces the interaction between the BRT service and general traffic.

An exclusive busway connecting either the I-17 or 19th Avenue Alternatives would ensure buses would not have to travel on the freeway with mixed traffic. These connection options thereby reduce the possibilities of collisions with freeway traffic when making the transfer from the I-10 median to southbound I-17. The buses would mix with general traffic once they reach street level in both alternatives. Therefore, the safety risk of operating in mixed traffic (or adjacent to mixed traffic without a barrier) on arterials was not a discriminator between the BRT Alternatives.

This brief safety comparison appears to indicate that both **the 19th Avenue Alternative and the I-17 Alternative are comparable in terms of safety.**

5.3.3 Peak Period Travel Time and Reliability

Peak period travel time was important in this evaluation because transit riders desire a rapid, reliable transit service from the West Valley to the State Capitol and downtown Phoenix. Both alternatives would have the same number of stations located between 79th Avenue and the State Capitol, including a downtown station as the service leaves the freeway. Several factors

were examined to determine the difference between travel time and reliability for the alternatives.

In the I-17 Alternative, the Part "A" service utilizing the general purpose lanes on I-17 would introduce substantial opportunities for those buses to be affected negatively by peak period highway congestion. Such congestion not only increases travel times, but it also reduces the reliability and consistency from one day to the next. For example, if the highways are operating around 40 mph one day but only 20 mph the next day, that part of the trip takes twice as long on the second day. Transit riders who need to arrive at their destination at a particular time will base their decision of whether to ride the bus or drive based on the longer travel time.

In contrast, the 19th Avenue Alternative would stay in the exclusive guideway until traveling in mixed traffic along 19th Avenue, thereby avoiding any potential highway congestion and benefiting from both minimum travel time and maximum reliability. The small amount of "back-tracking" required for buses to get back to 19th Avenue, as well as the possibility of using Culver Street to the north (or Latham Street to the south) of I-10, would introduce a small amount of additional travel time. Additional travel time would be increased by the addition of a station north of I-10 to access the State Fairgrounds.

Although the buses would operate in mixed traffic on the arterial portions of each BRT Alternative, the distance that the buses would travel on the arterial portions differ greatly. The distance of the arterials used in the 19th Avenue Alternative is about twice as long as the distance of the I-17 Alternative.

Combining the evaluation of these alternatives with respect to both travel time (slight advantage for I-17) and reliability (slight advantage for 19th Avenue), **the 19th Avenue Alternative and the I-17 Alternative** rate equally in terms of reliability during peak period travel.

5.3.4 Areas Served Between I-10 and the State Capitol

High capacity transit has the potential to help create conditions in which private investment can occur on the land around stations. At this time, one BRT station is envisioned on each of the remaining BRT Alternatives, between I-10 and the State Capitol.

It was expected that the I-17 Alternative would have a station in the vicinity of Adams Street and I-17, at street level (as opposed to on I-17), that serves the residential and industrial land uses in the immediate area. Connections to future bus service on I-17 or other routes are possible, but not necessarily envisioned at this time. The land uses in the vicinity of this proposed station area are low-density, and there are no significant existing or planned activity centers for transit riders in the area.

The 19th Avenue Alternative would have a station near the I-10 and 19th Avenue interchange, probably located on the north side of I-10 in order to facilitate connections with bus service on Grand Avenue, 19th Avenue, and McDowell Road. This station would also be in the vicinity of the Arizona State Fairgrounds, which hosts large events several times per year and has been discussed as a potential future urban infill redevelopment site. This station would also be located near several commercial establishments and the single-family residential neighborhoods Encanto to the north and F.Q Story to the east.

As a result of this basic comparison, **the 19th Avenue Alternative has a slight advantage in areas served** over the I-17 Alternative.

5.3.5 BRT Alternatives Evaluation Summary

The four key discriminators examined for the BRT Alternatives are summarized as follows:

Criterion	I-17 Alternative	19th Avenue Alternative
Cost	**Slight Advantage**	
Safety	Equally Ranked	Equally Ranked
Peak Period Travel Time and Reliability	Equally Ranked	Equally Ranked
Areas Served Between I-10 and the State Capitol		**Slight Advantage**

In addition to this qualitative comparison, public and stakeholder comments have indicated that the station area served by the 19th Avenue Alternative would be substantially preferred than the station area served by the I-17 Alternative. Further evaluation of these two Alignment Alternatives will occur during the subsequent Final Definition of Alternatives planning phase.

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6.0 ALTERNATIVES REMAINING AFTER TIER 2 DETAILED EVALUATION

The purpose of this chapter is to define the following alternatives remaining after the Detailed Tier 2 Evaluation for the I-10 West AA/EIS Study:

- No-Build
- Draft Baseline/TSM Alternative
- Build LRT Alternatives
- Build BRT Alternatives

The first part of this section identifies features common to all remaining alternatives. These alternatives will be evaluated and screened in the next phase of the I-10 West AA/EIS Study.

The Build LRT and BRT Alternatives remaining after the Tier 2 Evaluation described in Chapters 4 and 5 were subjected to additional analysis to determine the best configurations to be carried forward for final LPA refinement. This additional analysis considered in detail the performance results outlined in Chapters 4 and 5, focusing on the **key discriminators** between alternatives, and produced a ranking of the remaining alternatives. This ranking process can be considered the "results" of the Tier 2 Evaluation, in the sense that it indicated the best-performing LRT and BRT alternatives to be carried forward for final evaluation. **Whether only the single best alignment or multiple alternatives for each technology will be analyzed has not been determined at this time**.

6.1 Features Common to All Alternatives

This section describes improvements that would apply to the No-Build, Baseline/TSM, and Build Alternatives, including an overview of transportation improvements identified in the MAG RTP and operation policies and service hours common to all alternatives.

6.1.1 MAG 2030 Regional Transportation Plan

The MAG 2030 RTP (2007a) identifies improvements that were programmed to the year 2026. This section provides an overview of improvements that were identified in the highway network, transit network, and transit passenger facilities.

6.1.1.1 Highway Improvements

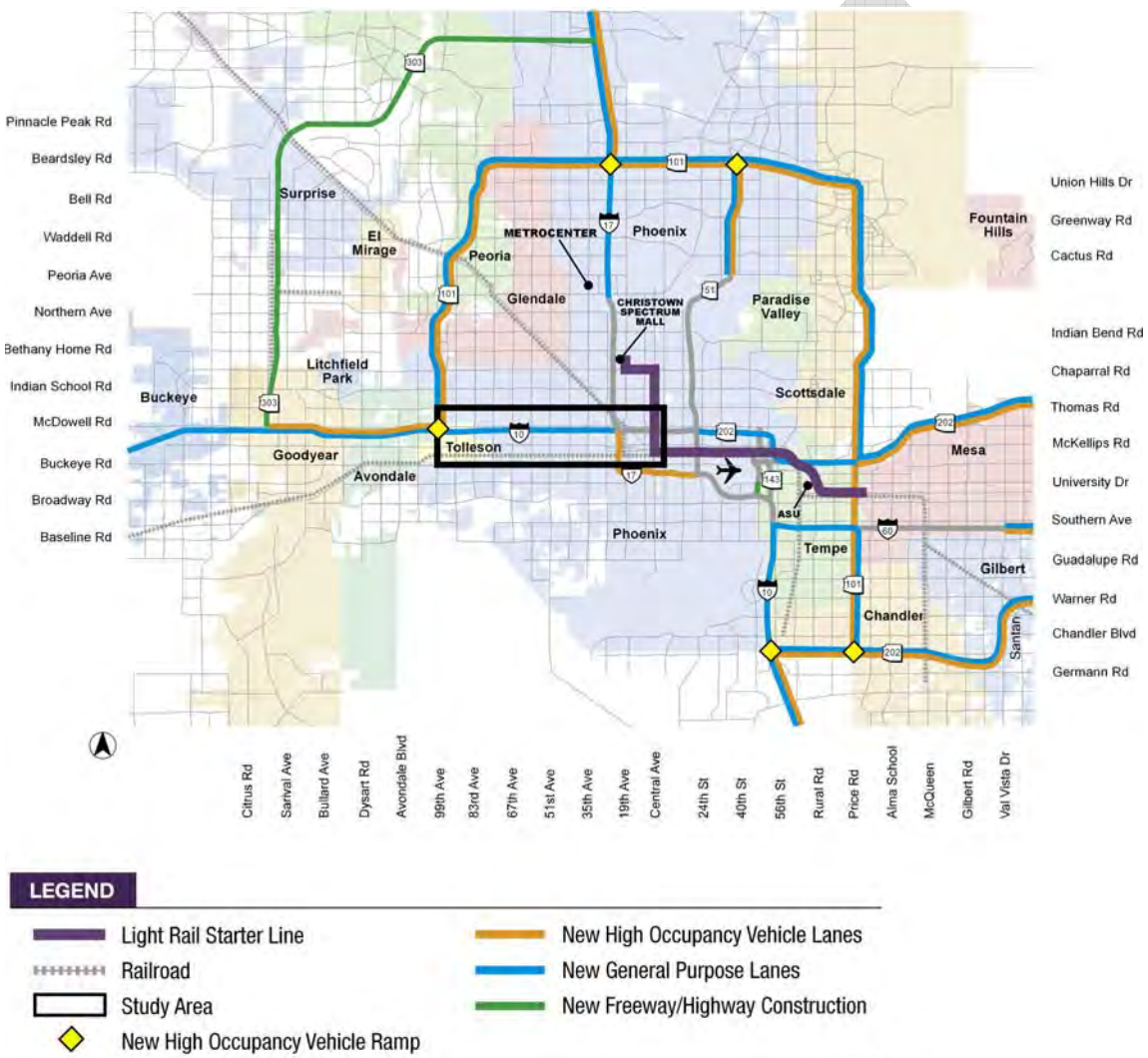
In anticipation of projected population and employment growth, several large-scale highway improvement projects either fall within the I-10 West Corridor or would directly impact traffic conditions within the study area. The proposed projects are illustrated in Figure 6-1.

- **ADOT I-10 Freeway Expansion** – A Design Concept Study commenced in August 2007 for the proposed addition of general purpose lanes in each direction along I-10 between Loop 101 and I-17. This study will evaluate the build-out scenario for I-10, but will also

scope a project for ADOT's fiscal year (FY) 2010, where $68 million is budgeted for improvements in the RTP. This FY 2010 project is expected to be complete in 2012.

- **ADOT Loop 101 to I-10 HOV Direct Connector** – This project, scheduled for FY 2025, would add an HOV direct connector ramp at the Loop 101/I-10 interchange and would include the south-to-east and west-to-north HOV ramp movements. Preliminary study is currently under way to determine how the interchange could be modified to include this ramp, since the freeway was not originally designed to accommodate the direct connector ramp.

Figure 6-1 Proposed Highway Improvements in the MAG Region



Source: MAG 2007

The 2007 MAG *FY 2008 – 2012 Transportation Improvement Program* identifies several transportation improvement projects within the I-10 West AA/EIS Study area. However, improvement projects identified within the I-10 West study area were limited to intersection widening and general improvement projects that would not affect HCT improvements proposed within the study area.

6.1.1.2 Passenger Facilities/Stations

The RTP identifies a total of seven PnR facilities that were programmed by the year 2030. Table 6-1 identifies the programmed PnR facilities including fiscal year of operation and the routes served at each facility. Figure 6-2 depicts the locations of each facility.

Table 6-1 Programmed Park-and-Ride Facilities

PnR	Fiscal Year of Operation	Routes Served
79th Avenue PnR	In Operation	-Route 17 -Route 560 -I-10 West
Glendale PnR	In Operation	-Route 70 -Route 573
Goodyear PnR	In Operation	- Papago Freeway Connector (FY 2009)
Surprise PnR	In Operation	- Route 571 - Surprise-Scottsdale Express - Grand Avenue Limited (FY 2013 Expansion) - Bell Road Supergrid (FY 2019) - Loop 303 Express (FY 2023)
East Buckeye PnR	2011	- Papago Freeway Connector (FY 2009) - Buckeye Express (FY 2015)
Peoria PnR	2013	- Route 106 - 83rd/75th Avenue Supergrid (FY 2023) - Peoria Express (FY 2014)
Loop 303 PnR (at Northern Avenue)	2023	- Loop 303 Express (FY 2023)

Source: MAG 2007

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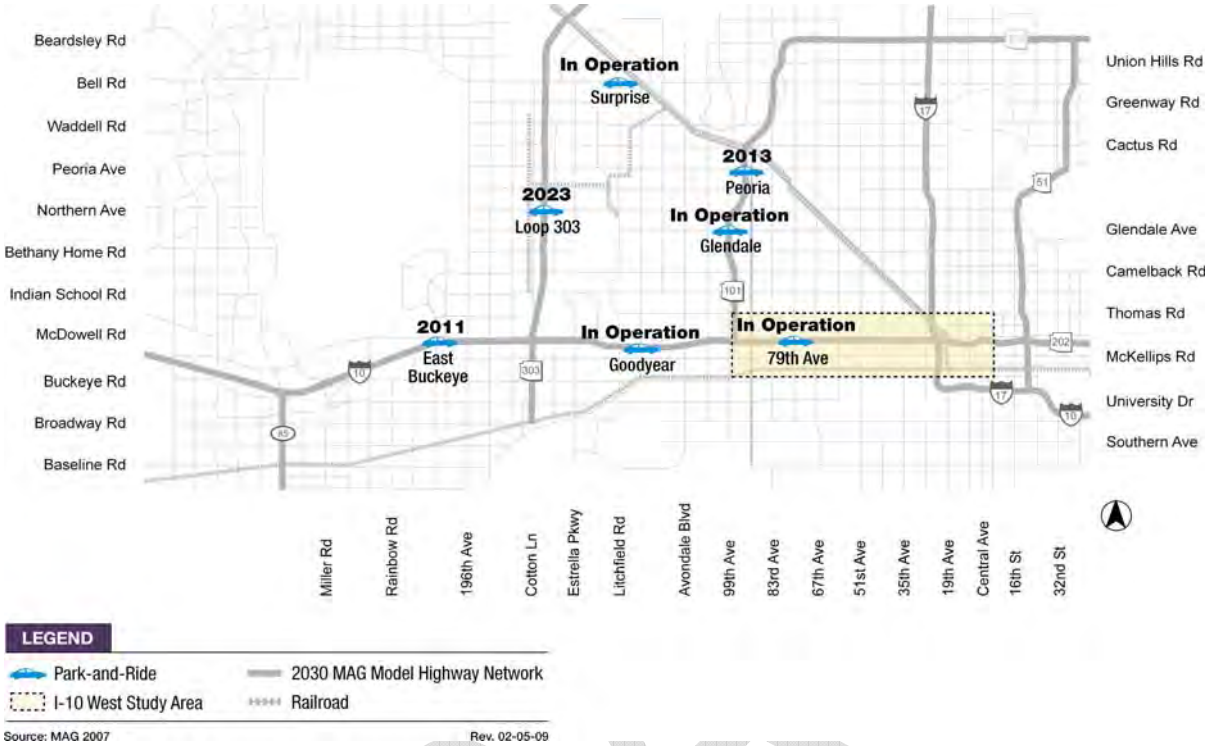
Figure 6-2 Programmed Park-and-Ride Facilities



6.1.1.3 Transit Service Modifications

The transit network for each alternative includes all improvements identified in the MAG RTP. The transit network is comprised of fixed route bus service and HCT.

6.1.1.3.1 Fixed Route Bus Service

According to the MAG 2030 RTP, by 2026, a total of 22 local bus routes will operate in the I-10 West study area including 3 circulators, 18 local bus routes, and 1 regional connector. Circulators are a city-funded free fare bus service that provides access to various activity and local bus routes within the study area. Local bus routes provide arterial transit service on the study area's one-mile grid network of streets. The regional connector provides service from the rural communities of Ajo and Gila Bend, approximately 50 miles southwest of downtown Phoenix, to the Desert Sky Mall Transit Center, allowing connections throughout the valley.

The MAG RTP also includes 6 new express routes in operation within the I-10 West study area by the year 2030:

- I-10 West RAPID – This service commenced operation in 2006 and provides peak period express service between the Desert Sky Mall, the 79th Avenue PnR, and downtown Phoenix.
- Arrowhead-Downtown Phoenix Express – This service commenced in 2008, providing peak period express service to downtown Phoenix from the following locations: 75th Avenue & Beardsley Road; Arrowhead Towne Center; and the Glendale PnR.

- Papago Freeway Express – This service will begin in 2009 and will provide peak period express service between downtown Phoenix from the following locations: East Buckeye PnR and the Goodyear PnR.
- Peoria Express – This service will begin in 2014 and will provide peak period express service between downtown Phoenix from the following locations: Peoria PnR and Glendale PnR.
- Buckeye Express – This service will begin in 2015 and will provide peak period express service between downtown Phoenix and the following locations: West Buckeye; East Buckeye PnR; and Goodyear PnR.
- Avondale Express – This service will begin in 2020 and will provide peak period express service between downtown Phoenix, a transit center at 43rd Avenue and I-10, and the Goodyear PnR.
- Loop 303 Express – This service will begin in 2023 and will provide peak period express service between downtown Phoenix and the following locations: Arrowhead Transit Center; 99th Avenue & Bell Road; Sunrise Municipal Complex; Surprise PnR; Loop 303 PnR (at Northern Avenue); and the Goodyear PnR.

Table 6-2 identifies all programmed fixed route service within the I-10 West study area including the route number, description, and headways.

Table 6-2 Programmed Fixed Route Service

Valley Metro Route No.	Description	Fiscal Year of Operation	Programmed Headways		Daily Trips
			Peak	Off-peak	
Express					
460	I-10 West RAPID	In Operation	10	N/A	25
560	Avondale Express	2020	30	N/A	16
561	Papago Freeway Express	In Operation	30	N/A	8
562	Buckeye Express	2015	30	N/A	6
573	Arrowhead-Downtown Express	In Operation	30	N/A	12
575	Peoria Express	2014	30	N/A	12
579	Loop 303 Express	2023	30	N/A	8
Local Bus/Supergrid Routes[1]					
1	Washington Street	In Operation	30	30	67
3	Van Buren Street[2]	2020	15	30	138
8	7th Avenue[2]	In Operation	30	30	66
10	Roosevelt Street	In Operation	15	30	77
13	Buckeye Road[2]	2021	30	30	72
15	15th Avenue	In Operation	30	30	66
17	McDowell/McKellips Road[2]	2014	15	30	88
19	19th Avenue[2]	In Operation	15	30	128
27	27th Avenue	In Operation	30	30	73
29	Thomas Road[2]	2020	10	20	138
35	35th Avenue[2]	In Operation	20	30	89
43	43rd Avenue	In Operation	30	30	72
51	51st Avenue	In Operation	35	35	56
59	59th Avenue[2]	2020	30	30	68

Valley Metro Route No.	Description	Fiscal Year of Operation	Programmed Headways		Daily Trips
			Peak	Off-peak	
67	67th Avenue	In Operation	30	60	63
75	75th Avenue[2]	2023	30	30	72
83	83rd Avenue	In Operation	30	30	68
131	START	In Operation	60	60	34
685	Gila Bend Connector	In Operation	N/A	N/A	8
Shuttle/Feeder Service					
DASH-G	DASH – Government Loop	In Operation	12	12	60
DASH-D	DASH – Downtown Loop	In Operation	12	12/20	65
MARY	Maryvale Circulator	In Operation	30	30	68

Source: MAG 2007
DASH = [Phoenix] Downtown Area Shuttle; MARY = Maryvale Area Ride for You
Note: Headways are in minutes
[1] Routes 3, 13, 17, 29, and 59 currently operate locally funded service. These routes will be modified to supergrid service which will provide consistent levels of service throughout the MAG region.
[2] Denotes supergrid service

6.1.1.3.2 Light Rail Transit / High Capacity Transit

In December 2008, the 20-mile CP/EV LRT Starter Line commenced operation providing service between Montebello Avenue/19th Avenue (Phoenix), downtown Phoenix, Phoenix International Airport, downtown Tempe/ASU, and Main Street/Sycamore (Mesa). In addition to the 20-mile CP/EV LRT Starter Line, the MAG RTP identifies an additional 37.7 miles of HCT, including an 11-mile extension along I-10 from 79th Avenue to the CP/EV LRT Starter Line in downtown Phoenix. Table 6-3 identifies the high capacity transit corridors including the fiscal year of operation and Figure 6-3 depicts the 57.7-mile HCT system.

Table 6-3 Programmed LRT/HCT Corridors

Route	Year of Operation	Transit Technology[1]
CP/EV LRT Starter Line	2008	LRT
Northwest Extension – Phase 1	2012	LRT
Central Mesa	2015	HCT
Tempe South	2015	HCT
Glendale	2017	HCT
Northwest Extension – Phase 2	2017	HCT
I-10 West	2019	HCT
Northeast Phoenix	2025	HCT

Source: MAG 2007
[1]Transit Technologies: LRT=Light Rail Transit; HCT=High Capacity Transit, (transit mode was not specifically defined)

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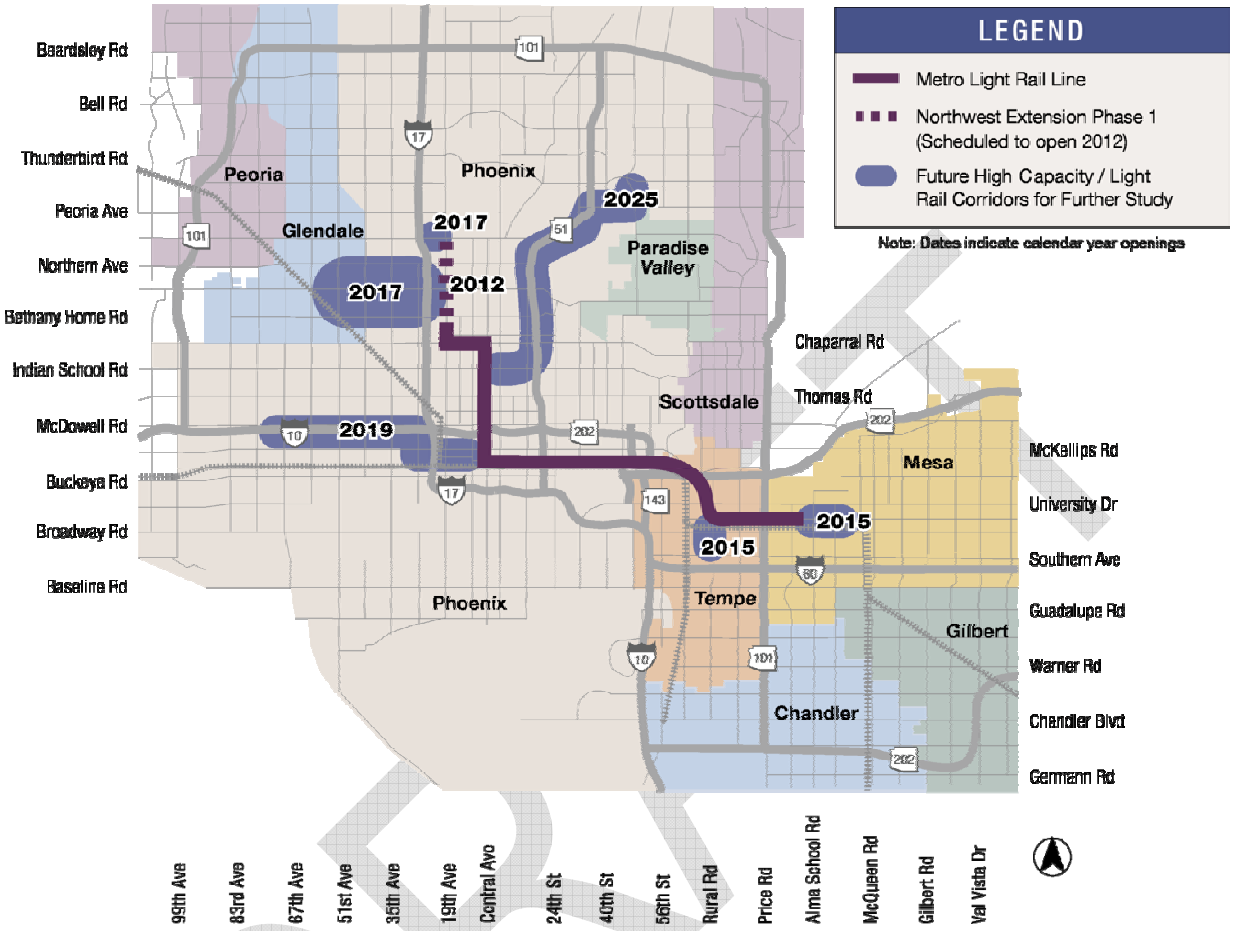
Figure 6-3 METRO 57.7-Mile Programmed Light Rail Transit/HCT Corridors



Source: MAG 2007

6.1.2 Operating Policy

Operating policies for all alternatives relating to service coverage, loading standards, fare structure, and service types would be consistent with those policies that were adopted by Phoenix Public Transit and Valley Metro.

6.1.3 Service Hours

The service hours for all the alternatives would be consistent with the services hours adopted by Phoenix Public Transit and Valley Metro.

6.2 No-Build Alternative

The No-Build Alternative describes a no-action plan in order to estimate travel conditions without operation of an HCT corridor in the I-10 West study area. This section describes the modifications that would be made to the 2030 MAG RTP in the No-Build Alternative to provide a benchmark for measuring improvements in the Baseline/TSM and Build Alternatives. The

refinements made in the No-Build Alternative will also be used by both the Baseline/TSM and Build Alternatives.

6.2.1 Highway Network

The No-Build Alternative would include all highway improvements that were identified in Section 6.1.1.1, including the completion of HOV lanes along I-10 from downtown Phoenix westward to Loop 303, as well as an HOV direct connector ramp at the Loop 101/I-10 interchange that would include the south-to-east and west-to-north HOV ramp movements.

6.2.2 Passenger Facilities/Stations

The No-Build Alternative would include all PnR facilities that were currently programmed in the RTP listed in Table 6-1.

6.2.3 Transit Service Modifications

6.2.3.1 Fixed Route Bus Service

The No-Build Alternative would include all fixed route bus service (local and express) that is currently programmed in the RTP. A stop was removed from routes 560 and 561 at 43rd Avenue and I-10 due to the removal of the HCT transit line between 79th Avenue and downtown Phoenix. Table 6-4 identifies the routes within the I-10 West study area and includes a description of each route, programmed headway and No-Build headway. Figure 6-4 identifies the No-Build express bus configuration to downtown Phoenix.

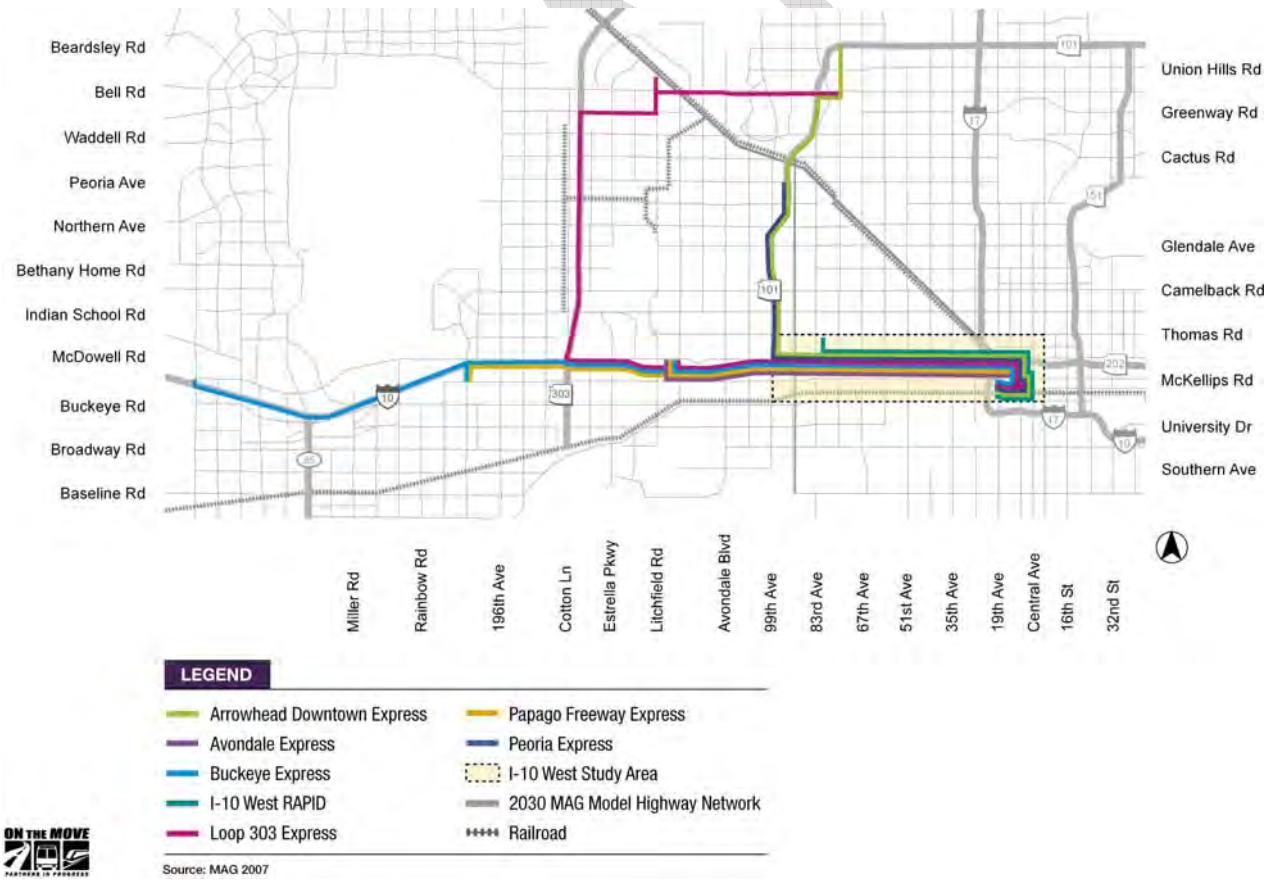
Table 6-4 No-Build Fixed Route Bus Service

Route No.	Description	Programmed Headway		No-Build Headway		Modifications for No-Build
		Peak	Off-Peak	Peak	Off-peak	
Express Bus						
460	I-10 West RAPID	10	N/A	10	N/A	~No Change
560	Avondale Express	30	N/A	30	N/A	~Stop removed at 43rd Avenue & I-10
561	Papago Freeway Express	30	N/A	30	N/A	~Stop removed at 43rd Avenue & I-10
562	Buckeye Express	30	N/A	30	N/A	~No Change
573	Arrowhead-Downtown Express	30	N/A	30	N/A	~No Change
575	Peoria Express	30	N/A	30	N/A	~No Change
Local Bus/Supergrid						
1	Washington Street	30	30	30	30	~No Change
3	Van Buren Street	15	30	15	30	~No Change
8	7th Avenue	30	30	30	30	~No Change
10	Roosevelt Street	15	30	15	30	~No Change
13	Buckeye Road	30	30	30	30	~No Change
15	15th Avenue	30	30	30	30	~No Change
17	McDowell/McKellips Road	15	30	15	30	~No Change
19	19th Avenue	15	30	15	30	~No Change
27	27th Avenue	30	30	30	30	~No Change

Route No.	Description	Programmed Headway		No-Build Headway		Modifications for No-Build
		Peak	Off-Peak	Peak	Off-peak	
29	Thomas Road	10	20	10	20	~No Change
35	35th Avenue	20	30	20	30	~No Change
43	43rd Avenue	30	30	30	30	~No Change
51	51st Avenue	35	35	35	35	~No Change
59	59th Avenue	30	30	30	30	~No Change
67	67th Avenue	30	60	30	60	~No Change
75	75th Avenue	30	30	30	30	~No Change
83	83rd Avenue	30	30	30	30	~No Change
131	START	60	60	60	60	~No Change
685	Gila Bend Connector	180	180	180	180	~No Change
Shuttle/Feeder Service						
DASH-G	DASH – Government Loop	12	12	12	12	~No Change
DASH-D	DASH – Downtown Loop	12	12/20	12	12/20	~No Change
MARY	Maryvale Circulator	30	30	30	30	~No Change

Source: METRO I-10 West Study Team 2008.
Note: Headways are in minutes

Figure 6-4 Programmed Express Bus Routes by Year 2030



6.2.3.2 High Capacity Transit

The No-Build Alternative would include all HCT improvements that were programmed in the MAG RTP with the exception of the 11-mile HCT line between 79th Avenue and downtown Phoenix, defined as the I-10 West Corridor.

6.3 Draft Baseline/TSM Alternative

The Draft Baseline/TSM Alternative would include highway and transit modifications to provide a low-cost alternative to adding a fixed HCT guideway. This section describes the Draft Baseline/ TSM Alternative, which has evolved from the Express Bus in HOV Lanes Alternative carried forward during Tier 1. The increase in existing express bus frequencies and improvements to existing capital facilities (e.g., the 79th Avenue drop ramp) are described in this section.

6.3.1 Highway Improvements

In the Draft Baseline/TSM Alternative, a set of drop ramps would be added to the west side of 79th Avenue at I-10 and connect to the existing I-10 HOV lanes. These drop ramps would be similar to the ramps that currently exist on the east side of 79th Avenue in the freeway median and would provide buses and commuters from the West Valley with direct access to the 79th Avenue PnR facility.

6.3.2 Passenger Facilities/Stations

A total of seven existing bus stops would be utilized and three median transit stations would be added to serve the I-10 West study area:

- Desert Sky Mall Transit Center (existing);
- I-10 and 79th Avenue PnR (existing);
- I-10 & 67th Avenue (new median station);
- I-10 & 51st Avenue (new median station);
- I-10 & 35th Avenue (new median station);
- Washington/Jefferson & 17th Avenue (existing);
- Washington/Jefferson & 12th Avenue (existing);
- Washington/Jefferson & 5th Avenue (existing);
- Washington/Jefferson & Central Avenue (existing); and
- Central Station located at 1st Avenue/Central Avenue and Van Buren Street (existing).

Transit connections would be available at all of the stations. Park-and-ride facilities would be located at the following I-10 interchanges: 79th Avenue, 67th Avenue, and 51st Avenue stations. These facilities would serve transit trips from the adjacent areas, which are expected to grow with in-fill development. The three proposed new median transit stations allow the commuter buses using the HOV lanes on I-10 to serve passengers using the PnR facilities or connect from other bus routes while minimizing route deviation. Minimizing deviation is crucial to

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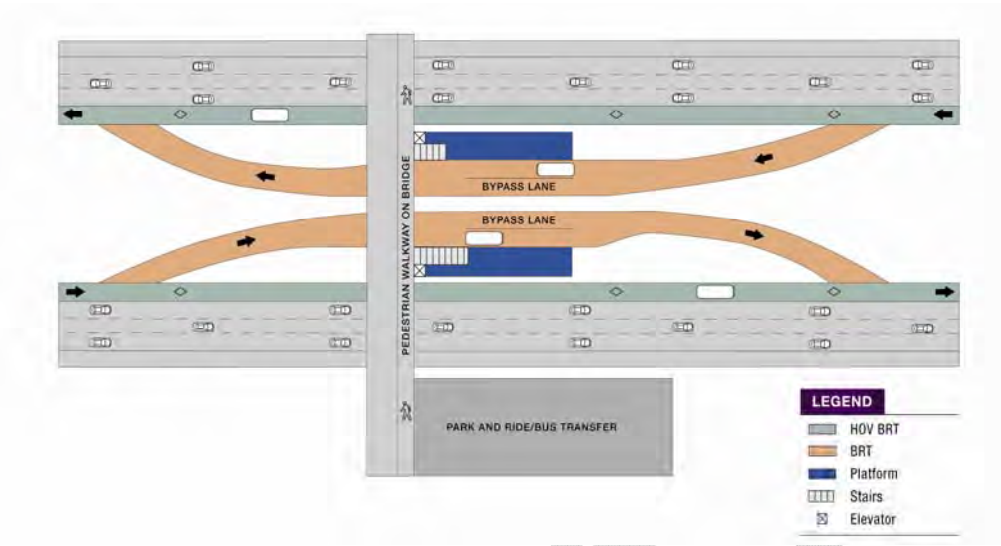
maintaining competitive travel times for bus riders on I-10. Figure 6-5 shows a representation of a typical BRT freeway median station.

Figure 6-5 Example Schematic of Median Bus Station (plan view)



Source: METRO 2009

6.3.3 Transit Service Modifications

6.3.3.1 Fixed Route/Arterial Bus Service Modifications

Several transit improvements would occur if the Final Baseline/TSM Alternative is selected. The I-10 West RAPID route would be modified to travel in an eastbound and westbound direction for peak and off-peak service with stops identified in Section 6.3.2.

Figure 6-6 identifies the proposed I-10 West RAPID route along with associated stops in both the Mainline and Downtown Sections. Headways for all local bus/Supergrid routes and shuttle/feeder service would remain the same. Route modifications are shown in Table 6-5. Figure 6-7 and Figure 6-8 identify the local bus routes that would serve the stations west of I-17.

Table 6-5 Bus Changes between No-Build and Draft Baseline/TSM Alternative

Route No.	Description	No-Build Headways		TSM Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
Express Bus						
460	I-10 West RAPID	10	N/A	10	20	~Route Modified ~Two-way Service ~EB/WB stops include: -Desert Sky Mall -79th Avenue & McDowell Road PnR -67th Avenue & I-10 PnR -51st Avenue & I-10 PnR -35th Avenue & I-10 PnR -17th Avenue & Wash/Jeff -12th Avenue & Wash/Jeff -5th Avenue & Wash/Jeff -1st Avenue/Central & Wash/Jeff -Central Station
560	Avondale Express	30	N/A	30	N/A	~No Change
561	Papago Freeway Express	30	N/A	30	N/A	~No Change
562	Buckeye Express	30	N/A	30	N/A	~No Change
573	Arrowhead-Downtown Express	30	N/A	30	N/A	~No Change
575	Peoria Express	30	N/A	30	N/A	~No Change
579	Loop 303 Express	30	N/A	30	N/A	~No Change
Local Bus/Supergrid						
1	Washington Street	30	30	30	30	~No Change
3	Van Buren Street	15	30	15	30	~Route Alignment Modified ~Additional Stop: 79th Avenue & McDowell Road PnR
8	7th Avenue	30	30	30	30	~No Change
10	Roosevelt Street	15	30	15	30	~No Change
13	Buckeye Road	30	30	30	30	~No Change
15	15th Avenue	30	30	30	30	~No Change
17	McDowell/McKellips Road	15	30	15	30	~Route Alignment Modified ~Additional Stop: 79th Avenue & McDowell Road PnR 51st Avenue & I-10 PnR
19	19th Avenue	15	30	15	30	~No Change
27	27th Avenue	30	30	30	30	~No Change
29	Thomas Road	10	20	10	20	~No Change
35	35th Avenue	20	30	20	30	~Additional Stop: 35th Avenue & I-10
43	43rd Avenue	30	30	30	30	~No Change
51	51st Avenue	35	35	35	35	~Additional Stop: 51st Avenue & I-10 PnR

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Route No.	Description	No-Build Headways		TSM Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
59	59th Avenue	30	30	30	30	~No Change
67	67th Avenue	30	60	30	60	~Additional Stop: 67th Avenue & I-10 PnR
75	75th Avenue	30	30	30	30	~Route Alignment Modified ~Additional Stop: 79th Avenue & McDowell Road PnR
83	83rd Avenue	30	30	30	30	~Route Alignment Modified ~Additional Stop: 79th Avenue & McDowell Road PnR
131	START	60	60	60	60	~No Change
685	Gila Bend Connector	180	180	180	180	~No Change
Shuttle/Feeder Service						
DASH-G	DASH – Government Loop	12	12	12	12	~No Change
DASH-D	DASH – Downtown Loop	12	12/20	12	12/20	~No Change
MARY	Maryvale Circulator	30	30	30	30	~No Change

Source: METRO I-10 West Study Team 2008.
Note: Headways are in minutes

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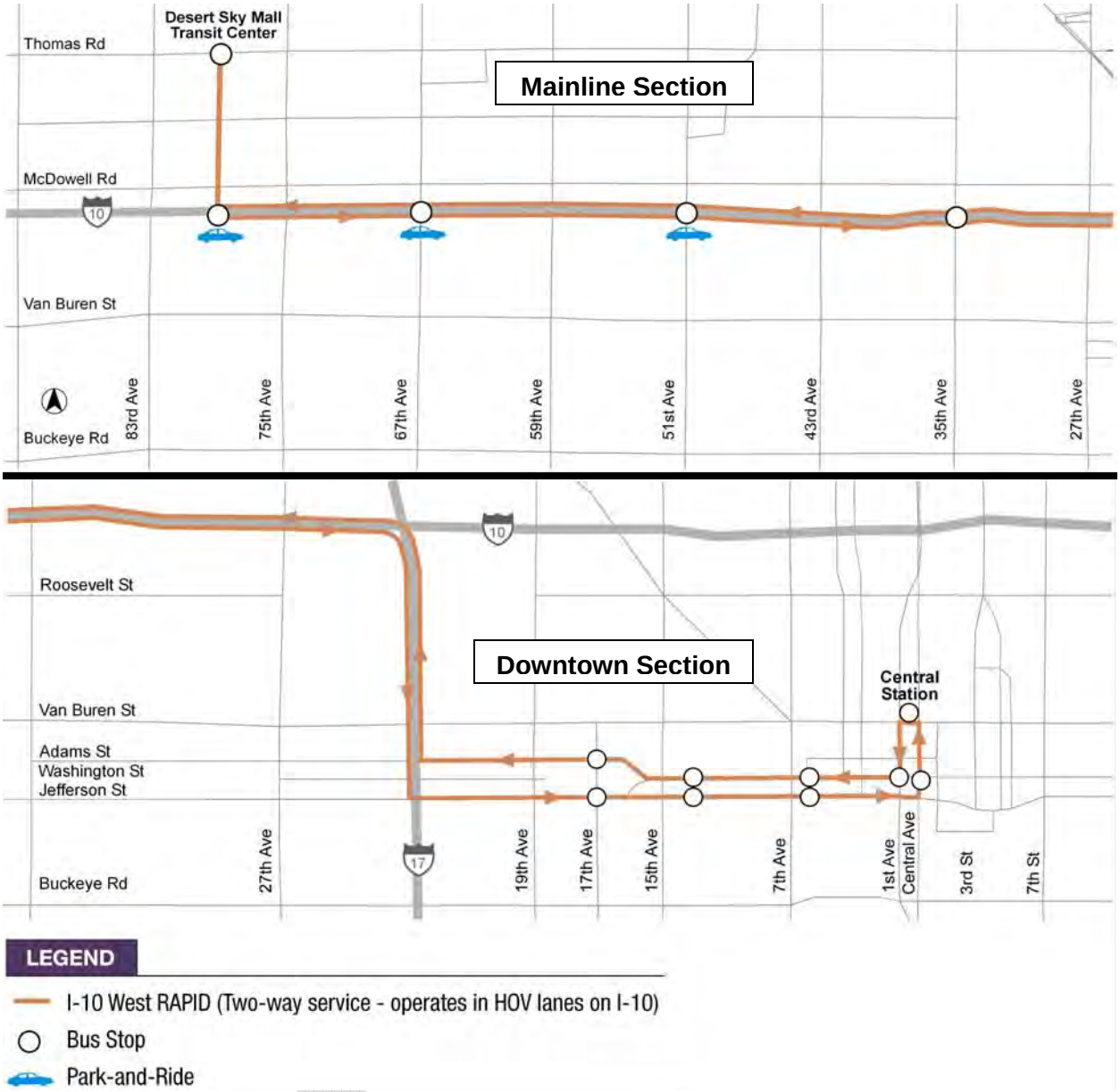
Figure 6-6 Draft Baseline/TSM Alternative I-10 West RAPID Route

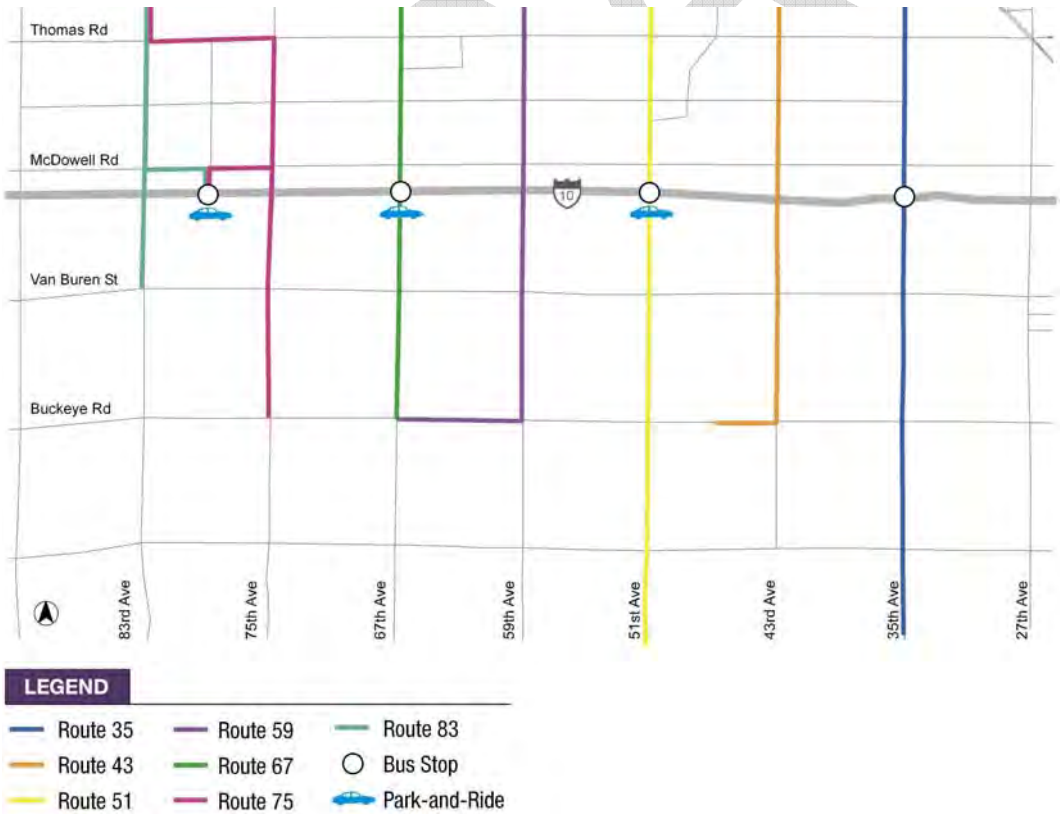


Source: METRO 2008

Figure 6-7 Mainline Section Draft Baseline/TSM Local Bus Routes (East-West Routes)

Source: METRO 2008

Figure 6-8 Mainline Section Draft Baseline/TSM Local Bus Routes (North-South Routes)



Source: METRO 2008

6.4 LRT Alternatives Recommended for Additional Evaluation Based on Tier 2 Detailed Evaluation

The following sections describe the specific components associated with each of the LRT alignment alternatives recommended for further evaluation based on Tier 2 Detailed Evaluation.

6.4.1 Highway Modifications

The following highway improvements would be applied to all LRT Alternatives:

- The drop ramps west of 79th Avenue at I-10 described for the Baseline/TSM Alternative for bus and auto access to the PnR facility would also apply to all LRT Alternatives. These drop ramps would be similar to the ramps that currently exist on the east side of 79th Avenue and would provide buses and commuters from the West Valley with direct access to the 79th Avenue PnR facility via I-10.
- An exclusive guideway would be added within the I-10 median between 79th Avenue and either I-17 or 17th Avenue (depending on the preferred north-south alignment). This guideway is not expected to result in modifications to the I-10 highway lanes at this time.
- On-line station platforms would be added as would vertical circulation elements for patrons from the transfer and parking facilities located at each station.
- A structure from the I-10 median to either I-17 or 17th Avenue. In the case of 17th Avenue, the LRT guideway would connect from the vicinity of 17th Avenue to either the 19th Avenue or Grand Avenue/15th Avenue alignment.

Figure 6-9 shows a typical cross-section of how LRT would operate in a median guideway.

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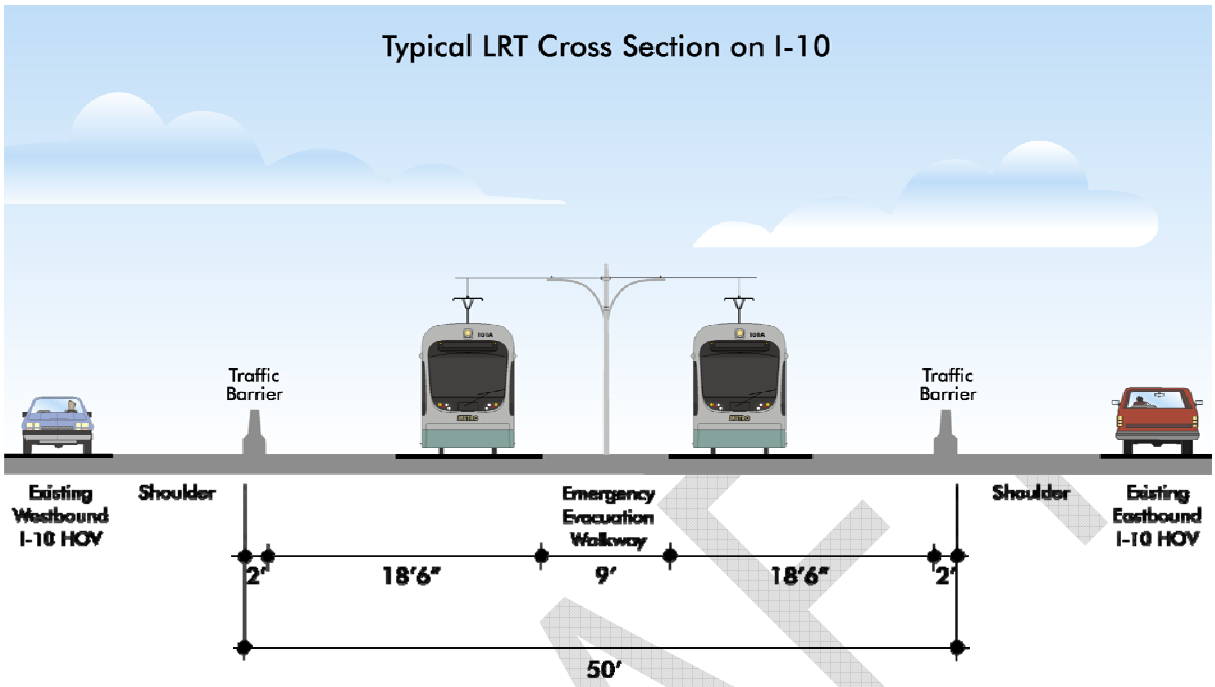
Figure 6-9 LRT Median Guideway Typical Cross-section



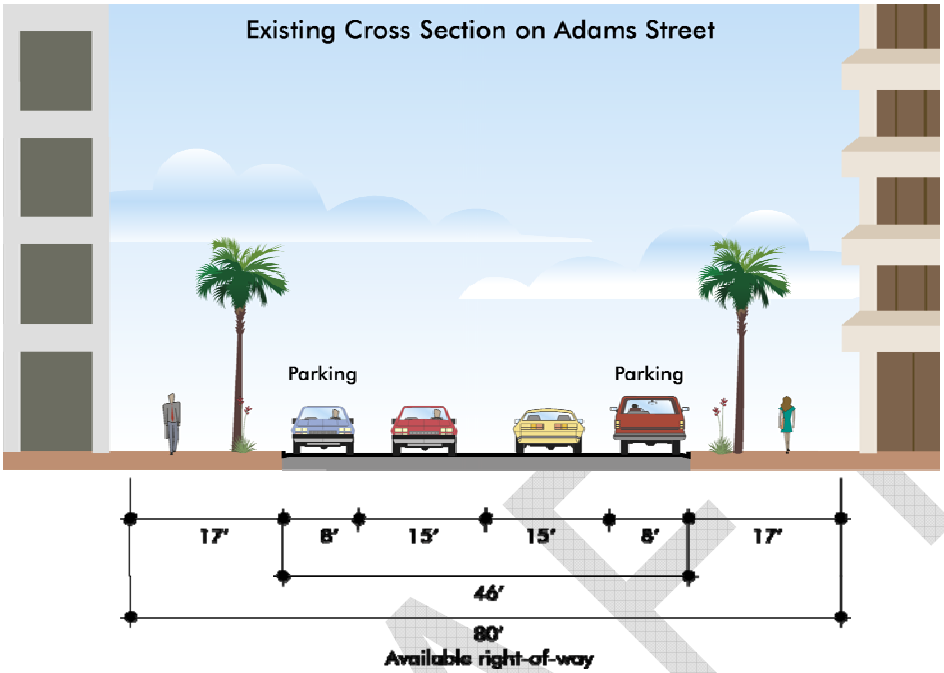
Source: I-10 West Study Team, 2009

6.4.2 Downtown Street Improvements

A guideway dedicated for LRT operations would be added on the downtown streets selected as the preferred alignment. It is highly likely that the entire street ROW would be reconstructed as part of the guideway construction. Depending on the guideway configuration, some intersections that are not signalized today could be signalized to accommodate LRT operations. Depending on the street, LRT could operate between auto traffic lanes and the sidewalk, or in the median of the street (with auto traffic on both sides). Elements related to the LRT system in downtown Phoenix would be in compliance with METRO's *Design Criteria Manual – Metro Light Rail Transit Projects* (January 2007).

The details of the connection of the I-10 West LRT guideway to the CP/EV LRT Starter Line guideway have not been defined at this time, but direct connections for all four LRT movements (I-10 West to/from Tempe/Mesa and to/from North Central) to CP/EV LRT Starter Line will be required. To meet this requirement for I-10 West light rail vehicles to be interlined with the CP/EV LRT Starter Line, track construction on one or more additional streets in the vicinity of 1st and Central Avenues could be required, depending on which Connection Option is selected. Figure 6-10, Figure 6-11, and Figure 6-12 show examples of potential LRT cross sections along Adams and Jefferson Streets in the Downtown Section.

Figure 6-10 Examples of Downtown LRT Cross-sections along Adams Street



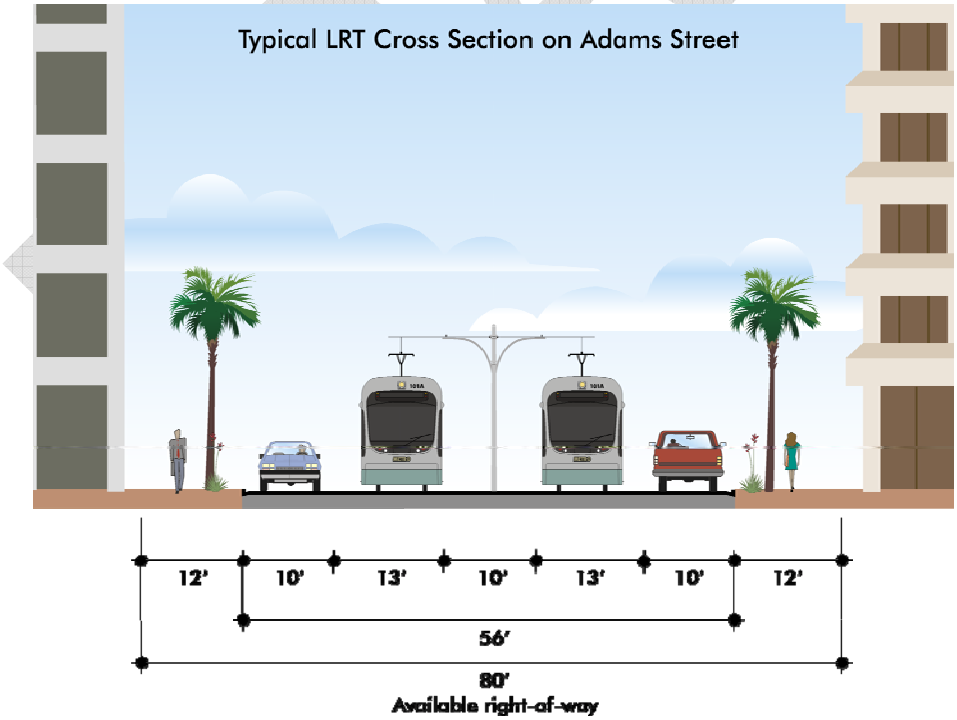
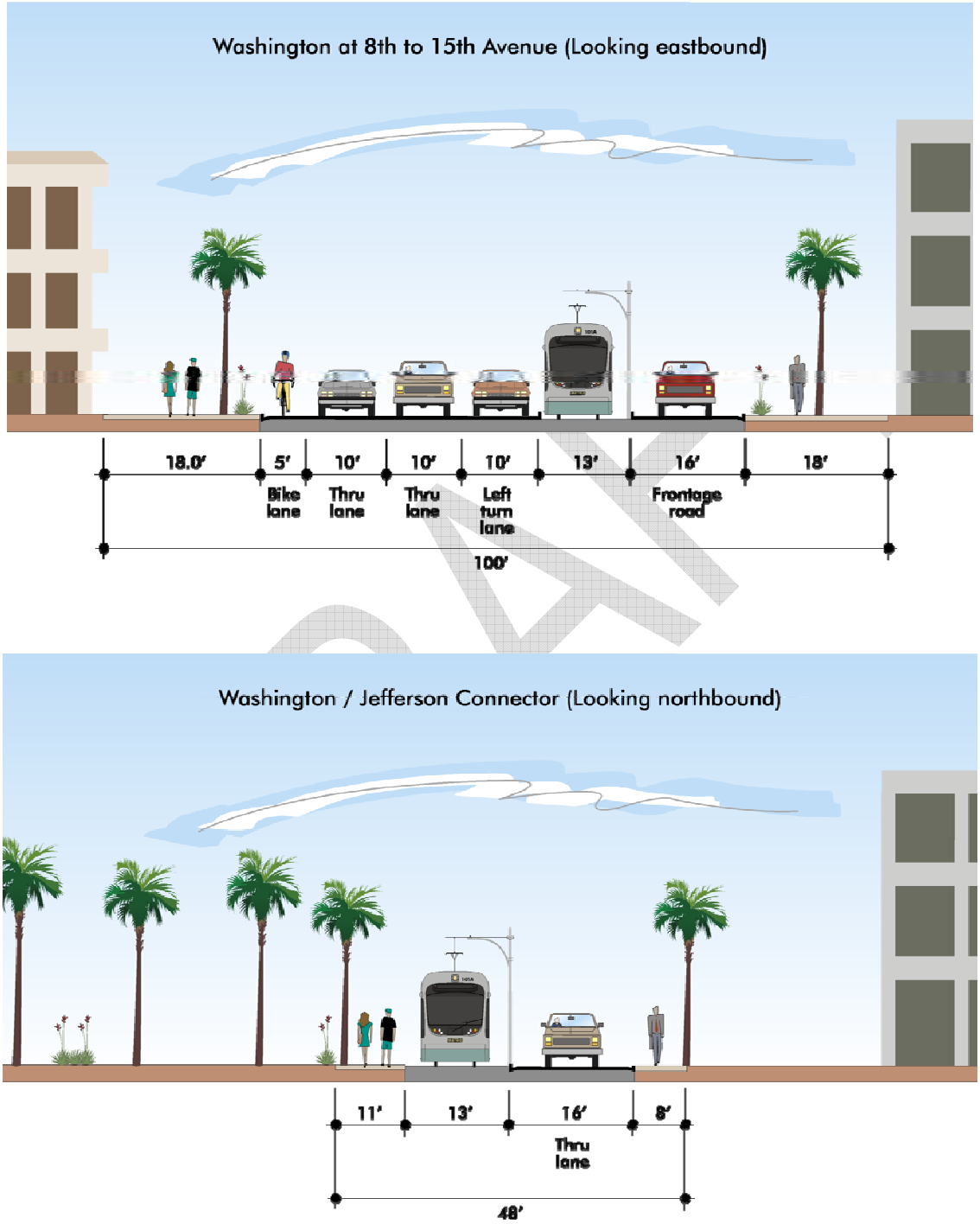
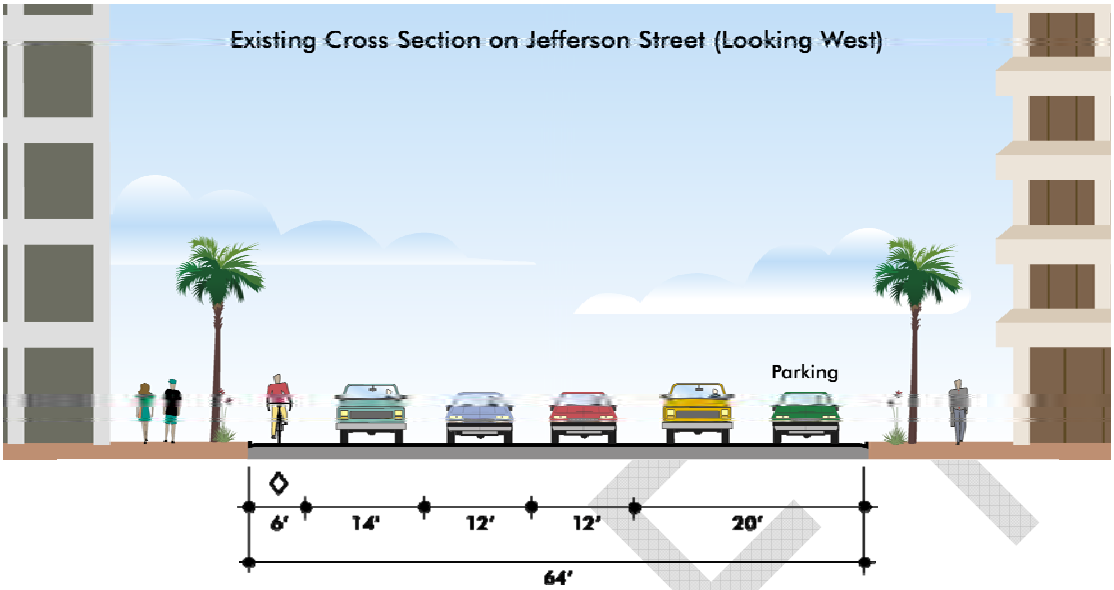


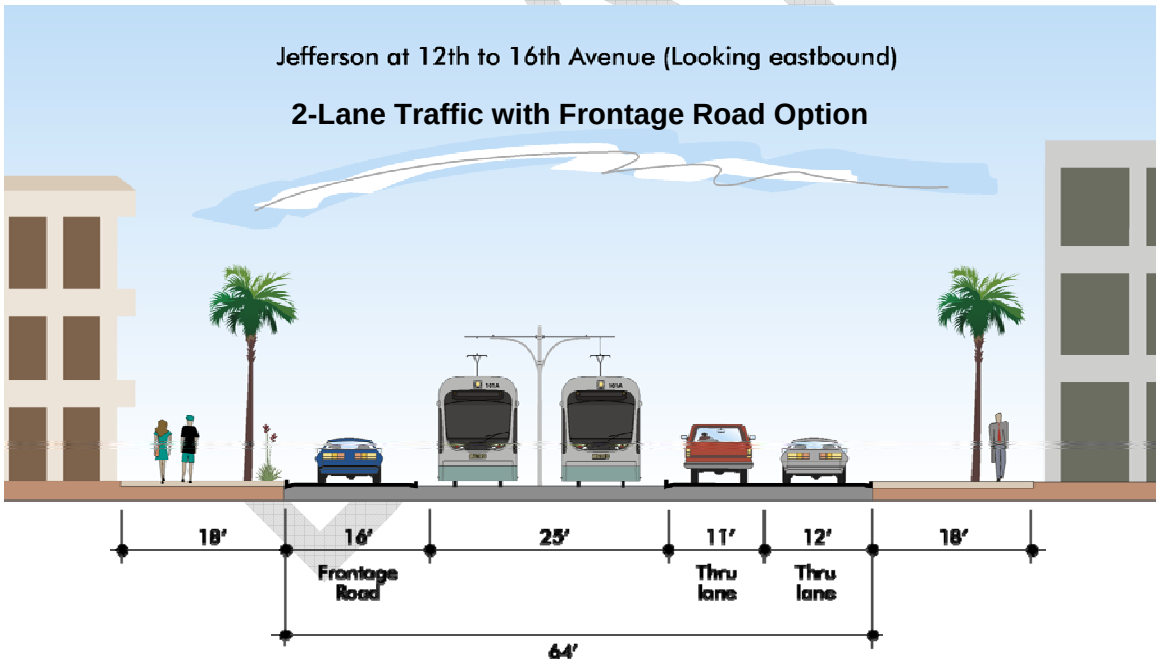
Figure 6-11 Examples of Downtown LRT Cross-sections for the Washington/Jefferson Street Couplet along Washington Street



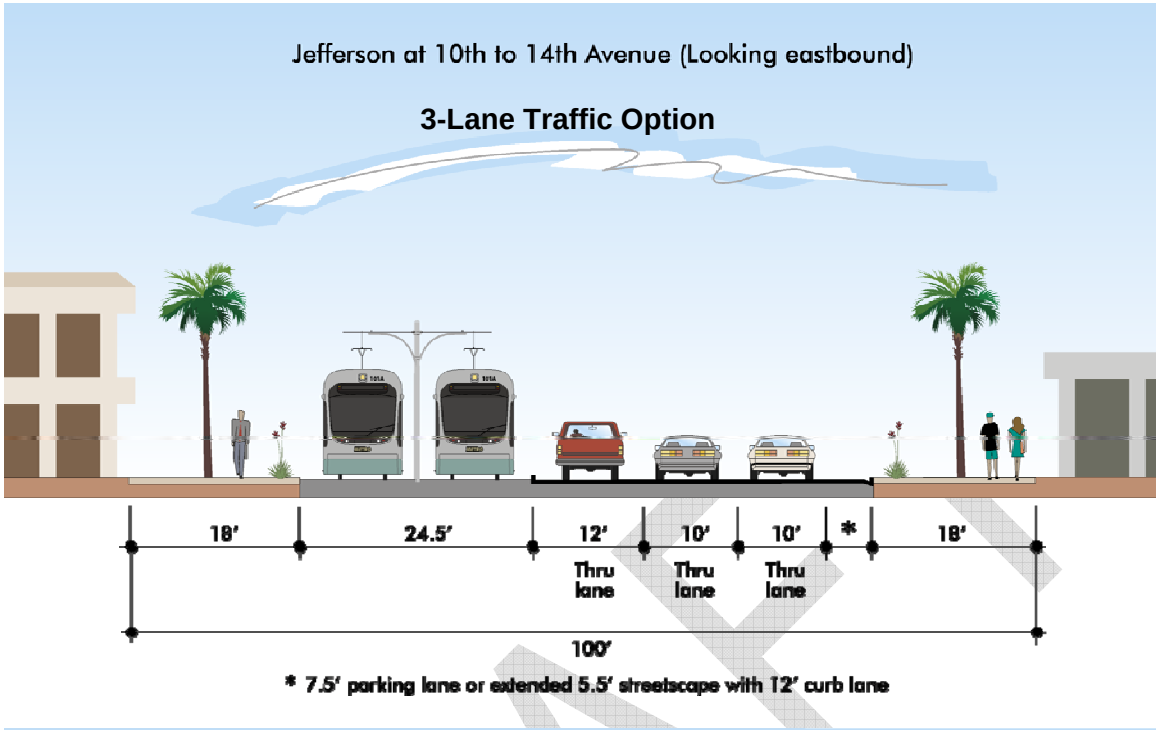
Source: I-10 West Study Team, 2009

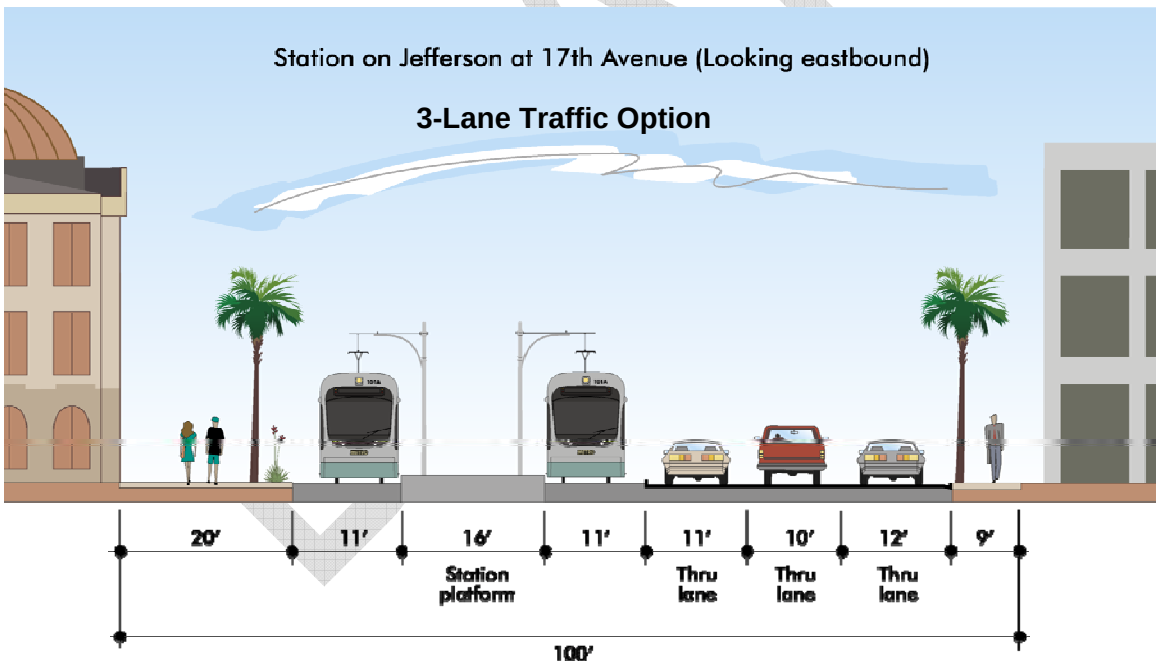
Figure 6-12 Examples of Downtown LRT Cross-sections along Jefferson Street





Source: I-10 West Study Team, 2009





Source: I-10 West Study Team, 2009

6.4.3 Passenger Facilities/Stations

Based on the results of the conceptual station site evaluation discussed in Section 3.2.1, the following LRT stations were recommended west of I-17 regardless of the Downtown Section LRT alignment alternative:

- 35th Avenue in the I-10 median;
- 51st Avenue and/or 59th Avenue in the I-10 median;
- 67th Avenue in the I-10 median; and
- 79th Avenue, either in the I-10 median or north of I-10.

The *Station Planning Report* attached as Appendix A describes physical and environmental factors that would influence the design of the median freeway stations. Special consideration would need to be given to bus and pedestrian access, and environmental factors including noise and climate considerations specific to the freeway median.

All of the stations would include bus-drop off areas for passengers transferring between LRT and buses, kiss-and-ride areas for those passengers dropped-off or picked up by automobile, and stairs and elevators to access the LRT platforms in the I-10 median. Park-and-ride facilities were proposed at the 79th Avenue; 67th Avenue; and 51st Avenue stations (the 51st Avenue station would only be used if ridership forecasting demonstrates that four stations are warranted along I-10). The potential fourth station could also be located at 59th Avenue, rather than 51st Avenue.

Downtown stations were initially projected to be located in the general vicinity of:

- I-10 & 19th Avenue (19th Avenue alignment only)
- 22nd Avenue and Van Buren, Adams, or Jefferson Streets (I-17 alignment only)
- 17th Avenue and Van Buren, Adams, or Jefferson Streets
- 12th Avenue and Van Buren, Adams, Jefferson, or Washington/Jefferson Streets
- 7th Avenue and Van Buren, Adams, Jefferson, or Washington/Jefferson Streets
- 2nd Avenue and Monroe/Adams, Jefferson, or Washington/Jefferson Streets
- 1st Street at Madison Street (Jackson/1st Street Connection Option only)

The identification of specific downtown blocks that will contain stations depends on the downtown alignment elements chosen and on additional analysis and negotiation by METRO staff. These approximate locations were used in the analysis of alternatives, but they are subject to refinement later in the project development process, prior to final design. Parking would not be provided at any of the proposed downtown LRT stations.

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6.4.4 Transit Modifications

A series of fixed route bus service improvements would be implemented for specific RAPID/express and local bus routes in order to provide access to the LRT stations identified in the passenger facilities / stations section. The overall service concept for the corridor consists of the following elements:

- Focus service from the outlying areas along I-10 west of Loop 101 and along Loop 101 north of I-10 to serve the 79th Avenue PnR.
- Provide local route connections from north/south and east/west routes at the corridor transit centers.
- In downtown Phoenix, provide direct service to the high areas of employment including the State Capitol.
- Provide a connection to the CP/EV LRT Starter Line, giving access to Central Station (Phoenix) and the downtown Phoenix business core.

6.4.4.1 Light Rail Service Modifications

Light rail service would operate between the 79th Avenue PnR and downtown Phoenix. The service would maintain 6-minute peak and 12-minute off-peak bi-directional service, stopping at the stations identified in the passenger facilities / stations section.

6.4.4.2 Express Bus Service Modifications

All express bus routes that operate in the I-10 West study area would terminate at the 79th Avenue Station from downtown. The I-10 West RAPID Route would be truncated to provide shuttle service between the Desert Sky Mall Transit Center and the 79th Avenue PnR. This shuttle route would begin operation at the Desert Sky Mall Transit Center, travel south on 79th Avenue and stop at the 79th Avenue Station. The route would operate during peak and off-peak hours with 6- and 12-minute headways, respectively.

Because over half of the RAPID/express route service would be served by the truncation of the route to feed the LRT line at 79th Avenue, additional service would be provided to outlying areas.

6.4.4.3 Local Bus Service Modifications

Several local bus routes would be modified to provide feeder service to the median stations located along I-10. The headways for both peak and off-peak would remain unchanged from the No-Build.

Table 6-6 identifies the fixed route bus modifications comparing the No-Build Alternative and the LRT Alternatives.

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Table 6-6 Bus Changes between No-Build Alternative and the LRT Alternatives

Route No.	Description	No-Build Headway		LRT Alternatives		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
Light Rail						
NEW	79th Avenue to downtown Phoenix	N/A	N/A	10	20	~New Route ~Peak/Off-Peak Service ~Service between 79th Avenue PnR and downtown Phoenix
Express Bus						
460	I-10 West RAPID	10	N/A	**ELIMINATED**		
560	Avondale Express	30	N/A	10	N/A	~Improved Headways ~Route Terminates at I-10 & 79th Avenue PnR to feed LRT
561	Papago Freeway Express	30	N/A	10	N/A	~Improved Headways ~Route Terminates at I-10 & 79th Avenue PnR to feed LRT
562	Buckeye Express	30	N/A	10	N/A	~Improved Headways ~Route Terminates at I-10 & 79th Avenue PnR to feed LRT
573	Arrowhead-Downtown Express	30	N/A	10	N/A	~Improved Headways ~Route Terminates at I-10 & 79th Avenue PnR to feed LRT
575	Peoria Express	30	N/A	10	N/A	~Improved Headways ~Route Terminates at I-10 & 79th Avenue PnR to feed LRT
579	Loop 303 Express	30	N/A	30	N/A	~Route terminates at I-10 & 79th Avenue PnR to feed LRT
Local Bus/Supergrid						
1	Washington Street	30	30	30	30	~No Change
3	Van Buren Street	15	30	15	30	~Route alignment modified ~Stop added at: 79th Avenue & I-10 PnR
8	7th Avenue	30	30	30	30	~No Change
10	Roosevelt Street	15	30	15	30	~No Change
13	Buckeye Road	30	30	30	30	~No Change
15	15th Avenue	30	30	30	30	~Stops added at: Grand Avenue & 15th Avenue (15th Avenue alignment only)

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Route No.	Description	No-Build Headway		LRT Alternatives		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
17	McDowell/McKellips Road	15	30	15	30	~Route alignment modified ~Stops added at: I-10 & 79th Avenue PnR I-10 & 51st Avenue PnR McDowell Road & 19th Avenue (19th Avenue alignment only)
19	19th Avenue	15	30	15	30	~Stop added at: McDowell Road & 19th Avenue (19th Avenue alignment only)
27	27th Avenue	30	30	30	30	~No Change
29	Thomas Road	10	20	10	20	~No Change
35	35th Avenue	20	30	20	30	~Stop added at: I-10 & 35th Avenue
43	43rd Avenue	30	30	30	30	~No Change
51	51st Avenue	35	35	35	35	~Stop added at: I-10 & 51st Avenue
59	59th Avenue	30	30	30	30	~No Change
67	67th Avenue	30	60	30	60	~Stop added at: I-10 & 67th Avenue PnR
75	75th Avenue	30	30	30	30	~Route alignment modified ~Stop added at: I-10 & 79th Avenue PnR
83	83rd Avenue	30	30	30	30	~Route alignment modified ~Stop added at: I-10 & 79th Avenue PnR
131	START	60	60	60	60	~No Change
371	Grand Avenue Limited	20	N/A	20	N/A	- Stop added at: McDowell Road & 19th Avenue (19th Avenue alignment only)
685	Gila Bend Connector	180	180	180	180	~No Change
Shuttle/Feeder Service						
DASH-G	DASH – Government Loop	12	12	12	12	~No Change
DASH-D	DASH – Downtown Loop	12	12/20	12	12/20	~No Change
MARY	Maryvale Circulator	30	30	30	30	~No Change
NEW	Desert Sky Mall Shuttle	N/A	N/A	10	20	~New Route ~Peak/Off-peak Service ~Service between the Desert Sky Mall TC and the 79th Avenue PnR

Note: PnR=Park-and-Ride Facility: Headways are in minutes.
Source: METRO I-10 West Study Team 2008

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6.5 BRT Alternatives Recommended for Additional Evaluation Based on Tier 2 Detailed Evaluation

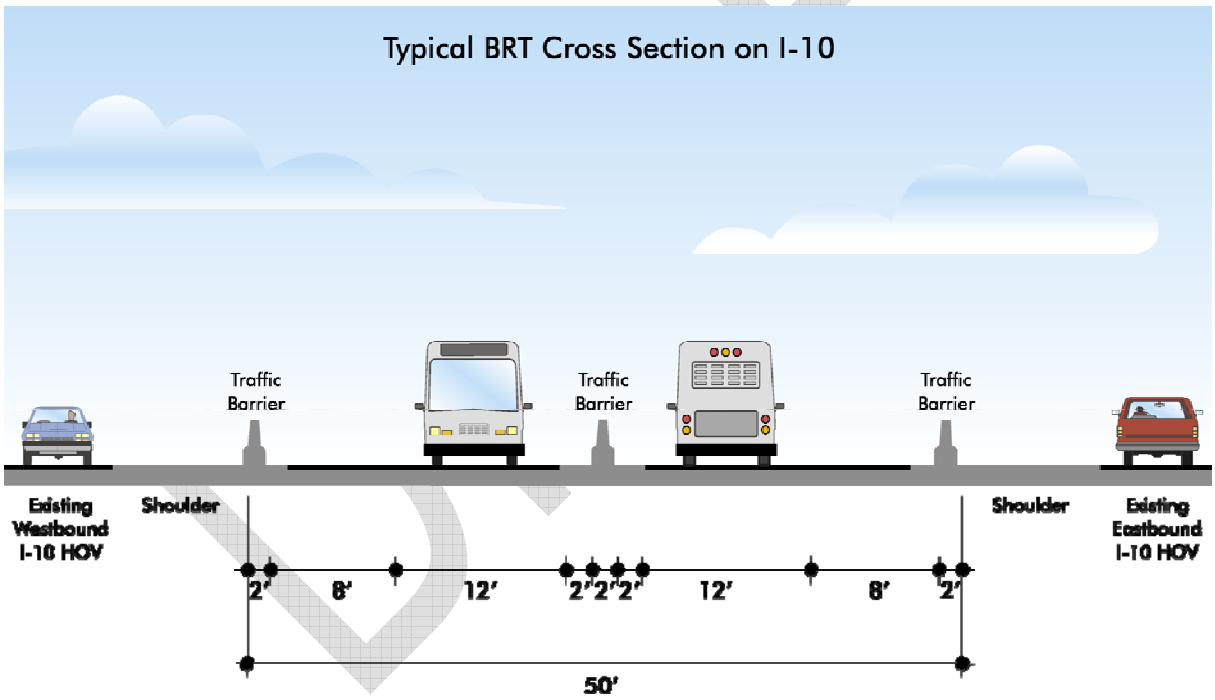
6.5.1 Highway Modifications

The following highway improvements would be made to the BRT Alternatives:

- The drop ramps west of 79th Avenue and I-10 would be preserved from the Baseline/TSM Alternative in all BRT Alternatives.
- An exclusive BRT-only guideway would be added within the I-10 median between 79th Avenue and the 5th/3rd Avenue HOV ramps.
- The I-17 alignment has multiple options for transitioning the buses traveling on I-10 to I-17. The 19th Avenue alignment would include bus-only ramps at I-10 and 19th Avenue.

A representative cross-section of BRT in the I-10 median is shown in Figure 6-13

Figure 6-13 BRT Median Guideway Cross-section

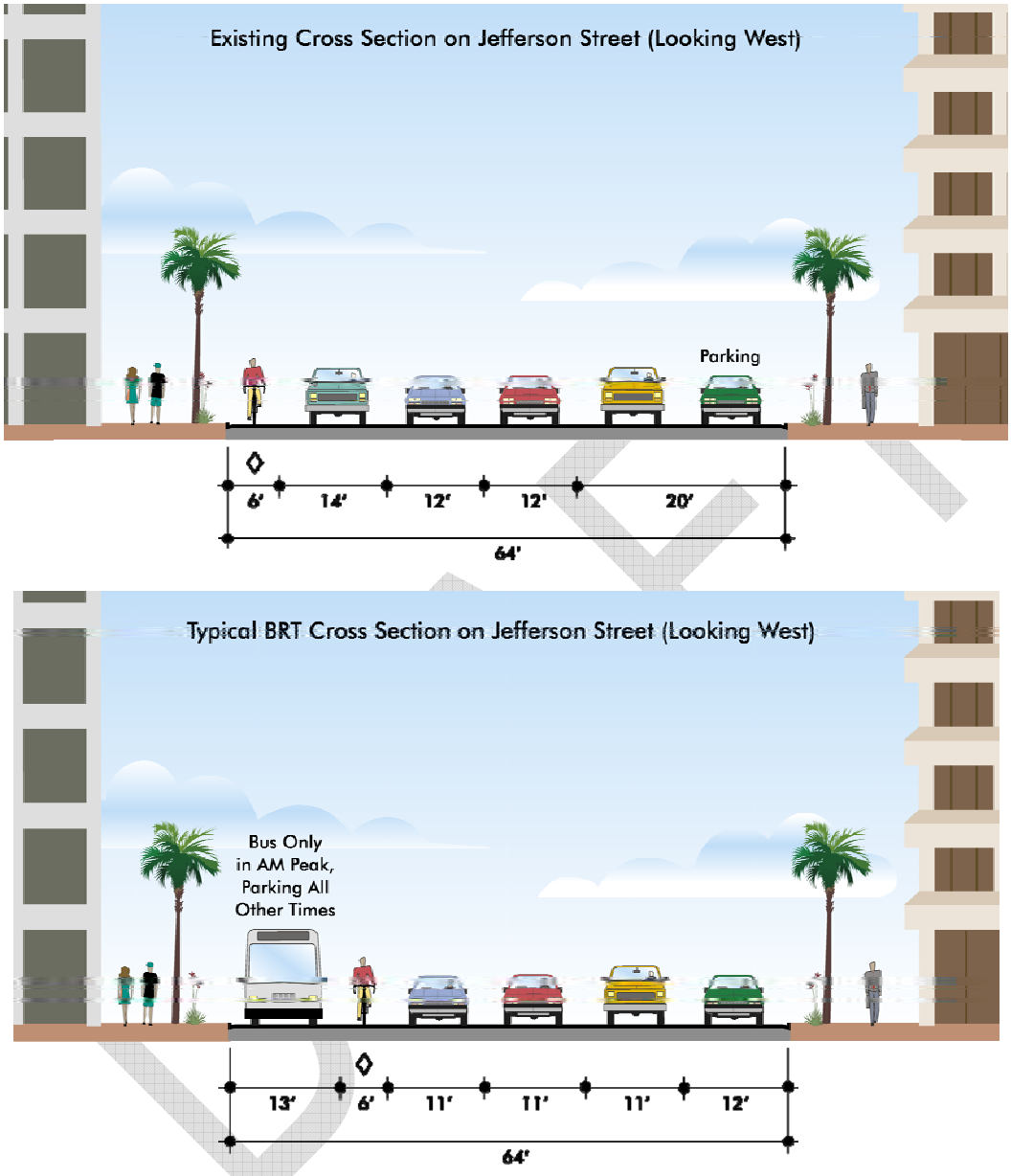


Source: METRO I-10 West Study Team 2009

6.5.2 Downtown Street Improvements

The BRT vehicles for each alternative would travel in an exclusive guideway while in the I-10 median. Once the BRT vehicle exits the I-10 median, the BRT service would operate in mixed traffic. Street improvements may include adding exclusive BRT lanes in the peak, and/or queue jump improvements to existing traffic signals. One example of how the street cross section could change to accommodate BRT in downtown Phoenix is shown in Figure 6-14.

Figure 6-14 Jefferson Street Cross-section- Existing and with Potential BRT



Source: METRO I-10 West Study Team 2009

6.5.3 Passenger Facilities/Stations

Based on the results of the conceptual station site evaluation discussed in Section 3.2.1, the following BRT stations were recommended west of I-17 regardless of the Downtown Section BRT alignment alternative:

- 35th Avenue;
- 51st Avenue and/or 59th Avenue (4 station option only);

- 67th Avenue; and
- 79th Avenue, either in the I-10 median or north of I-10.

Transit connections would be available at all of the stations. Park-and-ride facilities would be located at I-10 and: 79th Avenue; 67th Avenue and 51st Avenue. The 51st Avenue station would only be used with a 4 station alternative. These facilities would serve transit trips from the adjacent areas, which are expected to continue growing with in-fill development.

Downtown stations would be located in the general vicinity of:

- In the vicinity of I-10 and 19th Avenue (19th Avenue alignment only);
- Washington/Jefferson & 17th Avenue;
- Washington/Jefferson & 12th Avenue;
- Washington/Jefferson & 5th Avenue;
- Washington/Jefferson & Central/1st Avenue; and
- Central Station.

Stations listed are for both Part 'A" and Part "B" service, except that a station around I-10/19th Avenue would only be served by the Part "A" service.

6.5.4 Transit Service Modifications

A series of bus service improvements would be implemented for specific RAPID/express and local bus routes in order to provide access to the stops identified in the passenger facilities/ stations section. The overall service concept for the corridor consists of the following factors:

- Focus service from the outlying areas along I-10 west of Loop 101 and along Loop 101 north of I-10 to serve new transit centers in the corridor.
- Provide local route connections from north/south and east/west routes at transit centers.
- Use existing HOV lanes and HOV access ramps at 79th Avenue and 5th/3rd Avenue.
- In downtown Phoenix, provide direct service to the State Capitol as well as Central Station (Phoenix), the CP/EV LRT Starter Line and downtown Phoenix. From the analysis of corridor travel patterns and the results of the RAPID Survey, it was found that roughly 25 percent of transit trips would have a final destination at the State Capitol while the remaining trips were destined for downtown Phoenix; therefore, about 25 percent of the corridor bus service would be directed to the State Capitol.

6.5.5 Express Bus Service Modifications

The BRT Alternatives would utilize six RAPID/express bus routes that are programmed to operate on I-10 and Loop 101 west of the I-10 West study area. These express buses will have additional stops at one or more of the proposed stations along the I-10 portion of the corridor before transitioning to downtown Phoenix. The schedules of these bus routes will be coordinated such that each of the proposed stations will have buses operating at 10-minute

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peak frequency. Both part “A” and part “B” services will be available at all I-10 stations except at the 79th Avenue station during peak hours. The following modifications would be made:

- Route 460 provides 10-minute peak service at the 79th Avenue PnR Facility. The same level of service will be maintained in this alternative. Route 460 will continue to use the 5th/3rd HOV ramps to get into downtown Phoenix (Part “B” service) and then serve the State Capitol.
- Routes 561 (Papago Freeway Express) and 575 (Peoria Express) would be modified to travel south along I-17 or 19th Avenue (Part “A” service), then east along Jefferson Street, turn north along Central Avenue and terminate at Central Station (Phoenix). The routes will have an additional stop in the vicinity of I-10/19th Avenue in the downtown Phoenix portion of its route if 19th Avenue is the preferred North-South alignment.
- Routes 560, 561, and 562 would provide westbound service during the AM peak hour and stop along I-10 at 35th Avenue, 51st Avenue, 67th Avenue and terminate at the 79th Avenue PnR Facility. For eastbound service during AM peak hour, Route 560 will have stops at I-10 and 35th and 67th Avenue stations; Route 561 have stops at I-10 and 67th Avenue and Route 562 will have stops at I-10 and 35th and 51st Avenue stations. The same stops will also be served during PM peak hours in the westbound direction.
- In the off-peak, a new bi-directional bus route would be added with 20-minute service and stop along I-10 at 35th Avenue, 51st Avenue, and 67th Avenue, and 79th Avenue. This route would follow the Part “A” service to the State Capitol and then terminate at Central Station (Phoenix).
- In the No-Build and Baseline/TSM Alternative, Route 579 (Loop 303 Express) terminates in downtown Phoenix. In the BRT Alternatives, this route would terminate at the 79th Avenue PnR Facility.

6.5.6 Local Bus Service Modifications

Several local bus routes would be modified to provide feeder service to the stations located along I-10. For the 19th Avenue alternative, three local bus routes would be modified to serve the station in the vicinity of I-10/19th Avenue. The headways for the local bus routes in the peak and off-peak would remain unchanged from the No-Build Alternative.

In all BRT Alternatives, a new circulator route would provide off-peak service between the Desert Sky Mall Transit Center and the 79th Avenue PnR Facility with 15-minute headways. The route will begin operation at the Desert Sky Mall Transit Center, travel south on 79th Avenue and stop at the 79th Avenue Station. Once at the 79th Avenue Station, the shuttle would proceed north along 79th Avenue to the Desert Sky Mall.

Table 6-7 identifies the changes between the No-Build Alternative and the BRT Alternatives.

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Table 6-7 Bus Changes between No-Build Alternative and BRT Alternatives

Route No.	Description	No-Build Headways		BRT Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
Express Bus						
460	I-10 West RAPID	10	N/A	10	N/A	~No Change
560	Avondale Express	30	N/A	30	N/A	*Eastbound Direction (AM Peak)* ~Additional stops at: I-10 & 67th Avenue PnR I-10 & 35th Avenue *Westbound Direction (AM Peak)* ~Add service in westbound direction with stops at: I-10 & 35th Avenue I-10 & 51st Avenue PnR I-10 & 67th Avenue PnR I-10 & 79th Avenue PnR (last stop)
561	Papago Freeway Express	30	N/A	30	N/A	~Route alignment modified to I-17 or 19th Avenue, then east on Jefferson Street, north on Central Avenue and terminate at Central Station (Phoenix) *Eastbound Direction (AM Peak)* ~Additional stops at: I-10 & 67th Avenue PnR I-10 & 19th Avenue (19th Avenue alignment only) *Westbound Direction (AM Peak)* ~Add service in westbound direction with stops at: I-10 & 19th Avenue (19th Avenue alignment only) I-10 & 35th Avenue I-10 & 51st Avenue PnR I-10 & 67th Avenue PnR I-10 & 79th Avenue PnR (last stop)

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Route No.	Description	No-Build Headways		BRT Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
562	Buckeye Express	30	N/A	30	N/A	*Eastbound Direction (AM Peak)* ~Additional stop at: I-10 & 51st Avenue PnR I-10 & 35th Avenue *Westbound Direction (AM Peak)* ~Add service in westbound direction with stops at I-10 & 35th Avenue I-10 & 51st Avenue PnR I-10 & 67th Avenue PnR I-10 & 79th Avenue PnR (last stop)
573	Arrowhead-Downtown Express	30	N/A	30	N/A	~Additional stop at: I-10 & 67th Avenue PnR I-10 & 51st Avenue PnR
575	Peoria Express	30	N/A	30	N/A	~Route alignment modified to I-17 or 19th Avenue, then east on Jefferson Street, north on Central Avenue and terminate at Central Station (Phoenix) ~Additional stops at: I-10 & 35th Avenue I-10 & 51st Avenue PnR I-10 & 19th Avenue (19th Avenue alignment only)
579	Loop 303 Express	30	N/A	30	N/A	~Route terminates at I-10 & 79th Avenue PnR
NEW	Off-Peak Service Only	N/A	N/A	N/A	20	~New Route (Bi-directional) ~Off-peak Service Only ~Stops located at: 79th Avenue & I-10 PnR 67th Avenue & I-10 PnR 51st Avenue & I-10 PnR 35th Avenue & I-10 I-10 & 19th Avenue (19th Avenue alignment only) Jefferson/Washington & 17th Avenue Jefferson/Washington & 12th Avenue Jefferson/Washington & 5th Avenue Jefferson/Washington & Central Avenue Central Station (Phoenix)

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Route No.	Description	No-Build Headways		BRT Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
Local Bus						
1	Washington Street	30	30	30	30	~No Change
3	Van Buren Street	15	30	15	30	~Route alignment modified ~Stop added at: 79th Avenue & I-10 PnR
8	7th Avenue	30	30	30	30	~No Change
10	Roosevelt Street	15	30	15	30	~No Change
13	Buckeye Road	30	30	30	30	~No Change
15	15th Avenue	30	30	30	30	~No Change
17	McDowell/McKellips Road	15	30	15	30	~Route alignment modified ~Stops added at: I-10 & 79th Avenue PnR I-10 & 51st Avenue PnR I-10 & 19th Avenue (19th Avenue alignment only)
19	19th Avenue	15	30	15	30	~Stop added at: I-10 & 19th Avenue (19th Avenue alignment only)
27	27th Avenue	30	30	30	30	~No Change
29	Thomas Road	10	20	10	20	~No Change
35	35th Avenue	20	30	20	30	~Stop added at: I-10 & 35th Avenue
43	43rd Avenue	30	30	30	30	~No Change
51	51st Avenue	35	35	35	35	~Stop added at: I-10 & 51st Avenue
59	59th Avenue	30	30	30	30	~No Change
67	67th Avenue	30	60	30	60	~Stop added at: I-10 & 67th Avenue PnR
75	75th Avenue	30	30	30	30	~Route alignment modified ~Stop added at: I-10 & 79th Avenue PnR
83	83rd Avenue	30	30	30	30	~Route alignment modified ~Stop added at: I-10 & 79th Avenue PnR
131	START	60	60	60	60	~No Change
371	Grand Avenue Limited	20	N/A	20	N/A	- Stop added at: I-10 & 19th Avenue (19th Avenue alignment only)
685	Gila Bend Connector	180	180	180	180	~No Change

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Route No.	Description	No-Build Headways		BRT Headways		Modifications from No-Build
		Peak	Off-Peak	Peak	Off-peak	
Shuttle/Feeder Service						
DASH-G	DASH – Government Loop	12	12	12	12	~No Change
DASH-D	DASH – Downtown Loop	12	12/20	12	12/20	~No Change
MARY	Maryvale Circulator	30	30	30	30	~No Change
NEW	Desert Sky Mall Shuttle	N/A	N/A	N/A	20	~New Route ~Off-peak Service Only ~Service between the Desert Sky Mall TC and the 79th Avenue PnR

Source: I-10 West Study Team 2008
Note: PnR=Park-and-Ride Facility; Headways are in minutes.

6.6 Summary of Recommendations

The evaluation of the detailed alternatives documented here has produced additional information with respect to the relative merits of the LRT and BRT alternatives. As mentioned at the beginning of this chapter, the decision as to whether LRT or BRT is preferable will not be made during the Tier 2 process.

The downtown LRT Alignment Alternatives carried forward for further evaluation include:

North-South Alternatives

- I-17
- 19th Avenue

East-West Alternatives

- Washington/Jefferson Couplet
- Jefferson Street 2-Track
- Adams Street

The detailed BRT alternatives that will be evaluated for Part "A" service to the State Capitol are:

- 19th Avenue
- I-17

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7.0 NEXT STEPS

The next steps in the Alternatives Analysis process will be to further analyze and refine the remaining alternatives that were carried forward from Tier 2 Screening into the Final Definition of Alternatives phase. Ultimately, an LPA recommendation will be provided at the end of the Final Definition of Alternatives phase, which will include analysis of additional evaluation criteria under the advisement of added public and agency input. These efforts will work to narrow the list of viable alternatives. Initial work involved in the NEPA process will also occur in conjunction with the Final Definition of Alternatives.

7.1 Evaluation of the Final Alternatives

The purpose of the evaluation performed during the Final Definition of Alternatives phase is to narrow the remaining alternatives down to a recommended LPA, which may include both a BRT and LRT option, or a stand-alone transit mode between the two. Specific evaluation criteria were measured during Tier 2 Conceptual and Detailed Screening to eliminate unfavorable alignment alternatives from consideration. Additional evaluation criteria to be measured during the Final Definition of Alternatives are listed in Table 7-1.

Table 7-1 Evaluation Criterion to be used to Evaluate Final Alternatives

Categories	Criterion
Transit Performance	• Ridership Potential • Transit Patron Travel Time Savings • User Benefits • New Riders by Auto Ownership • Transit Dependent Riders Benefits • Transit Service Efficiency • Number of Transfers • Riders per Service Hour or Mile • Population Served
Transportation System Impacts	• Vehicle Miles of Travel Savings • Changes in Vehicle Miles Traveled • Number of Travel Lanes Removed • Bulb-Outs • Curbs and Sidewalks
Complexity of Construction	• Grade Separations Required • Contractor Access During Construction
Costs	• Capital Costs • Economic Development Potential
Environmental Constraints	• Environmental Justice • Endangered and Threatened Species • Floodplains and Riparian Areas • Visual Impacts • Economic Development • Cultural Resources • Hazardous Materials

Source: METRO 2007

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The remaining alternatives will be compared against each other based on these evaluation criteria as well as additional public and agency involvement in an effort to reach a recommended locally preferred alternative(s).

Initial results of the Tier 2 and Final Definition of Alternatives screening process will be presented at the Tier 2 public meetings scheduled spring of 2009. Upon reviewing public comments and final evaluation, the LPA will be identified.

7.1.1 Scoping

Scoping is the first step in the AA/EIS process and is designed to inform the public, interested groups, and involved agencies about the proposed project, alternatives, and issues for public and agency review and input. The scoping process defines the alternatives to be examined in the study, identifies impacts to be considered, and establishes the goals and objectives that will guide the evaluation of alternatives. The main goal is to encourage the active participation of public agencies early in the decision making process. It provides the public an opportunity to communicate issues and concerns to help develop alternatives before considerable resources are expended.

Public and agency scoping have occurred through the completion of the Tier 2 screening process and will transition seamlessly into the draft EIS phase of the study. Scoping will shift towards the evaluation and refinement of the locally preferred alternative(s) that is carried forward into the draft EIS once the AA process is complete.

7.1.2 Agency Coordination

Coordination with all participating agencies will continue seamlessly as the transition is made into the Final Definition of Alternatives and draft EIS phase of the I-10 West AA study. All agencies that were involved in the Tier 2 screening process will continue to be integrated throughout the detailed evaluation of the remaining alternatives.

Coordination between METRO, FTA and agencies such as the ADOT, Arizona State Historic Preservation Office (SHPO) and the City of Phoenix Historic Preservation Office (CHPO) will continue throughout the remainder of the AA and EIS process to satisfy the requirements of NEPA's implementing regulations and in compliance with the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

7.1.3 Public Involvement

The purpose of public involvement is to inform the community about the project's progress and to actively seek and incorporate input from the public into the decision-making process. This involvement will ensure that the project will meet the needs of the community. Public involvement will continue with additional CWG meetings for both the Mainline and Downtown Sections that were involved throughout Tier 2 Conceptual Screening. The recently formed Governmental Working Group (GWG) which is comprised of city, state, and county officials will be involved in the evaluation and analysis of the remaining downtown alignments that will potentially serve the Capitol Mall area. Both CWG and GWG involvement will be seamless and

ongoing as the transition is made into the Final Definition of Alternatives phase and subsequent identification of an LPA.

Public involvement goals, objectives and activities may change as the needs of the project and public change. Once a LPA is recommended, the focus of public information will shift from evaluation of alignment criteria to addressing environmental impacts and mitigation issues consistent with NEPA requirements.

7.2 Engage in NEPA

The purpose of the NEPA process is to explore the effects of the proposed project and its alternatives on the physical, human, and natural environment. The FTA and METRO will evaluate all significant environmental, social, and economic impacts of the LPA. Impact areas to address will include but are not limited to:

- Land Use
- Development Potential
- Secondary Development
- Land Acquisition
- Displacements and Relocations
- Cultural Resources (including impacts on historical and archeological resources)
- Parklands and Recreation Areas
- Visual and Aesthetic Qualities
- Air Quality
- Noise and Vibration
- Ecosystems (including threatened and endangered species, and floodplains and riparian areas)
- Energy Use
- Business and Neighborhood Disruptions
- Environmental Justice
- Changes in Traffic and Pedestrian Circulation and Congestion
- Changes in Transit Service and Patronage

Measures to avoid, minimize, or mitigate any significant adverse impacts will be identified and evaluated.

Notice of Intent

The FTA issued a NOI stating that the FTA and METRO intend to prepare and AA/EIS on proposed high capacity transit improvements in the I-10 West Corridor. Although an NOI was issued for the preparation of an AA/EIS congruently, METRO and FTA have determined that the preparation of the draft EIS would not begin until the AA process has been completed and a locally preferred alternative(s) is recommended. Therefore, the FTA and METRO intend to issue a supplemental NOI for the preparation of the draft EIS.

7.3 LPA Recommendation

Recommending an LPA before the draft EIS process will allow resources to be focused on evaluating one alignment alternative for BRT and LRT respectively. The evaluation criteria used in Final Definition of Alternatives screening will be a determining factor along with public and agency input on defining an LPA. An LPA recommendation for the I-10 West study is anticipated for approval in fall 2009.

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Appendix A
I-10 Mainline Station Planning Report

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I-10 Mainline Station Planning Report

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February 2009

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1.0 INTRODUCTION

This report presents a comprehensive summary of the station planning process for the I-10 West AA/EIS. Specifically, it details the identification and evaluation of station locations and concept plans under consideration along the I-10 freeway between I-17 and 83rd Avenue for high-capacity transit (HCT) improvements in the I-10 West Corridor.

- Section 2 describes the I-10 Mainline segment, which is the section of the I-10 West Corridor under consideration for station locations in this report.
- Section 3 describes the comprehensive technical and stakeholder process for developing, evaluating and narrowing down the I-10 Mainline station location alternatives. Specifically, this section presents the identification of station target areas, the development of station location options within those target areas, and the preliminary evaluation of those station location options based on a wide range of criteria.

  Note that this section concludes with preliminary station location recommendations, but discloses that current gaps in information preclude the selection of final station locations. Both ridership forecasting and station cost estimates, which are key determinants in the evaluation and selection of station locations have yet to be completed at this time. This report will be updated when this information is made available.
- Section 4 defines the potential HCT station configuration options under consideration within the I-10 Mainline and recommends options that will be studied in greater detail in the selection of a Locally Preferred Alternative (LPA).
- Section 5 provides a preliminary description of the physical conditions and circulation patterns likely to be used by transit patrons within the I-10 Mainline segment of the corridor. Physical conditions and circulation elements will be important factors to consider as station designs progress from conceptual layouts to more detailed design and engineering.
- Section 6 concludes with a summary of recommended I-10 Mainline station location and HCT station configuration options to be retained for further analysis during the Tier 2 evaluation process. It also describes those steps necessary to complete the detailed station evaluation and recommend station locations to carry forward into the selection of a LPA.
- Appendix A includes all meeting materials and stakeholder comments from the monthly I-10 Community Working Group (CWG) meetings held between June and October 2008.
- Appendix B presents a preliminary evaluation of station traffic access for all candidate I-10 Mainline stations.

2.0 DESCRIPTION OF THE I-10 MAINLINE SEGMENT

2.1 Introduction

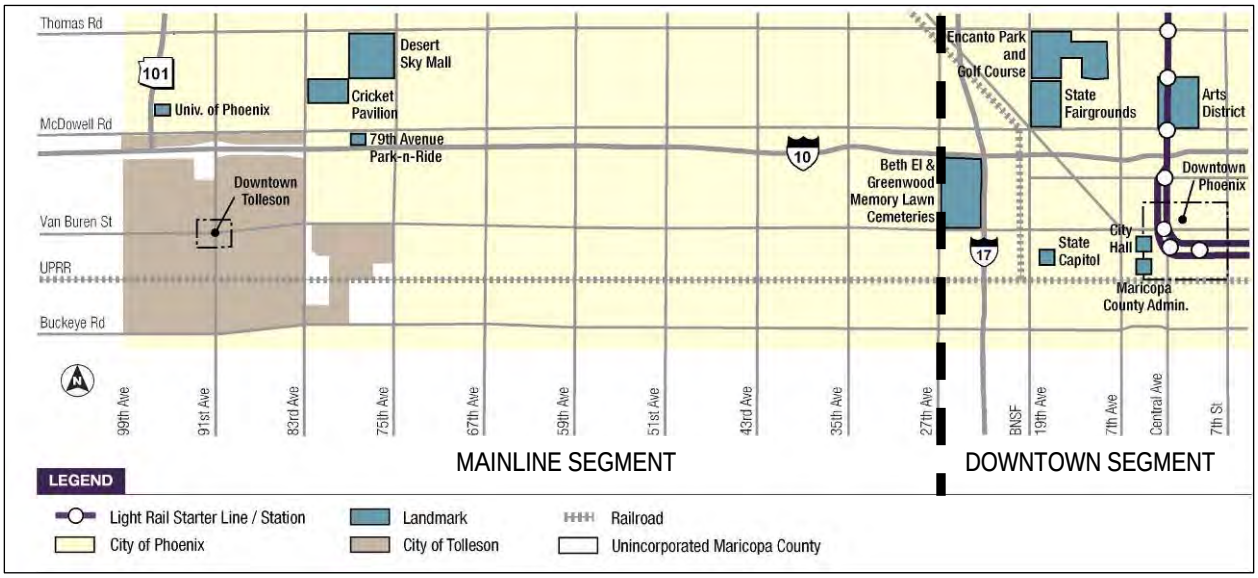
This section describes the I-10 Mainline segment in terms of its relation to the overall project corridor and its physical characteristics, including surrounding land uses.

2.2 I-10 West Study Area and the I-10 Mainline Segment

The I-10 West Study Area extends along the I-10 freeway west of downtown Phoenix to SR-101 (Loop 101) in Maricopa County, Arizona. The north and south boundaries of the Study Area include Thomas and Buckeye Roads. Based on land uses within the project Study Area, the I-10 West Corridor was organized into two distinct areas: west of I-17 and east of I-17, as illustrated in Figure 1. The section west of I-17, referred to as the Mainline Segment, serves as the east-west connection from the Southwest Valley and outlying areas to central Phoenix. The Downtown Segment, the portion of the Study Area between 7th Street and I-17, serves as the connection between the Mainline Section, downtown Phoenix, and the Central Phoenix/East Valley Light Rail (CP/EV LRT) Starter Line.

Based on the results of the Tier 1 evaluation completed in spring of 2008 and documented in detail in the *Tier 1 Analysis Report*, one east-west Mainline Segment alignment alternative was carried forward for further evaluation: the I-10 freeway median between I-17 and 83rd Avenue. With only one alignment advanced in the Mainline Segment, the Tier 2 evaluation process focused primarily on station locations, with the evaluation of transit technology proceeding as a parallel effort.

Figure 1: I -10 West AA/EIS Study Mainline and Downtown Segments



Source: METRO I-10 West Project Team, 2008.

2.3 I-10 Mainline Freeway Description

The I-10 Mainline segment alignment has been established as the I-10 freeway median, generally between 79th Avenue and I-17. This alignment is part of a section of the regional east-west I-10 freeway built in the

mid-1980's. This 15-mile freeway section from approximately 91st Avenue in west Phoenix to 20th Street in downtown Phoenix was considered the "missing link" between the west and downtown Phoenix. The Final Environmental Impact Statement (FEIS) prepared for this freeway section included reserving a 50-foot wide right-of-way within the median for future HCT. The reserved freeway median right-of-way extends from the eastern intersection of I-10 and I-17 at 24th Street west to 91st Avenue. Outside of the median, I-10 currently consists of four general purpose lanes and one HOV lane in each direction, with interchanges generally located at mile intervals and arterial overpasses and underpasses generally located one-half mile between interchanges. A drainage channel runs parallel to the freeway on the north side and is an open channel from 43rd Avenue westward. A restricted direct access ramp at the east side of the 79th Avenue interchange provides direct freeway access to buses and carpools utilizing the 79th Avenue Park-and-Ride. Figure 1 illustrates I-10 in relation to the regional highway and arterial network.

2.4 I-10 Mainline Land Use Character

Land uses on either side of the I-10 Mainline include a varied mix of residential, commercial and industrial uses. Most interchange locations are bordered by commercial uses and a large concentration of industrial developments is located along the south side of I-10. Single- and multi-family neighborhoods, including many newer developments to the west, also comprise much of the development bordering the I-10 Mainline. In addition, several large vacant parcels are scattered throughout the I-10 Mainline segment.

3.0 HCT STATION PLANNING AND EVALUATION

3.1 Introduction

This section summarizes the development and evaluation of potential I-10 Mainline segment station locations and concept plans. The purpose of the station planning process is to determine the appropriate number, spacing, and location of stations in order to meet the project goals of connectivity, cost-effectiveness, and minimizing environmental impacts.

The I-10 median is the only alignment alternative being considered, therefore, the station alternatives that are being evaluated only vary in terms of location. Given that either transit technology under consideration, LRT or BRT, would work within the median of I-10, the station locations under consideration have been evaluated irrespective of the chosen transit technology.

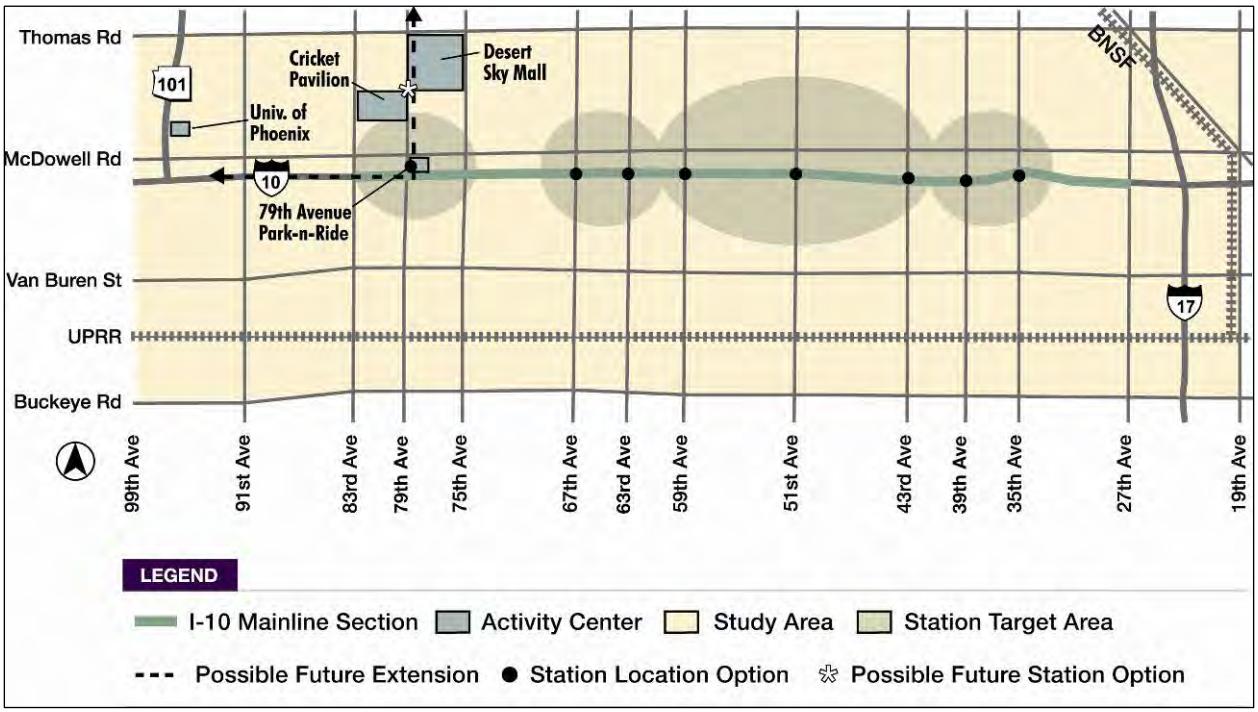
The project team worked closely with METRO, City of Phoenix representatives and public and agency stakeholders in the I-10 Mainline corridor to develop and evaluate station concept plans. The process was a joint effort that included a technical analysis by the project team and input from the I-10 Mainline Community Working Group (CWG), which represent a cross-section of stakeholder interests along the I-10 freeway. Throughout the station planning process, the I-10 Mainline CWG met on a monthly basis between June and October 2008 to provide input and feedback to the project team.

The following sections summarize the station planning process conducted as part of the Tier 2 evaluation process between spring and fall of 2008.

3.2 Conceptual Evaluation of Station Target Areas

The project team identified four station target areas along the I-10 Mainline segment using a number of factors, including recommendations from the *I-10 West Alternative Alignments Technical Report*; site visits and aerial photography; Village plans; and input received from the I-10 Mainline CWG. Alternative station target areas along the I-10 Mainline segment are described in terms of the nearest arterial street to which they are located as shown in Figure 2.

Figure 2: I-10 Mainline Station Target Areas



Source: METRO I-10 West Project Team, 2008.

The following bullet points provide descriptions of the four station target areas.

- 35th – 39th Avenue Station Target Area: The purpose of this station would be to serve as a neighborhood walk-up and bus/auto drop-off station. Given the higher density of development within the station target area, its proximity to downtown Phoenix, and the lack of available land for a parking area, this station was considered most suited for walk-up and drop-off access.

  Existing Conditions This station target area includes a mix of commercial, institutional and residential uses. The 35th Avenue interchange is bordered the Navy Operational Support Center on the southeast corner and a mix of small retail uses and single-family residential uses on all other sides. By contrast, the 39th Avenue vehicle and pedestrian overpass is bordered exclusively by single-family residential uses. Within a half-mile radius of the 35th – 39th Avenue station target area, land uses are primarily residential, with commercial uses generally found along McDowell Road to the north of I-10 and along portions of both 35th and 39th Avenues. This station target area also includes a number of parks and three public schools, including Isaac Middle School, Carl Hayden High School, and Butler Elementary School.

- 43rd – 59th Avenue Station Target Area: The purpose of this station would be to serve as a mid-corridor park-and-ride and bus/HCT transfer point to capture commuters from the south via the proposed South Mountain Freeway and to serve commuters from residential areas to the north.

Existing Conditions This station target area is generally characterized by a large concentration of residential and business uses to the north and industrial uses to the south of I-10. South of the 43rd Avenue interchange a large vacant parcel is located on the west and a single-family residential neighborhood is located on the east side. To the north of I-10, 43rd Avenue is bordered by an electrical substation and mix of multi-family and single-family residential uses to the east and a vacant parcel and retail uses to the west. The 51st Avenue interchange is bordered by a mix of hotels and commercial and industrial uses to the south and a mix of vacant parcels and hotels to the north. Further west, the 59th Avenue interchange is bordered by two large vacant parcels to the north, a restaurant and trucking facility to the southeast and residential uses to the southwest. Within the vicinity of the interchange, a large concentration of multi-family residential uses is located between I-10 and McDowell Road.

- 63rd – 67th Avenue Station Target Area: The purpose of this station would be to serve as another mid-corridor park-and-ride, as well as bus/HCT transfer point and pedestrian-accessible station for surrounding residential areas.

  Existing Conditions This station target area includes a mix of large vacant parcels, residential uses, and industrial uses. A large concentration of multi-family development is located between I-10 and McDowell Road, with residential densities tapering off to the north. The area south of I-10 is dominated by single-family residential uses, with industrial development occurring west of 67th Avenue. The 63rd Avenue overpass is a pedestrian bridge structure that is currently closed and is bordered by a mini-storage facility on the northwest corner and multi-family residential uses on the northeast corner. South of I-10, 63rd Avenue is immediately bordered by large vacant parcels, with Sunridge Elementary School and Park located further to the south. The 67th Avenue interchange is bordered by a restaurant and truck stop on the southwest corner and large vacant parcels on the remaining three corners. However, the northeast corner is slated for the development of a hotel in the future.

- End-of-Line/79th Avenue Station Target Area: The purpose of this station would be as an end-of-line park-and-ride and/or bus/HCT transfer facility. It is intended as a commuter station for those transit patrons coming from the west as well as a pedestrian-accessible station for surrounding residential areas.

  Existing Conditions This station target area includes a varied mix of development, including residential, commercial, institutional uses, as well as large amounts of vacant land. The area immediately surrounding the 79th Avenue overpass includes the 79th Avenue Park-and-Ride to the northeast and an older agricultural property and newer multi-family residential use to the northwest. South of I-10, a large industrial warehouse is located to the east of 79th Avenue and a large parcel of vacant land is located to the west. A mixed-use Planned Unit Development (PUD) has been proposed for the southwest corner of I-10 and 79th Avenue. Further north along 79th Avenue, major activity centers include the Cricket Wireless Pavilion and Desert Sky Mall. The remaining large vacant parcels in the area are rapidly being developed for residential uses. Two newer public schools are also located within the station target area and include Manuel Peña Jr. Elementary School and Raul H. Castro Middle School, which is currently under construction and anticipated to open in 2009.

3.3 Identification of Station Sites and Concept Plans within Each Station Target Area

The project team identified potential station sites within each target area using a rough order of magnitude for preliminary ridership estimates to determine station size requirements, vacant land availability and auto and bus ingress and egress needs. Potential station sites are located at either an I-10 interchange (spaced one-mile apart along I-10) or at an I-10 overpass, (spaced one-half mile from an interchange). Each station site includes a station platform located within the median of I-10 and supporting station elements such as pedestrian access ways, stairs and elevators for access to the station platforms, park-and-rides (with the exception of 35th Avenue and 39th Avenue station concepts), bus drop off areas, and auto drop off areas (referred to as kiss-and-rides). The project team worked with the I-10 Mainline CWG to identify sites that would influence new development in and around each station location. Based on this information, hand-drawn alternative station concept plans at 1”=100’ plan view for each station site were developed. In some cases, more than one park-and-ride location is considered at any given station site. Descriptions of each candidate station concept plan are presented in the next several pages.

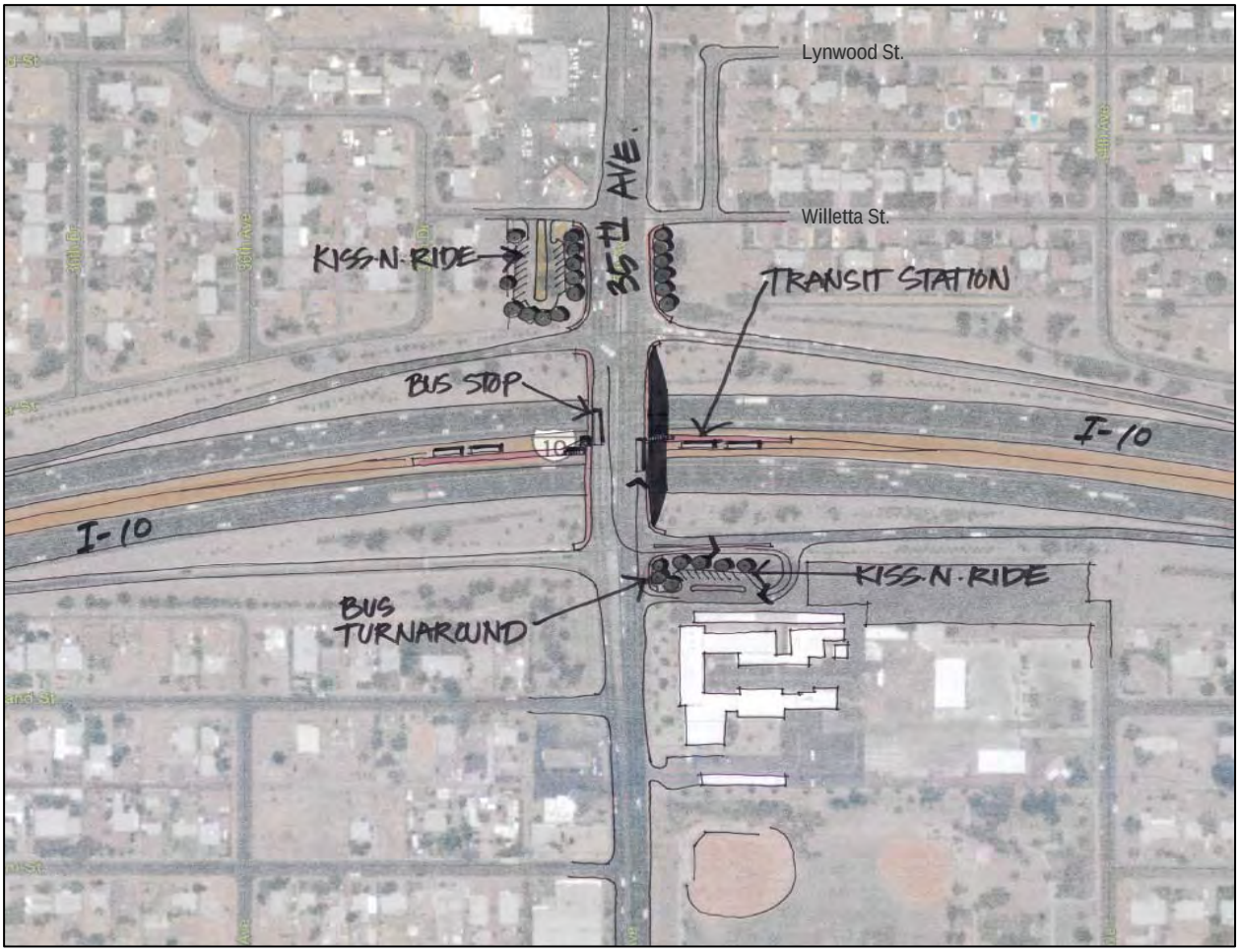
35th Avenue Station Concept

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under 35th Avenue. Transit patrons would access the interchange bridge via enhanced crosswalks at the on- and off-ramps. On the interchange bridge, transit patrons would use enhanced sidewalks on either side of the bridge and would descend to the platform below using stairs and/or elevators. Enhanced sidewalk features could include widened walkways, enhanced lighting, landscaping treatments, and safety railings.

Auto Access: This station would be designed as a neighborhood walk-up station; making auto access limited to short term parking for passenger pick-up and drop-off. Potential kiss-and-ride locations are shown in the immediate northwest and southeast quadrants of the interchange. The southeast location would have in-bound vehicles access the lot via the eastbound I-10 on-ramp. Vehicles leaving the kiss-and-ride would be required to turn right on to northbound 35th Avenue. The northwest kiss-and-ride lot would have full access to Willetta Street, which has right-in/right-out access at 35th Avenue.

Bus Access: Route 35 (north-south) buses would stop on the 35th Avenue bridge, directly above the I-10 station platform or use the bus turnaround facility at the kiss-and-ride.

Figure 3: 35th Avenue Station Concept



Source: METRO I-10 West Project Team, 2008.

39th Avenue Station Concept

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under 39th Avenue. Transit patrons would access the station platform via enhanced sidewalks on either side of the interchange bridge and would descend to the platform below using stairs and/or elevators. Enhanced crosswalks on each side of I-10 would facilitate the safe movement of pedestrians and bicyclists to and from the overpass.

Auto Access: This station would be designed as a neighborhood walk-up station; making auto access limited to short-term parking for passenger pick-up and drop-off. A potential kiss-and-ride and bus turnaround location is shown in the southeast quadrant of the overpass. The southeast location would have inbound buses access the lot via Moreland Street while autos would access the kiss-and-ride via 39th Avenue. An additional kiss-and-ride lot is shown on the northwest quadrant of the overpass. Southbound vehicles would access this kiss-and-ride from 39th Avenue via a new curb cut.

Bus Access: Route 35 and 43 (north-south) buses would stop on the rebuilt/widened 39th Avenue bridge, directly above the I-10 station platform using a bus stop pullout.

Figure 4: 39th Avenue Station Concept

Source: METRO I-10 West Project Team, 2008.

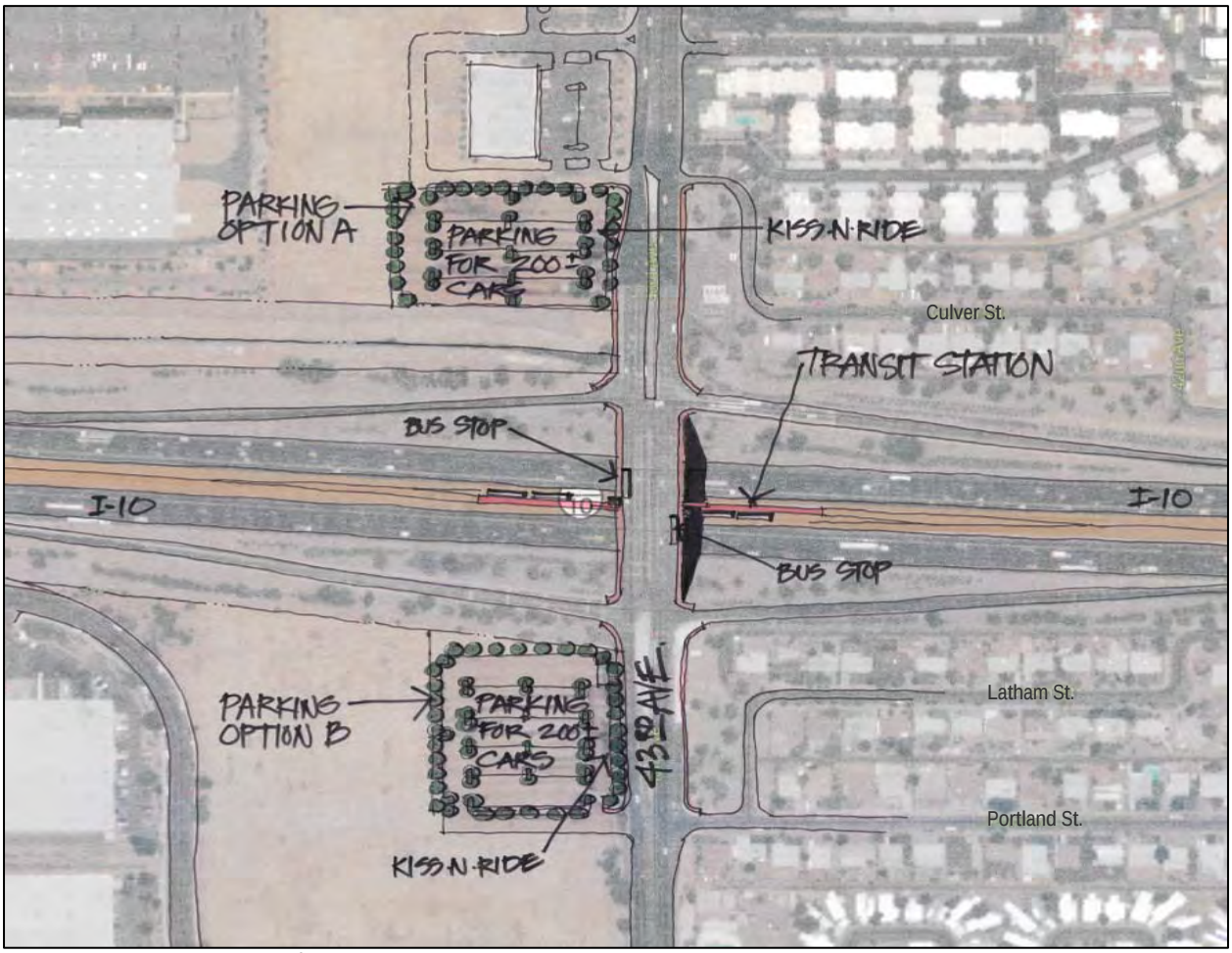
43rd Avenue Station Concept

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under 43rd Avenue. Transit patrons would access the interchange bridge via enhanced crosswalks at the on- and off-ramps. On the interchange bridge, transit patrons would use enhanced sidewalks on either side of the bridge and would descend to the platform below using stairs and/or elevators.

Auto Access: The 43rd Avenue station concept has two options located on vacant parcels that would allow a 200-space park-and-ride immediately northwest or southwest of the interchange. Primary driveway access for the park-and-ride to the south would be located opposite Portland Street, with the potential for a traffic signal at this location. The park-and-ride to the north would likely share access to 43rd with the business just to the north at the Culver Street intersection.

Bus Access: Route 43 (north-south) buses would stop on the 43rd Avenue bridge, directly above the I-10 station platform and/or in the park-and-ride lot.

Figure 5: 43rd Avenue Station Concept



Source: METRO I-10 West Project Team, 2008.

51st Avenue Station Concept

Note: This station option assumes an available median right-of-way width of 50 feet for a station platform. Given ADOT's requirements for freeway improvements, the median right-of-way in this location may be less than the needed 50 feet at the interchange bridge. For this reason, two options have been developed for the 51st Avenue Station: Option A assumes 50 feet of available right-of-way at the interchange and shows the platform at the interchange and Option B assumes that right-of-way is limited at the interchange and shows a concept further east where a 50 foot median would be available to locate a station platform. Because Option B was developed after the station evaluation process, it was not carried through the preliminary station evaluation process described in the following section.

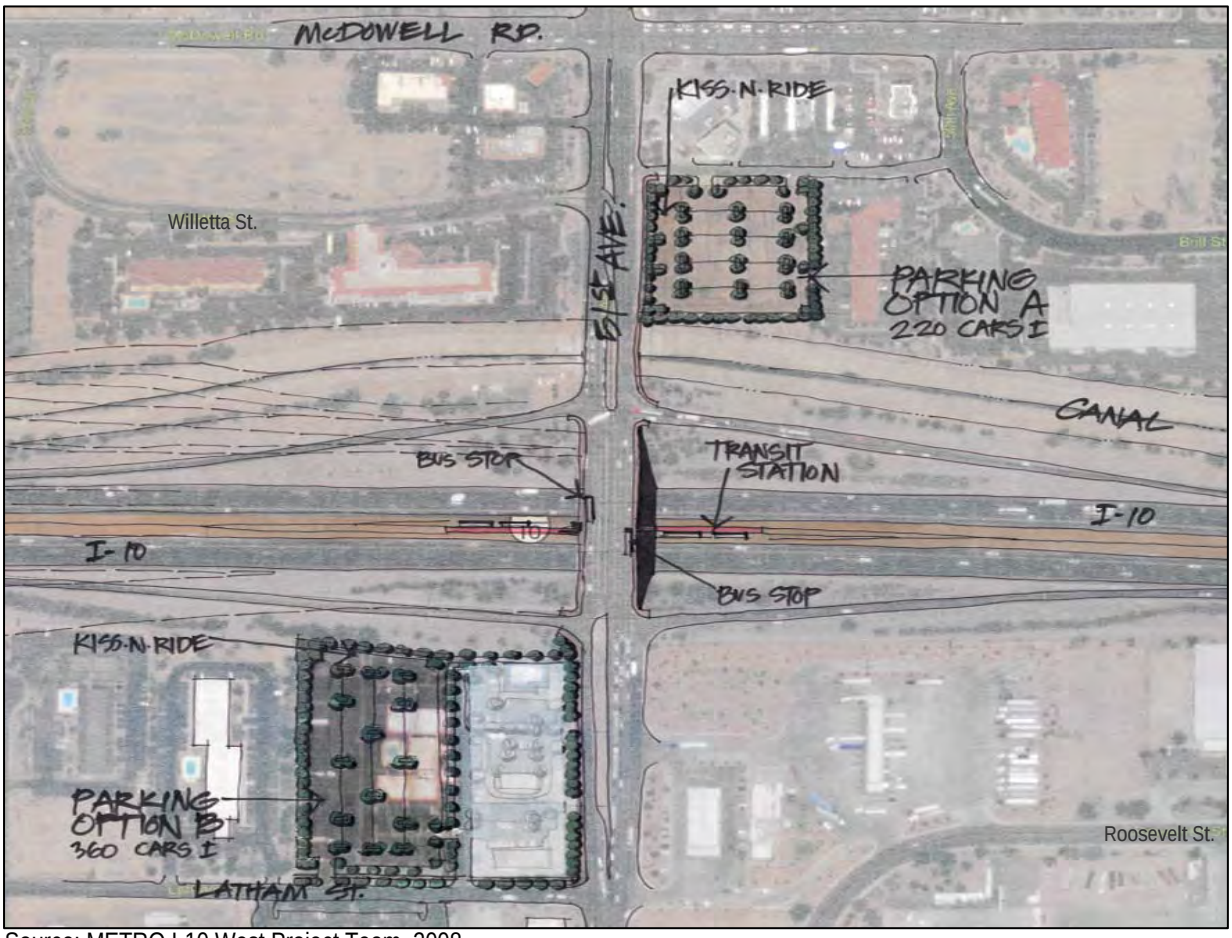
Option A

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under the 51st Avenue overpass. Transit patrons would access the interchange bridge via enhanced crosswalks at the on- and off-ramps. On the interchange bridge, transit patrons would use enhanced sidewalks on either side of the bridge and would descend to the platform below using stairs and/or elevators.

Auto Access: The 51st Avenue station concept has two options for parking areas: a 220-space park-and-ride on a vacant parcel immediately northeast of the interchange or a 360-space park-and-ride southeast of the interchange in an area currently occupied by a large motel. Both parking areas may require a signalized intersection to facilitate safe and efficient automobile access.

Bus Access: Route 51 (north-south) buses would stop on the 51st Avenue bridge, directly above the I-10 station platform and/or in the park-and-ride lot. The Route 17 buses would be deviated to serve this station and would either stop on the bridge or at either of the park-and-ride locations, which could also accommodate a bus turnaround.

Figure 6: 51st Avenue Station Concept Option A



Source: METRO I-10 West Project Team, 2008.

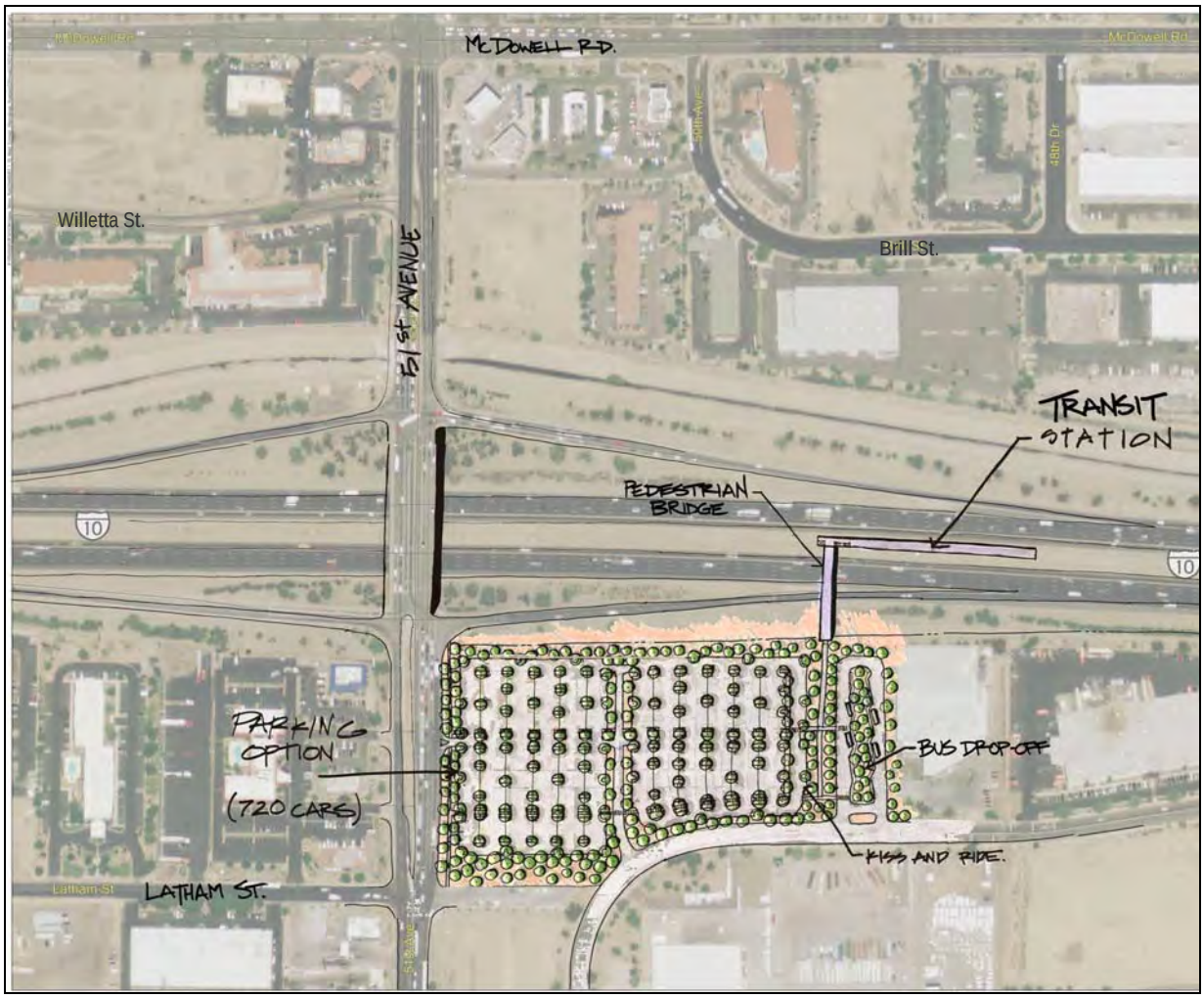
Option B

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 east of the 51st Avenue overpass. Transit patrons would access a pedestrian-only bridge via the park-and-ride on the south side of I-10. Transit patrons would descend to the platform below using stairs and/or elevators.

Auto Access: The 51st Avenue station concept shows a 720-space park-and-ride southeast of the interchange in an area currently occupied by a trucking facility.

Bus Access: Route 51 (north-south) buses would access the bus drop off area in the park-and-ride lot via West Roosevelt Street. Route 17 buses would be deviated to serve this station and would also use the bus turnaround in the park-and-ride lot.

Figure 7: 51st Avenue Station Concept Option B



Source: METRO I-10 West Project Team, 2008.

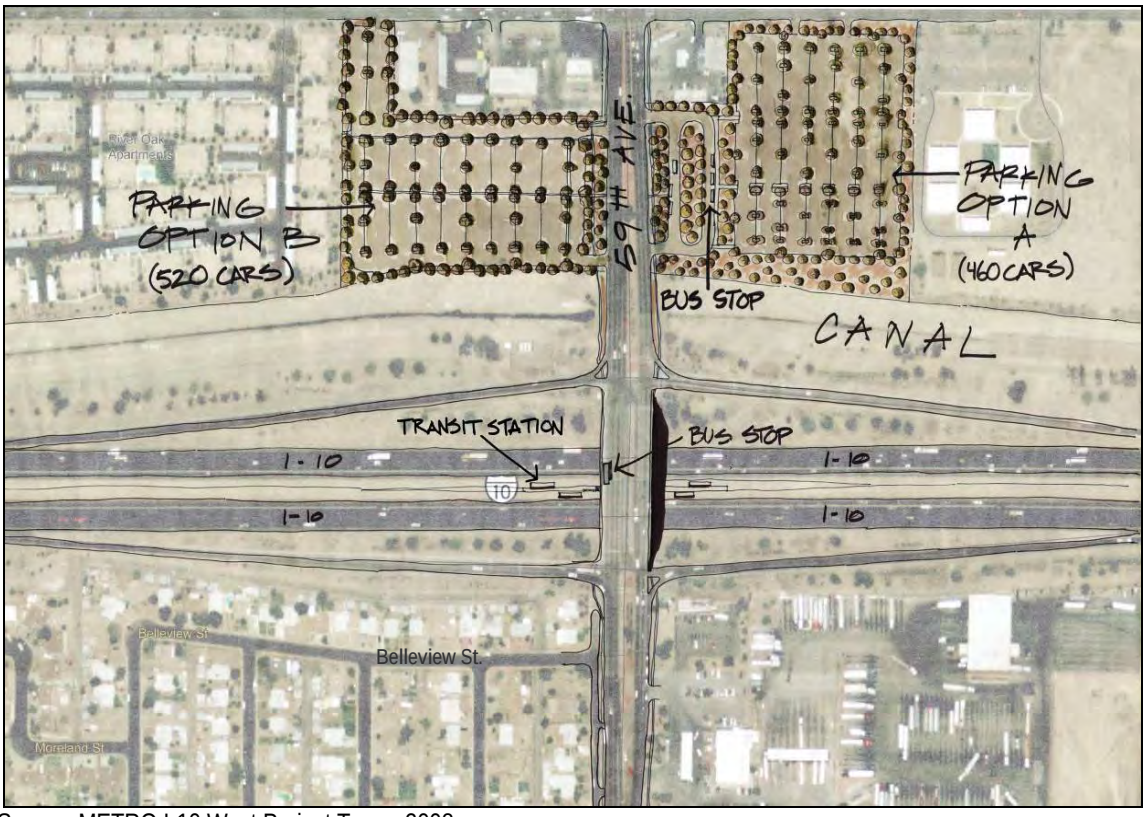
59th Avenue Station Concept

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under 59th Avenue. Transit patrons would access the interchange bridge via enhanced crosswalks at the on- and off-ramps. On the interchange bridge, transit patrons would use enhanced sidewalks on either side of the bridge and would descend to the platform below using stairs and/or elevators.

Auto Access: The 59th Avenue station concept has two options for parking areas: a 460-space park-and-ride on a vacant parcel immediately northeast of the interchange or a 520-space park-and-ride on a vacant parcel northwest of the interchange. At 59th Avenue, neither parking area would have access to an intersection that is currently signalized. Both park-and-ride options would provide direct access to McDowell Road. McDowell Road access would be important for traffic using either parking area to complete inbound and outbound movements in all directions if a signalized access could not be provided on 59th Avenue between I-10 and McDowell Road. However, either option is likely to require that access to McDowell Road allow for access in all directions. Signalization of McDowell Road at these access points would need to be evaluated for either option.

Bus Access: Route 59 (north-south) buses would stop on the 59th Avenue bridge, directly above the I-10 station platform and/or in the park-and-ride lot. The Route 17 buses could be deviated to either stop on the bridge or at the park-and-ride location north of I-10, which would also accommodate a bus turnaround option.

Figure 8: 59th Avenue Station Concept



Source: METRO I-10 West Project Team, 2008.

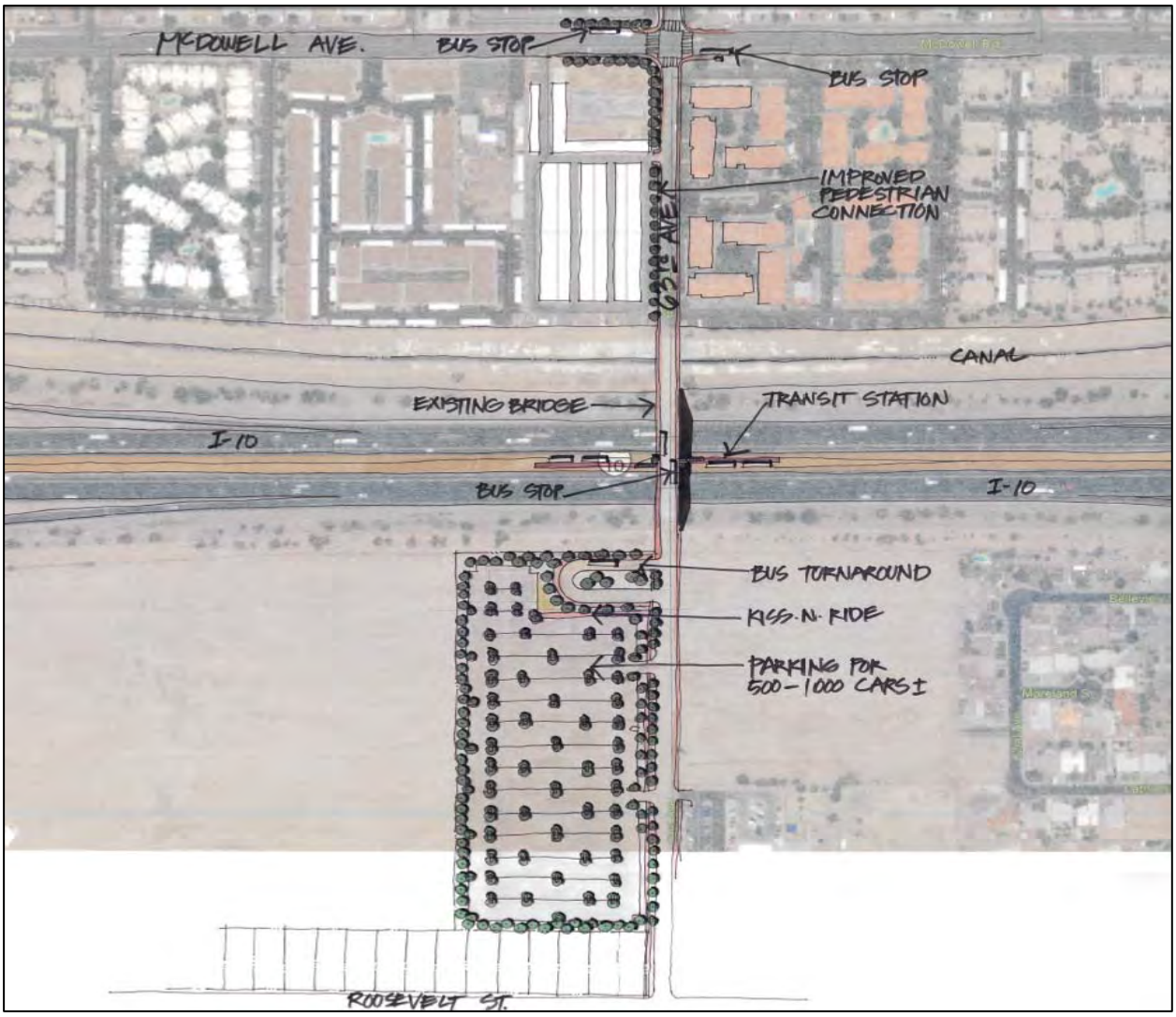
63rd Avenue Station Concept

Pedestrian and Bicycle Access: The station platform would be located in the median of I-10 centered under 63rd Avenue. Transit patrons would access the station platform via enhanced sidewalks on either side of the interchange bridge and would descend to the platform below using stairs and/or elevators.

Auto Access: The 63rd Avenue park-and-ride would provide space for between 500 and 1,000 cars and would be located on the southwest quadrant of the overpass on a currently vacant parcel. Two curb cuts along 63rd Avenue would provide direct auto access into the park-and-ride lot.

Bus Access: Route 59 and 67 (north-south) buses would divert to serve this station and stop on the 63rd Avenue bridge, directly above the I-10 station platform and/or in the park-and-ride lot.

Figure 9: 63rd Avenue Station Concept



Source: METRO I-10 West Project Team, 2008.

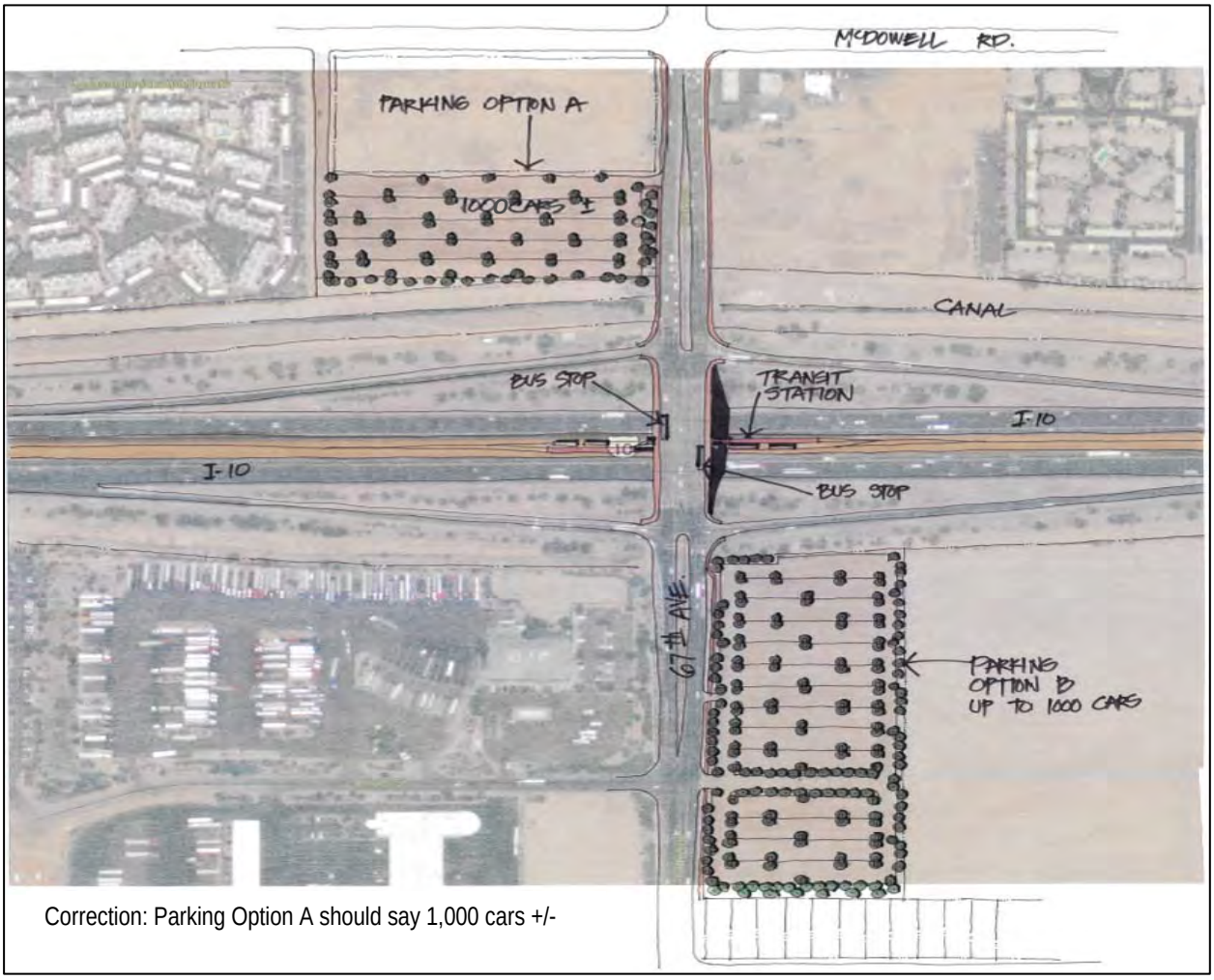
67th Avenue Station Concept

Pedestrian Access: The station platform would be located in the median of I-10 centered under 67th Avenue. Transit patrons would access the station platform via enhanced sidewalks on either side of the interchange bridge and would descend to the platform below using stairs and elevators.

Auto Access: The 67th Avenue station concept has two options for a parking area that would accommodate up to 1,000 parking spaces: a vacant parcel immediately northwest of the interchange or a vacant parcel immediately southeast of the interchange. Vehicular access to the park-and-ride on the north would likely be via McDowell Road. Access to the park-and-ride on the south would likely require a new signal at the existing 67th Avenue/Latham Street intersection.

Bus Access: Route 67 (north-south) buses would stop on the 67th Avenue bridge, directly above the I-10 station platform and/or in the park-and-ride lot.

Figure 10: 67th Avenue Station Concept



Source: METRO I-10 West Project Team, 2008.

End-of-Line Station Options

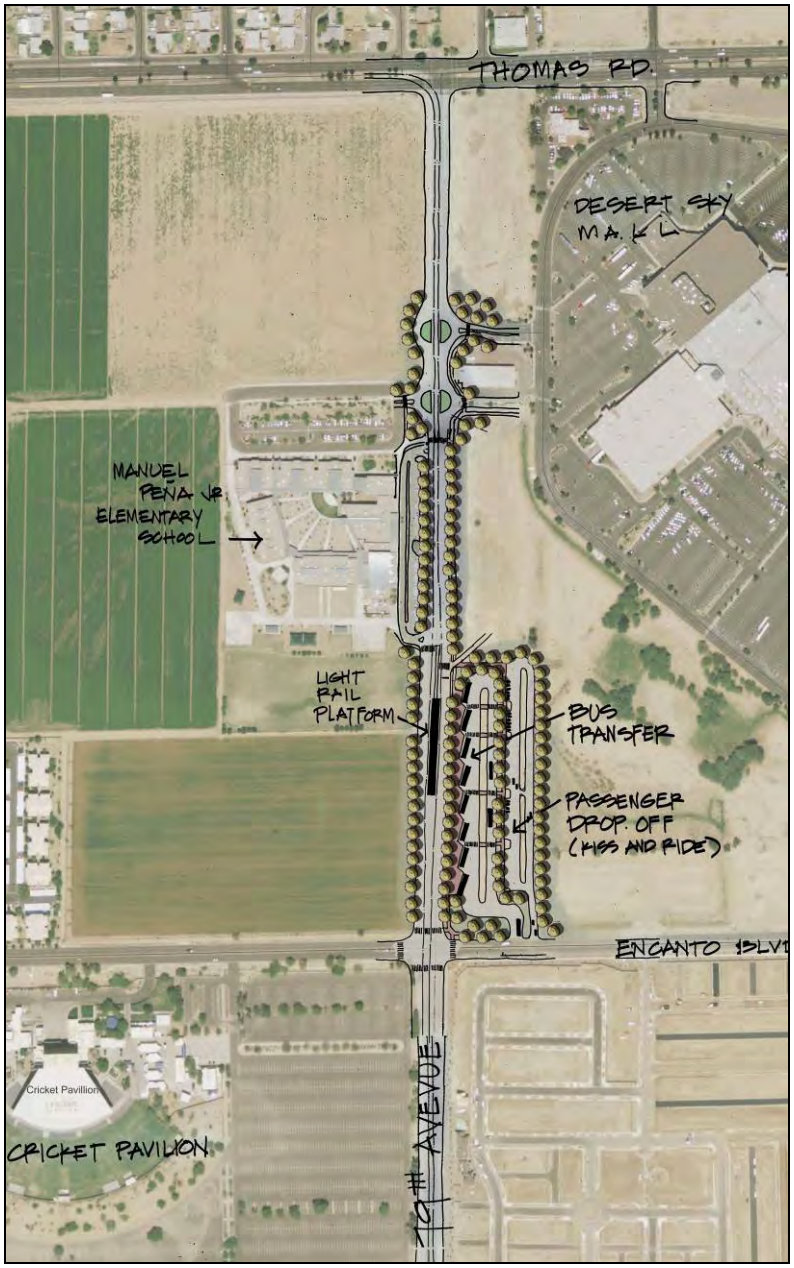
Two end-of-line station options, as shown in Figures 11 and 12, are currently under consideration and will be more fully investigated in a separate subsequent End-of-Line Station Technical Memorandum to be completed in early 2009.

- A station along I-10 at 79th Avenue, which would allow for future HCT extensions to the west or north (Figure 11). Note that while not shown in Figure 10, Parking Options A and B may be accessed from a HCT platform in the I-10 median; and/or
- A station along 79th Avenue in the vicinity of the Desert Sky Mall, which would allow for future HCT extensions to the north (Figure12).

Figure 11: I-10/79th Avenue Station Option One

Source: METRO I-10 West Project Team, 2008.

Figure 12: 79th Avenue/Encanto Boulevard Station Option Two



Source: METRO I-10 West Project Team, 2008.

3.4 Station Location Evaluation Criteria

The project team developed a set of evaluation criteria by which to assess each station concept plan. The criteria included both qualitative and quantitative factors, as shown in Table 1.

Table 1: Evaluation Criteria for Station Concept Plans

Category of Criterion	Criteria
Mobility	▪ Projected daily station boardings (2030) ▪ Proximity to regional north-south arterials ▪ Number of bus routes serving the station ▪ Number of bus routes requiring diversion to the station ▪ Proximity to existing or planned bicycle/pedestrian routes
Traffic	▪ Ease of traffic ingress/egress ▪ Existing traffic congestion in station area
Community	▪ Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses ▪ Vacant land available within a ½ mile to meet parking requirements, bus facilities, transit-oriented development potential, etc.
Demographics	▪ Future population within ½ mile of station (2030) ▪ Future employment within ½ mile of station (2030) ▪ Percentage of households that are transit dependent within a ½ mile of station (zero car households)
Station Costs	▪ Station development/property acquisition costs
Environmental	▪ Impacts to historic structures/buildings ▪ Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)
Public Input	▪ Support of station concept received at stakeholder meetings

Source: METRO I-10 West Project Team, 2008.

3.5 Preliminary Station Location Evaluation Results

The following tables are evaluation matrices that summarize the results of the project team's initial station evaluation process. The evaluation matrices are primarily qualitative assessments of how well each station option meets each of the sixteen criteria. Ratings are based on a color-coded system as follows: Good = green; Fair = orange; and Poor = red. Criteria pertaining to future population, employment and transit-dependent populations around station sites are based on numeric quantitative ratings. For these criteria, ratings have been applied as follows:

	Population	Employment	Zero-Car Households
Poor	< 4,000 persons	< 1,000 employees	< 60 households
Fair	4,000-5,500 persons	1,000-2,000 employees	60-120 households
Good	> 5,500 persons	> 2,000 employees	> 120 households

Source: METRO I-10 West Project Team, 2008.

Table 2: 35th Avenue – 39th Avenue Station Target Area
Preliminary Station Location Evaluation

CRITERION	I-10 & 35TH AVENUE OPTION	I-10 & 39TH AVENUE OPTION
MOBILITY		
Projected daily station boardings (2030)	To be determined	To be determined
Proximity to regional north-south arterials	Good – located along 35th Avenue, which is one of the longest north-south regional arterials, connecting North Phoenix to South Mountain and Laveen	Fair – located along 39th Avenue, which is a minor arterial that terminates at Van Buren Street to the south and Osborn Road to the north
Number of bus routes serving the station	Fair – station would be served by two bus routes (Routes #17, #35)	Good – station would be served by three bus routes (Routes #17, #35, #43)
Number of bus routes diverting to the station	Good – would require diversion of one bus route (Route #17)	Fair – would require diversion of three bus routes (Routes #17, #35, #39)
Walk access between parking and/or bus loading and station platform	Good – bus drop-off area would be located directly above platform stairs and elevator	Good – bus drop-off area would be located directly above platform stairs and elevator
Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks to the north of I-10; but intermittent sidewalks to the south	Good – existing bicycle lanes and continuous sidewalks north and south of I-10
TRAFFIC		
Ease of traffic ingress/egress	Poor – southbound buses and vehicles turning left into drop-off area would cross three traffic lanes	Good – southbound buses and vehicles turning left into drop-off area would cross one traffic lane and low traffic volumes on 39th Avenue, which is a minor arterial, would allow for easier ingress and egress
Existing traffic congestion in the station area	Poor – high traffic volumes in and around the 35th Avenue interchange	Good – low traffic volumes within the station area
COMMUNITY		
Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Good – bus turnaround and kiss-and-ride facilities would be surrounded by existing and planned commercial and public/quasi-public land uses, which are generally more compatible than residential land uses	Fair/Poor – bus turnaround and kiss-and-ride facilities would be surrounded by existing and planned residential land uses, which are generally less compatible than other land uses
Vacant land available to meet parking requirements, bus facilities, etc.)	Fair – constrained by lack of vacant parcels; area needed to accommodate bus facilities and kiss-and-ride would require acquisition or shared use of Falcon Park and Navy Operational Support Center parking areas on the south side of I-10	Poor – constrained by lack of vacant parcels, area needed to accommodate bus facilities and kiss-and-ride would require acquisition of residential properties on both sides of I-10
DEMOGRAPHICS		
Future population within ½ mile of station (2030)	Fair – between 4,000 – 5,500 persons	Good – greater than 5,500 persons
Future employment within ½ mile of station (2030)	Good – greater than 2,000 employees	Fair – between 1,000 – 2,000 employees
Percentage of zero car households within ½ mile of station (2030)	Good – greater than 6.3% of households are transit dependent	Good – greater than 6.3% of households are transit dependent
STATION COSTS		
Station development/ property acquisition costs	To be determined	To be determined

Table 2: 35th Avenue – 39th Avenue Station Target Area
Preliminary Station Location Evaluation

CRITERION	I-10 & 35TH AVENUE OPTION	I-10 & 39TH AVENUE OPTION
ENVIRONMENTAL		
Impacts to historic structures/buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	Poor – Isaac Middle School to the north of I-10 and Carl Hayden High School and Falcon Park to the south of I-10 are sensitive land uses that would potentially be impacted by increased traffic and noise associated with the station; note that most bus activity would not be routed in front of the high school	Fair – existing residential neighborhoods to the north and south of I-10 and Butler Elementary school to the south of I-10 would potentially be impacted by increased traffic and noise associated with the station; note that most bus activity would not be routed in front of the elementary school
PUBLIC INPUT		
Support of station concept received at stakeholder meetings	To be determined. Comments noted at CWG Meeting #2 include: ▪ 35th Avenue was a preferred station location because it would have fewer neighborhood impacts ▪ A station in this area would provide mobility to high school students ▪ Safety/security features should be incorporated into station facilities	To be determined. Comments noted at CWG Meeting #2 include: ▪ Residential neighborhoods may be impacted by station traffic ▪ Increased traffic volumes may create congestion narrow streets south of I-10 ▪ Safety/security features should be incorporated into station facilities
PRELIMINARY RECOMMENDATION		
Set aside or carry forward into detailed station location evaluation	Carry forward into detailed station location evaluation	Set aside pending outcome of ridership and cost assessment

Source: METRO I-10 West Project Team, 2008.

Table 3: 43rd Avenue – 59th Avenue Station Target Area Preliminary Station Location Evaluation

CRITERION	I-10 & 43RD AVENUE OPTION	I-10 & 51ST AVENUE OPTION	I-10 & 59TH AVENUE OPTION
MOBILITY			
Projected daily station boardings (2030)	To be determined	To be determined	To be determined
Proximity to regional north-south arterials	Fair – located along 43rd Avenue, which terminates at West Lower Buckeye Road to the south	Good – could provide direct connection to future South Mountain Freeway; also located along 51st Avenue, which is one of the longest north-south arterials, bridging the Salt River to the south	Fair – located along 59th Avenue, which terminates at West Broadway Road to the south
Number of bus routes serving the station	Good – station would be served by three bus routes (Routes #17, #3, #43)	Fair – station would be served by two bus routes (Routes #3, #51)	Fair – station would be served by two bus routes (Routes #17, #59)
Number of bus routes requiring diversion to the station	Fair – would require diversion of two bus routes (Routes #17, #3)	Good – would require diversion of one bus route (Routes #3)	Good – would require diversion of one bus route (Routes #17)
Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks to the north and south of I-10	Fair – no bicycle lane or route; continuous sidewalks to the north and south of I-10	Fair – no bicycle lane or route; continuous sidewalks to the north and south of I-10
TRAFFIC			
Ease of traffic ingress/egress	Fair – northbound buses and vehicles turning left into the park-and-ride would cross two traffic lanes	Poor – vehicles turning left into the park-and-ride would cross three traffic lanes	Poor – buses and vehicles accessing either park-and-ride from the other side would cross three traffic lanes; would also require modifications to existing median; both park-and-ride options do provide for direct access from McDowell Road
Existing traffic congestion in the station area	Poor – high traffic volumes in and around the 43rd Avenue interchange	Poor – high traffic volumes in and around the 51st Avenue interchange	Poor – high traffic volumes in and around the 59th Avenue interchange
COMMUNITY			
Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Fair – park-and-ride facility would be surrounded by existing industrial and/or commercial land uses to the west, which are generally compatible, but residential land uses to the east are less compatible	Good – park-and-ride facility would be surrounded by existing industrial and/or planned commercial land uses that would be compatible	Fair – park-and-ride facility on the northeast corner would be surrounded by existing commercial land uses/businesses, which are generally compatible; park-and-ride facility on the northwest corner would be surrounded on three sides by existing industrial and/or commercial land uses and residential land uses on one side, which are generally less compatible

Table 3: 43rd Avenue – 59th Avenue Station Target Area Preliminary Station Location Evaluation

CRITERION	I-10 & 43RD AVENUE OPTION	I-10 & 51ST AVENUE OPTION	I-10 & 59TH AVENUE OPTION
Vacant land available to meet parking requirements, bus facilities, etc.	Good – vacant parcels are available; either a 15-acre vacant parcel on the southwest corner of the interchange or vacant land at the northwest corner of the interchange could accommodate a 200+ car park-and-ride as well as the potential to support transit-oriented development	Fair – constrained by lack of vacant parcels; preferred park-and-ride location is already developed and would require business acquisitions to accommodate a 200+ car park-and-ride; an alternate park-and-ride location on the northeast corner of the interchange is vacant	Good – either a vacant parcel on the northwest corner or the northeast corner of the interchange could accommodate between a 460 - 520 car park-and-ride as well as the potential to support transit-oriented development
DEMOGRAPHICS			
Future population within ½ mile of station (2030)	Good – greater than 5,500 persons	Fair – between 4,000 – 5,500 persons	Good – above 5,500 persons
Future employment within ½ mile of station (2030)	Good – greater than 2,000 employees	Good – greater than 2,000 employees	Fair – between 1,000 – 2,000 employees
Percentage of zero car households within ½ mile of station (2030)	Good – greater than 6.3% of households are transit dependent	Good – greater than 6.3% of households are transit dependent	Fair – between 3% - 6.3% of households are transit dependent
STATION COSTS			
Station development/ property acquisition costs	To be determined	To be determined	To be determined
ENVIRONMENTAL			
Impacts to historic structures/buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	Fair – existing residential neighborhoods to the east would potentially be impacted by increased traffic and noise associated with the station, but industrial uses would unlikely be impacted	Good – surrounding industrial uses would unlikely be impacted by increased traffic and noise associated with the station	Fair – existing residential development to the northwest would potentially be impacted by increased traffic and noise associated with the station, but businesses north of the interchange would unlikely be impacted

Table 3: 43rd Avenue – 59th Avenue Station Target Area Preliminary Station Location Evaluation

CRITERION	I-10 & 43RD AVENUE OPTION	I-10 & 51ST AVENUE OPTION	I-10 & 59TH AVENUE OPTION
PUBLIC INPUT			
Support of station concept received at stakeholder meetings	To be determined. Comments noted at CWG Meeting #2 include: ▪ Frys supermarket at 43rd Avenue is a major destination venue ▪ Many apartments are located in close proximity to I-10 ▪ Station would provide a direct connection to the secondary Maryvale Village Core	To be determined. Comments noted at CWG Meeting #2 include: ▪ 51st Avenue could be difficult due to the unknowns regarding the new South Mountain freeway connection ▪ A station near a freeway junction could use excess space inside or near ramps ▪ Station could provide a connection to the secondary Maryvale Village Core (Maryvale Hospital, Maryvale Stadium, ASU West Campus) located north of the study area along 51st Avenue ▪ Semi trucks that access industrial facilities south of I-10 add to traffic levels along 51st Avenue	To be determined. Comments noted at CWG Meeting #4 include: ▪ Station could provide a direct connection to the Estrella Village Core, which is located along 59th Avenue. Future redevelopment of the area could benefit by a station in this location ▪ 59th Avenue connects directly to the Arizona State University west campus
PRELIMINARY RECOMMENDATION			
Set aside or carry forward into detailed station location evaluation	Set aside pending outcome of ridership and cost assessment	Carry forward into detailed station location evaluation	Carry forward into detailed station location evaluation

Source: METRO I-10 West Project Team, 2008.

Table 4: 63rd Avenue – 67th Avenue Station Target Area
Preliminary Station Location Evaluation

CRITERION	I-10 & 63rd AVENUE OPTION	I-10 & 67th AVENUE OPTION
MOBILITY		
Projected daily station boardings (2030)	To be determined	To be determined
Proximity to regional north-south arterials	Poor – located along 63rd Avenue, which is intermittent both north and south of I-10 and terminates at West Broadway Road to the south	Good – located along 67th Avenue, which is one of the longest north-south arterials, bridging the Salt River to the south
Number of bus routes serving the station	Good – station would be served by three bus routes (Routes #17, #67, #59)	Fair – station would be served by two bus routes (Routes #17, #67)
Number of bus routes requiring diversion to the station	Fair – would require diversion of three bus routes (Routes #17, #59, #67)	Good – would require diversion of one bus route (Routes #17)
Walk access between parking and/or bus loading and station platform	Good – bus drop-off area would be located directly above platform stairs and elevator	Good – bus drop-off area would be located directly above platform stairs and elevator
Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks to the north of I-10; but intermittent sidewalks to the south	Good – existing bicycle lane south of I-10 and continuous sidewalks to the north and south of I-10
TRAFFIC		
Ease of traffic ingress/egress	Good – lower traffic volumes on 63rd Avenue, which is a minor arterial, would allow for easier ingress and egress	Fair – added bus volumes in congested interchange area may restrict ease of ingress and egress
Existing traffic congestion in station area	Good – low traffic volumes within the station area	Fair – relatively higher traffic volumes in and around the 67th Avenue interchange
COMMUNITY		
Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Poor – park-and-ride facility would be surrounded by existing and/or planned residential land uses on all sides, which are less compatible than other land uses	Fair – park-and-ride facility would be surrounded by existing and/or planned residential land uses to the south and east, but would be located across from an industrial land use to the west, which is generally more compatible than residential land uses
Vacant land available within a ½ mile to meet parking requirements, bus facilities, transit-oriented development potential, etc.	Good – a portion of a 35-acre vacant parcel on the southwest corner of the overpass could accommodate a 500-1,000 car park-and-ride as well as the potential to support transit-oriented development	Good – a portion of a 27-acre vacant parcel on the southeast corner of the interchange or an 11-acre vacant parcel on the northwest corner of the interchange could accommodate a 500-1,000 car park-and-ride as well as the potential to support transit-oriented development
DEMOGRAPHICS		
Future population within ½ mile of station (2030)	Good – greater than 5,500 persons	Good – greater than 5,500 persons
Future employment within ½ mile of station (2030)	Poor – less than 1,000 employees	Fair – between 1,000 – 2,000 employees
Percentage of zero car households within ½ mile of station (2030)	Fair – between 3% - 6.3% of households are transit dependent	Fair – between 3% - 6.3% of households are transit dependent
STATION COSTS		
Station development/ property acquisition costs	To be determined	To be determined

Table 4: 63rd Avenue – 67th Avenue Station Target Area
Preliminary Station Location Evaluation

CRITERION	I-10 & 63rd AVENUE OPTION	I-10 & 67th AVENUE OPTION
ENVIRONMENTAL		
Impacts to historic structures/buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	Poor – existing and planned residential neighborhoods to the north and south of I-10 and Sunridge Elementary School and Sunridge Park on the southeast side of the overpass would potentially be impacted by increased traffic and noise associated with the station	Fair – existing residential neighborhoods to the south would potentially be impacted by increased traffic and noise associated with the station, but a trucking facility on the southwest corner of the interchange would unlikely be impacted
Support of station concept received at stakeholder meetings	To be determined. Comments noted at CWG Meeting #2 include: ▪ Sunridge Elementary School is located within ½ mile of proposed station ▪ Station location could allow for continuation of transit service south on 63rd Avenue ▪ West Roosevelt Street may not have the capacity to accommodate additional traffic	To be determined. Comments noted at CWG Meeting #2 include: ▪ Station location could provide direct access to Desert West Community Center ▪ Existing traffic congestion could be amplified south of I-10; vacant parcels north of I-10 could accommodate transit-related facilities ▪ West Roosevelt Street may not have the capacity to accommodate additional traffic
PRELIMINARY RECOMMENDATION		
Set aside or carry forward into detailed station location evaluation	Set aside pending outcome of ridership and cost assessment	Carry forward into detailed station location evaluation

Source: METRO I-10 West Project Team, 2008.

3.6 Summary of Key Discriminators and Findings

Based on the results of the preliminary station evaluation described above, key discriminators are summarized by potential station locations within each station target area.

35th/39th Avenue Station Options

The evaluation of these two station options indicated that locating a station at the one-mile interchange (35th Avenue) rather than the half-mile interchange (39th Avenue) would provide better regional mobility and result in fewer potential compatibility issues and property impacts. Specifically, 35th Avenue provides greater regional access by connecting north Phoenix to South Mountain and Laveen. By locating a station at a congested interchange, it will be important to design the station and associated roadway improvements to mitigate potential traffic impacts. Another key discriminator would be the need for property acquisition. While the 35th Avenue station option would require the partial acquisition of the Naval Training Center, this facility has been recently vacated and therefore may become an ideal site for joint development. On the other hand, the 39th Avenue station option would require the acquisition of three residential parcels. The third key discriminator was that of compatibility with surrounding uses. The 35th Avenue station option would be immediately surrounded by business uses that would buffer potential traffic and noise impacts from surrounding neighborhoods and would likely serve high school students from nearby Carl Hayden High School. Conversely, the 39th Avenue station option would be surrounded by existing and planned residential areas that may be impacted by an increase in traffic.

Preliminary Recommendation: Carry forward the 35th Avenue station for further refinement and evaluation.

43rd/51st/59th Avenue Station Options

The evaluation of these three station options revealed that regional mobility was the primary discriminator among the options. Specifically, the 51st Avenue and 59th Avenue station options would have the advantage of being located along longer north-south arterials than the 43rd Avenue station option and would potentially intersect traffic and attract commuters from the proposed South Mountain Freeway. The primary disadvantage of the 43rd Avenue station option is that it would be unlikely to intercept eastbound South Mountain Freeway commuters as they would drive approximately one mile on I-10 before accessing a park-and-ride at 43rd Avenue. Both 51st Avenue and 59th Avenue station options would also provide direct connections to Village Cores (secondary Maryvale Village Core to the north and Estrella Secondary Village Core to the south). While the 59th Avenue station option has large tracts of vacant land available for a park-and-ride, the 51st Avenue station option would likely require business acquisitions.

Preliminary Recommendation: Carry forward both the 51st Avenue and 59th Avenue stations for further refinement and evaluation.

63rd/67th Avenue Station Options

The evaluation of these two station options revealed that the two key discriminators were regional mobility and compatibility of a park-and-ride with surrounding uses. While 63rd Avenue is intermittent both north and south of I-10, 67th Avenue is one of the area's longest north-south regional arterials. Further, while the 67th Avenue station option would be surrounded on one side by industrial uses and on another by planned

residential development, the 63rd Avenue station option is entirely surrounded by existing and planned residential uses, as well as an elementary school that may be impacted by increased traffic associated with a large park-and-ride. In addition, the Fowler School district has stated that it is planning to develop an elementary school park on the vacant property immediately west of Sunridge Elementary School and is also requesting that 63rd Avenue be vacated north of Roosevelt.

Preliminary Recommendation: Carry forward the 67th Avenue station for further refinement and evaluation.

End-of-Line Station Options

As described earlier, the evaluation of end-of-line station options will be documented in detail in a forthcoming End-of-Line Station Technical Memorandum.

Preliminary Recommendation: Carry forward all end-of-line station options for further refinement and evaluation.

3.7 Next Steps: Recommended Station Concept Plans

The result of this evaluation is a list of candidate stations being preliminarily recommended for further detailed evaluation in selection of a LPA. Station locations that were rated significantly lower than one or more of the other options were not recommended for further evaluation. Those stations that were determined to warrant further evaluation are recommended to be carried forward for further consideration. In some instances, more than one station option per station target area is recommended to be carried forward for a more detailed station location evaluation.

To summarize, based on preliminary recommendations, and pending the outcome of ridership and cost analyses, the following station locations will be carried forward for further refinement and evaluation:

- 35th Avenue Station
- 51st Avenue and 59th Avenue Station Options
- 67th Avenue Station
- All End-of-Line Station Options

4.0 HCT STATION PLATFORMS: CONFIGURATION OPTIONS AND EVALUATION

4.1 Introduction

While the station concept plans presented in the preceding section of this report illustrated I-10 Mainline stations as median station platforms, the specific design of platforms may vary significantly based on the technology selected and the physical dimensions of the freeway itself. This section describes the development and evaluation of HCT station configuration options along the I-10 freeway. It describes both the feasibility of a number of station layout options and an assessment of platform capacity.

4.2 LRT Station Configuration along I-10

A typical LRT station configuration was developed assuming an available right-of-way of 50-feet in the median of I-10.

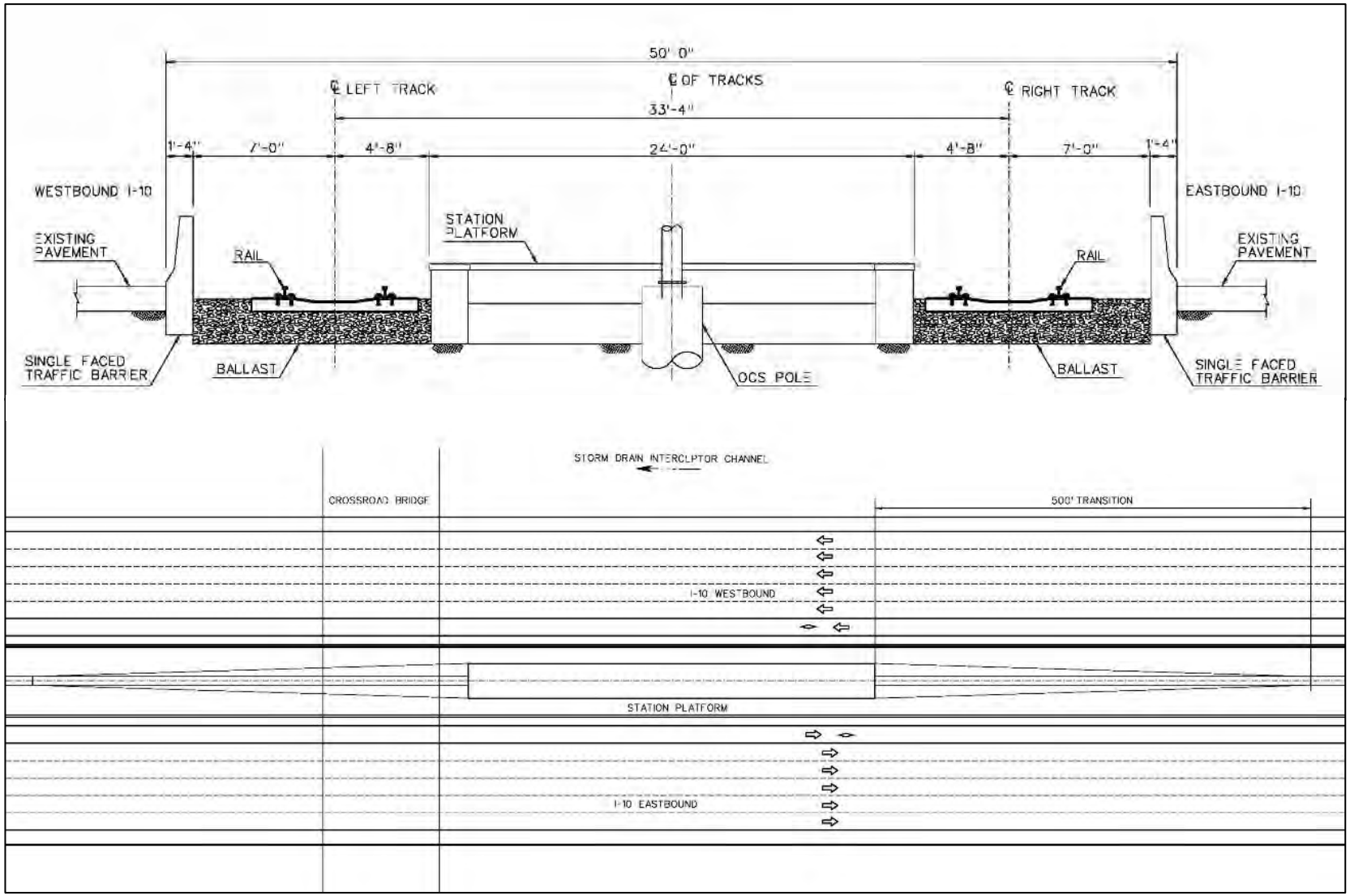
Station Configuration

The LRT station consists of a single passenger platform centered between two ballasted double tracks. Traffic barriers are placed between the freeway lanes and the rail tracks. The platform is 24 feet wide. With this configuration a single platform could be used for both directions of travel. Figure 13 illustrates an LRT station platform in section and plan.

Pedestrian Access

This LRT station configuration places a center platform to one side of a cross street, requiring access via stair and elevator/escalator at one end of the platform for all users. Park-and-ride users would arrive at the parking area, walking from their vehicle along either a path directly to a pedestrian overpass and/or along the cross street bridge to the stair entry or elevator entry. Patrons would descend either down the stairway or by elevator to the platform approximately 20 feet below. Both west and eastbound travelers would occupy the same platform area. With all travelers required to travel to one side of the connecting bridge to a single platform, only one elevator is anticipated for both arriving and departing passengers.

Figure 13: Typical I-10 Median LRT Station Section and Plan



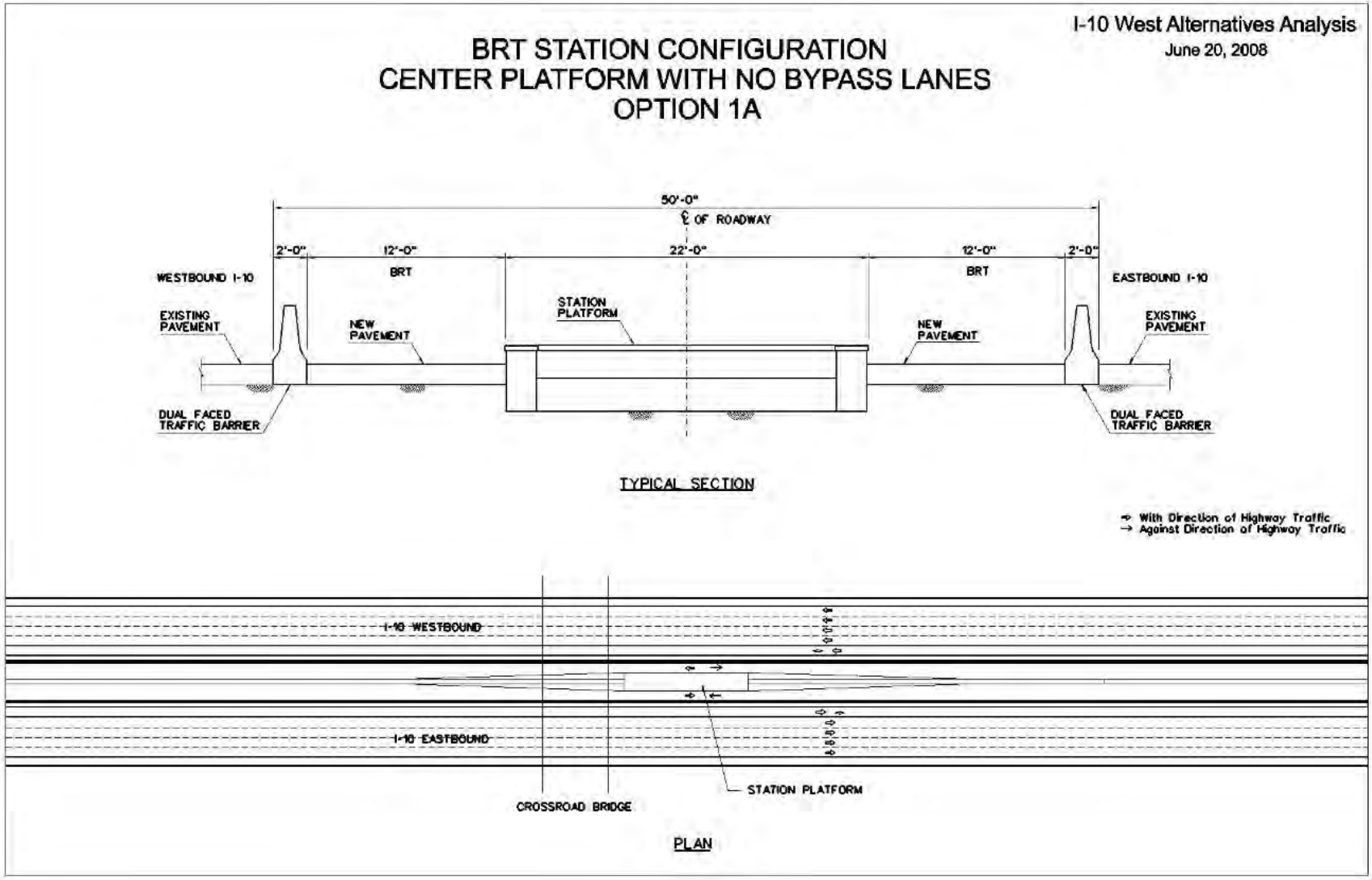
Source: METRO I-10 West Project Team, 2008.

4.3 BRT Station Configuration Options along I-10

Like the LRT station configuration described above, BRT station configurations were also developed assuming an available right-of-way of 50-feet in the median of I-10. Unlike LRT stations, however, BRT stations may vary in their layout and operational requirements. The design options described in this section vary in both the physical means by which buses and pedestrians would access the platforms as well as the operational means by which the buses would function within the transit guideway. BRT station configuration options include the following:

- Option 1A: Center platform with no bypass lanes;
- Option 1B: Staggered center platform with bypass lanes;
- Option 2A: Adjacent side platforms with no bypass lanes;
- Option 2B: Staggered side platforms with bypass lanes;
- Option 3A: Off-line platform with at-grade freeway bypass lanes;
- Option 3B: Off-line platform with elevated bypass lanes;
- Option 4A: Elevated platform with at-grade bypass lanes; and
- Option 4B: Elevated platform with elevated bypass lanes.

Option 1A: Center platform with no bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 1A: Center platform with no bypass lanes

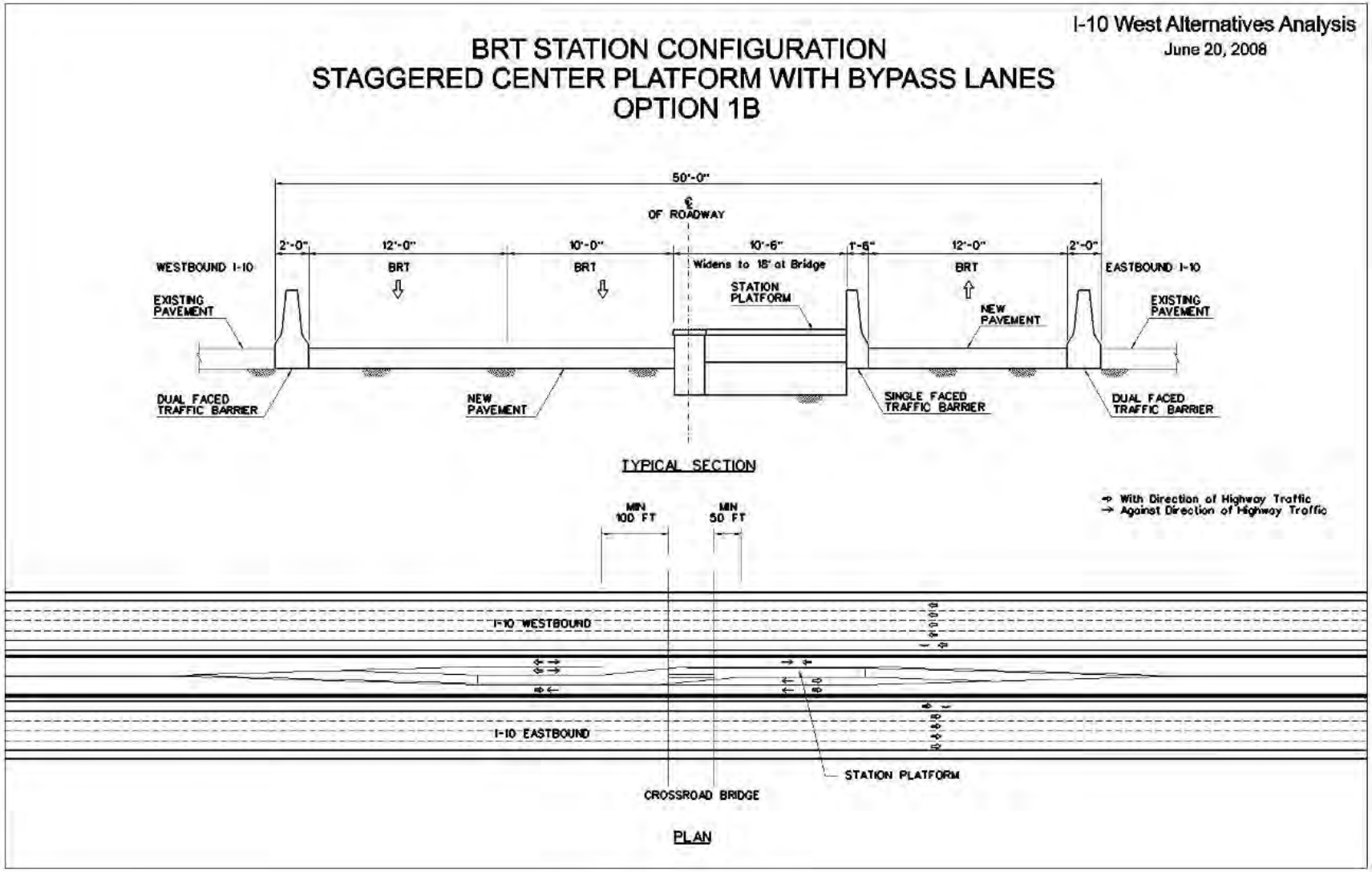
Station Configuration and BRT Operations

Option 1A consists of a single passenger platform centered between two travel lanes. The lanes are 12 feet wide. Traffic barriers are placed between the freeway lanes and the BRT lanes. The platform is 22 feet wide. With this configuration a single platform could be used for both directions of travel. A single lane in each direction does not provide for a bus to bypass the platform while a bus is loading and unloading passengers. The location of the platform in the center of the busway would require doors on the left side of the buses or bus travel in a contraflow direction.

Pedestrian Access

Like the LRT station configuration described above, Option 1A places a center platform to one side of a cross street, requiring access via stair and elevator/escalator at one end of the platform for all users. Park-and-ride users would arrive at the parking area, walking from their vehicle along either a path directly to a pedestrian overpass and/or along the cross street bridge to the stair entry or elevator entry. Patrons would descend either down the stairway or by elevator to the platform approximately 20 feet below. Both west and eastbound travelers would occupy the same platform area. With all travelers required to travel to one side of the connecting bridge to a single platform, only one elevator is anticipated for both arriving and departing passengers.

Option 1B: Staggered center platform with bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 1B: Staggered center platform with bypass lanes

Station Configuration and BRT Operations

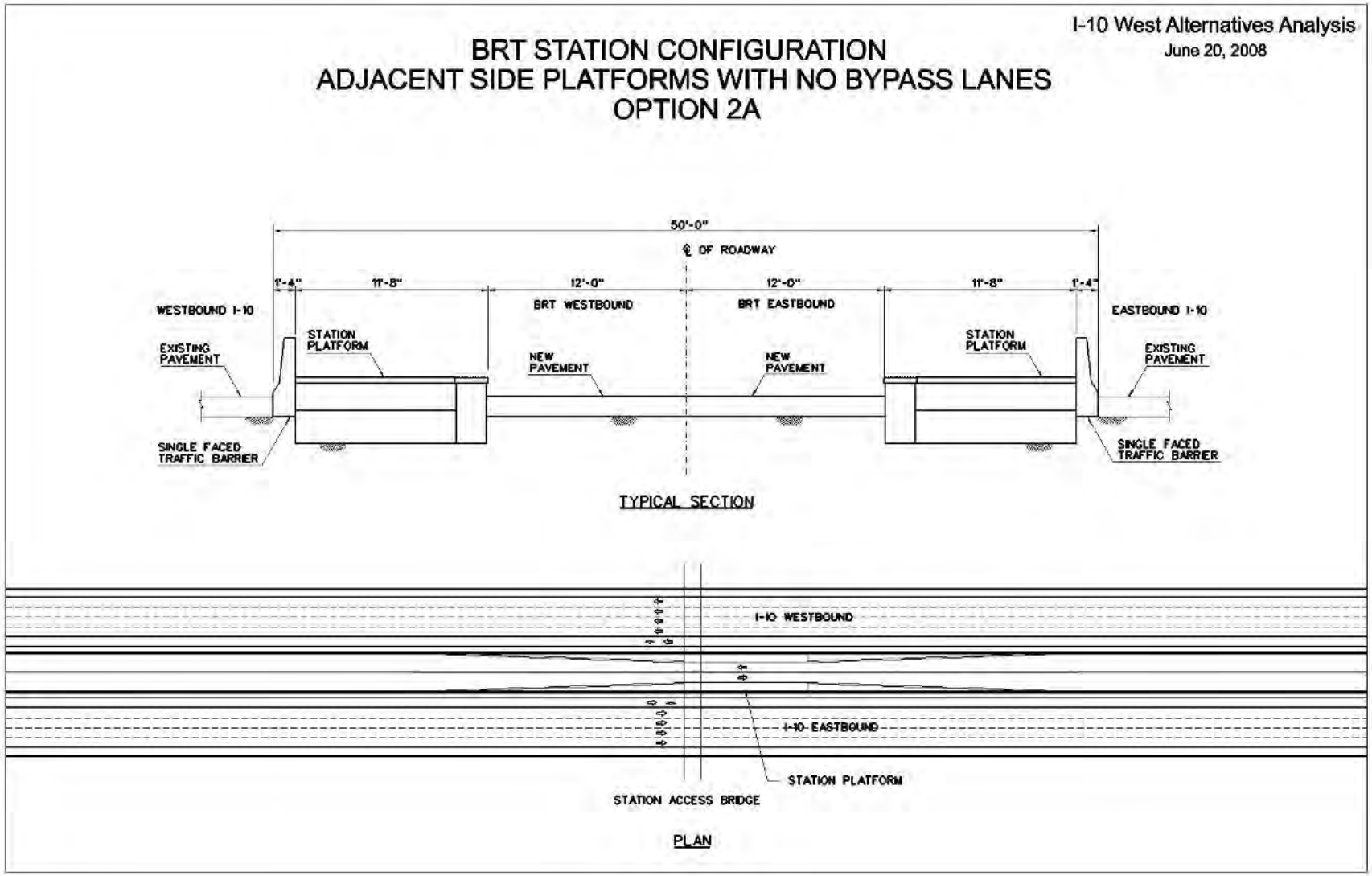
Option 1B consists of a single passenger platform located generally in the center of three travel lanes. The through lanes are 12 feet wide. The lane against the platform is 10 feet wide. Traffic barriers are placed between the freeway lanes and the BRT lanes. The platform is 10 feet 6 inches wide. A barrier is also placed at the back side of the station platform. A second lane at the front side of the platform allows a bus to bypass a bus stopped at the platform. This configuration would require two platforms, one for each direction of travel. The platforms would be connected by a widened area at a bridge crossing the freeway. This widened area would contain the required stairs and elevators for vertical access. The location of the platform in the center of the busway would require doors on the left side of the buses or bus travel in a contraflow direction.

Pedestrian Access

Option 1B splits the westbound and eastbound platforms on either side of the bridge pier to allow for a bus to bypass the platform. The platform is accessed as in 1A, by stairway or elevator, with travelers descending down to the platform level. This option, with its split platforms at 10 foot 6 inches each, should provide elevator and stairway access to both sides of the street so that both eastbound and westbound travelers can access their direction of travel easily. The platforms are also narrower than Option 1A, necessitating efficient use of the space.

Access from the park-and-ride or bus drop-off areas could be by walkway along the street to the midway point of the freeway, or to a pedestrian overpass. The overpass option would potentially require two bridges, with one to each platform.

Option 2A: Adjacent side platforms with no bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 2A: Adjacent side platforms with no bypass lanes

Station Configuration and BRT Operations

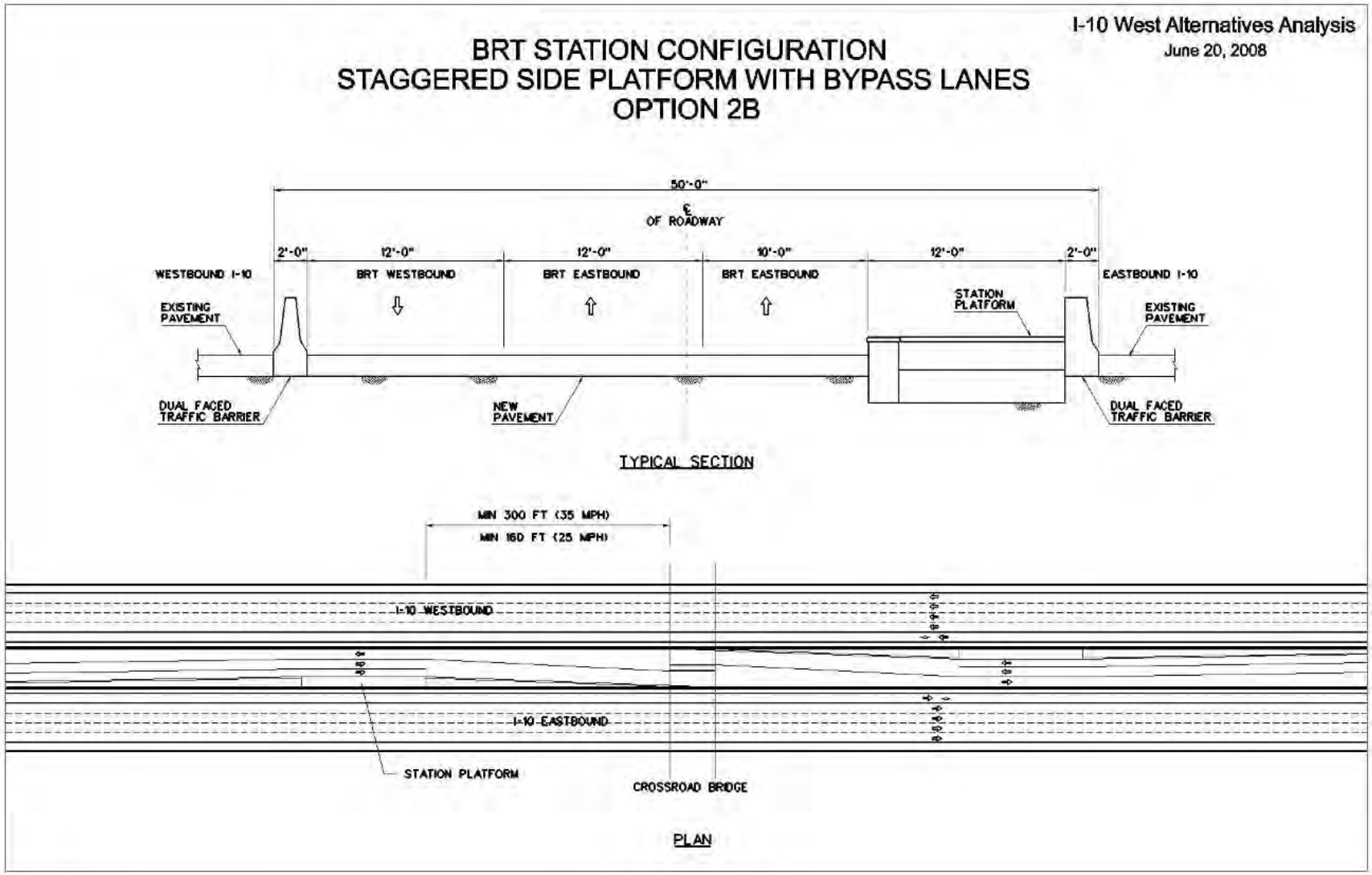
Option 2A consists of two platforms located outside the BRT lanes. Each platform is separated from the freeway lanes by a single sided traffic barrier. The BRT lanes are 12 feet wide with no separation between the opposite directions of travel. Each platform is 11 feet 8 inches wide. This configuration would require two platforms, one for each direction of travel. Standard buses could be used.

Pedestrian Access

Similar to 1A, which is a center platform with no bypass lanes, Option 2A locates side platforms to one side of the cross street to connect to the lower level platforms. Using a stairway or elevator, transit passengers descend to the platforms on either side of the guideway; therefore, two elevators/stairways would be required along with wayfinding to direct passengers to the westbound or eastbound platforms. This necessitates a wide walkway sufficient for queuing and passing of passengers coming to and from the elevators and stairways to their various destinations.

Access from the park-and-ride or bus drop-off areas could be by walkway along the street to the midway point of the freeway, or through a separate pedestrian overpass. The overpass option would require one pedestrian bridge that provided access to both side platforms to serve both directions.

Option 2B: Staggered side platforms with bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 2B: Staggered side platforms with bypass lanes

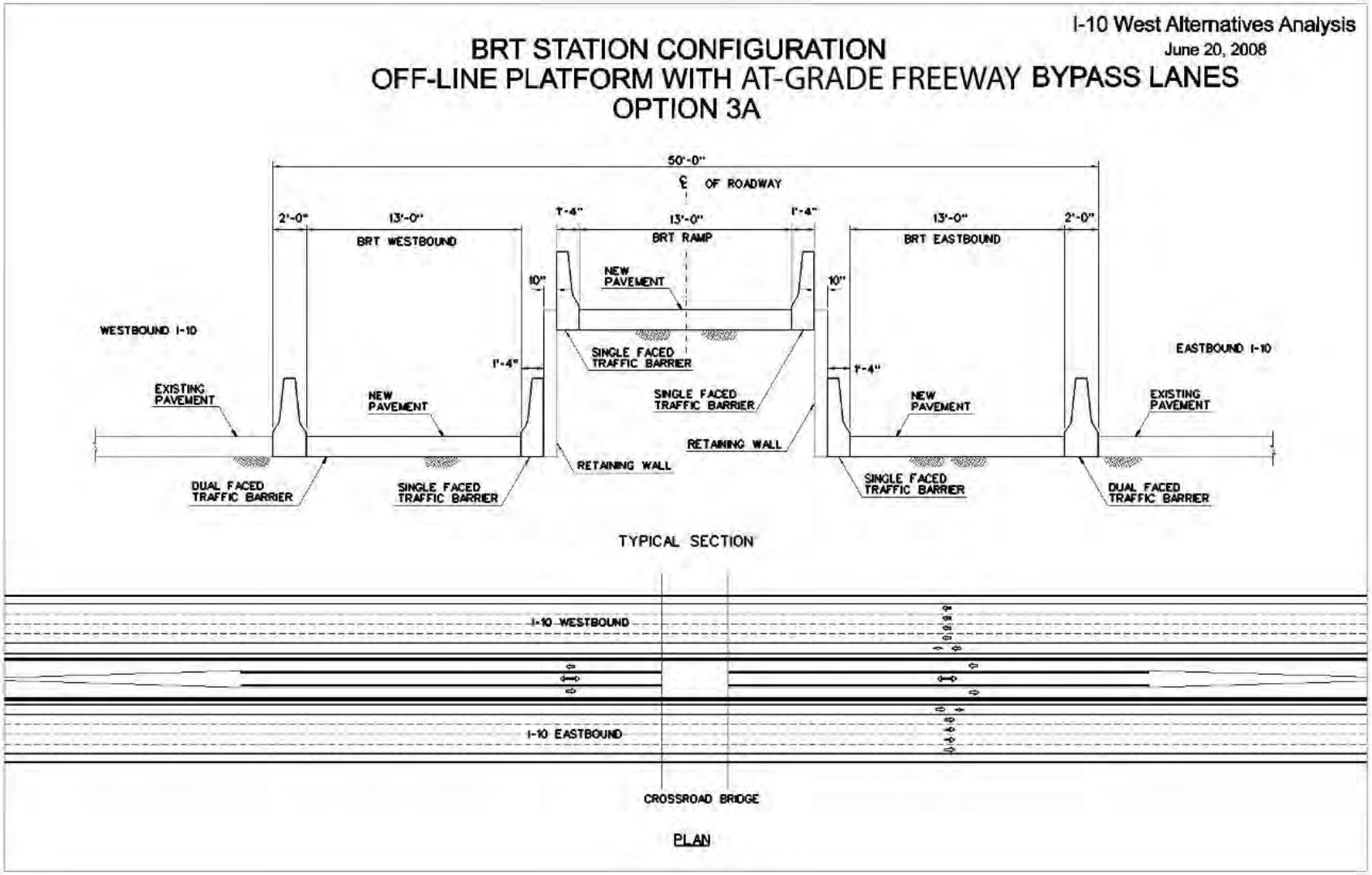
Station Configuration and BRT Operations

Option 2B consists of two platforms located outside the BRT lanes. The platform locations are staggered to provide for a bypass lane. Each platform is separated from the freeway lanes by a single sided traffic barrier. The through lanes are 12 feet wide with no separation between the opposite directions of travel. The lane against the platform is 10 feet wide. Each platform is 12 feet wide. This configuration would require two platforms, one for each direction of travel. Standard buses could be used.

Pedestrian Access

Similar to 1B, which is a staggered center platform with bypass lanes, Option 2B splits the westbound and eastbound platforms on either side of the cross street bridge to allow for a bus to bypass the platform. By locating these platforms as side-staggered from one another to accommodate the bypass, the distance that transit passengers have to travel becomes significantly longer, necessitating overpasses to each platform from the adjacent parking and drop-off areas. There is no possibility of a connection between the two platforms due to distance and width restrictions. A transit passenger could get to a platform from either an overhead and parallel walkway from the cross street or from an overpass directly from the park-and--ride/bus drop-off area for one leg of their trip; however, the return trip requires them to ascend the platform and take another overpass or elevated walkway back to the other side where they left their vehicle or to pick up a bus.

Option 3A: Off-line platform with at-grade freeway bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 3A: Off-line platform with at-grade freeway bypass lanes

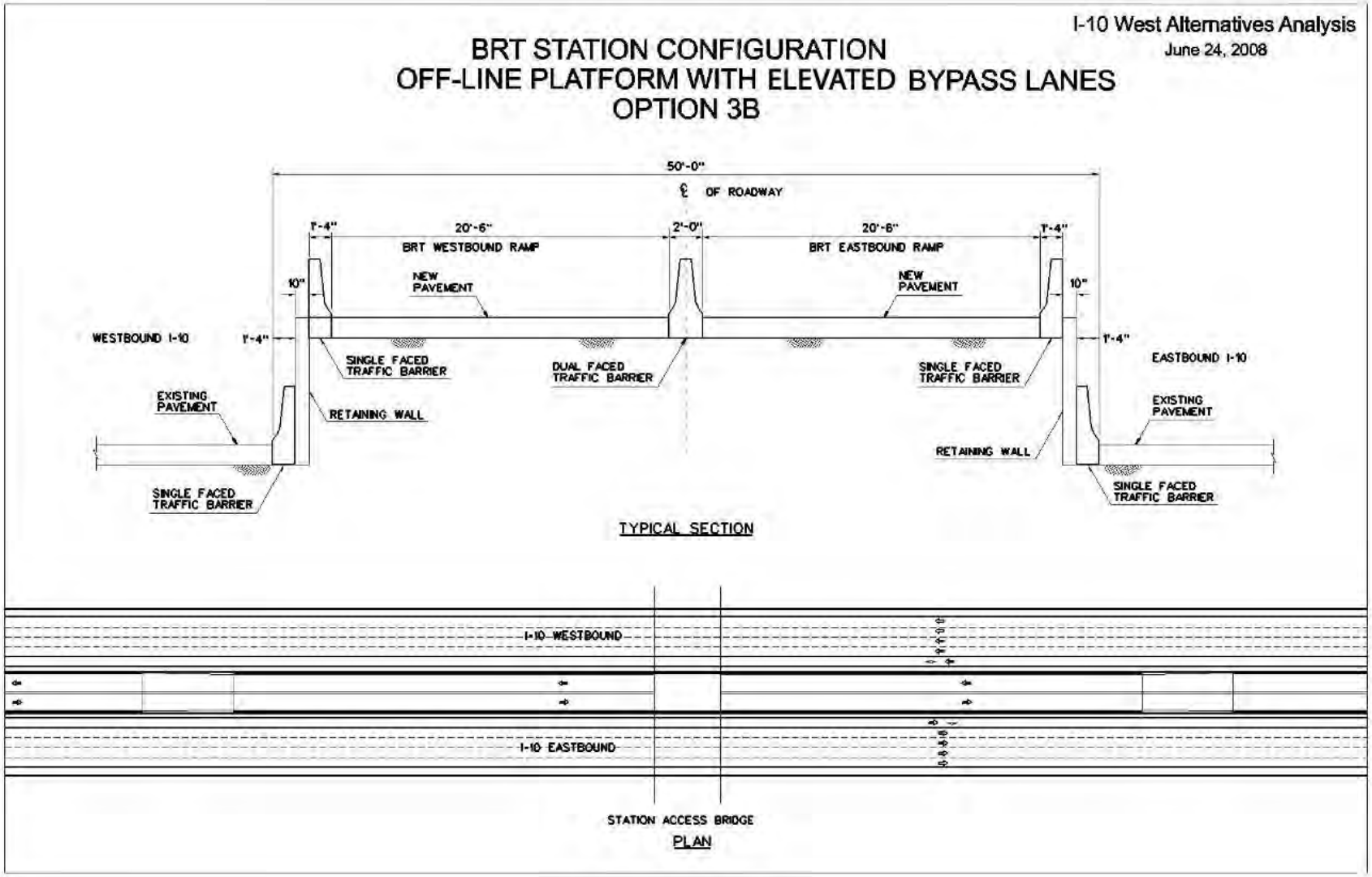
Station Configuration and BRT Operations

Option 3A consists of a ramp out of the median. The platform would be outside of the freeway right-of-way. The ramp is a single 13-foot lane. Two 13-foot bypass lanes are provided at the freeway grade. The ramp would require metering to provide for two-direction operation and bus schedules would be synchronized to facilitate safe movements. The ramps would rise to the same level as the cross street, which would be signalized to also allow for safe bus movements. Buses would merge or diverge at ramp exits/entrances with a bypass lane. Traffic barriers are provided at wall locations and between the BRT lanes and the freeway lanes. Standard buses could be used.

Pedestrian Access

Option 3A emulates the existing 79th Avenue exit ramp from the freeway, which provides exclusive access for buses on and off the freeway from the median to an offsite drop-off/pickup area at the park-and-ride lot for personal vehicles and for local buses. No platforms are located in the center of the freeway; the "platform" is located at the park-and-ride and drop-off area. This diverts the bus instead of the pedestrian, with less walking time required for transit passengers, but requires the bus to exit and enter back onto the freeway from the cross street. No elevators or stairways are required with this option.

Option 3B: Off-line platform with elevated bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 3B: Off-line platform with elevated bypass lanes

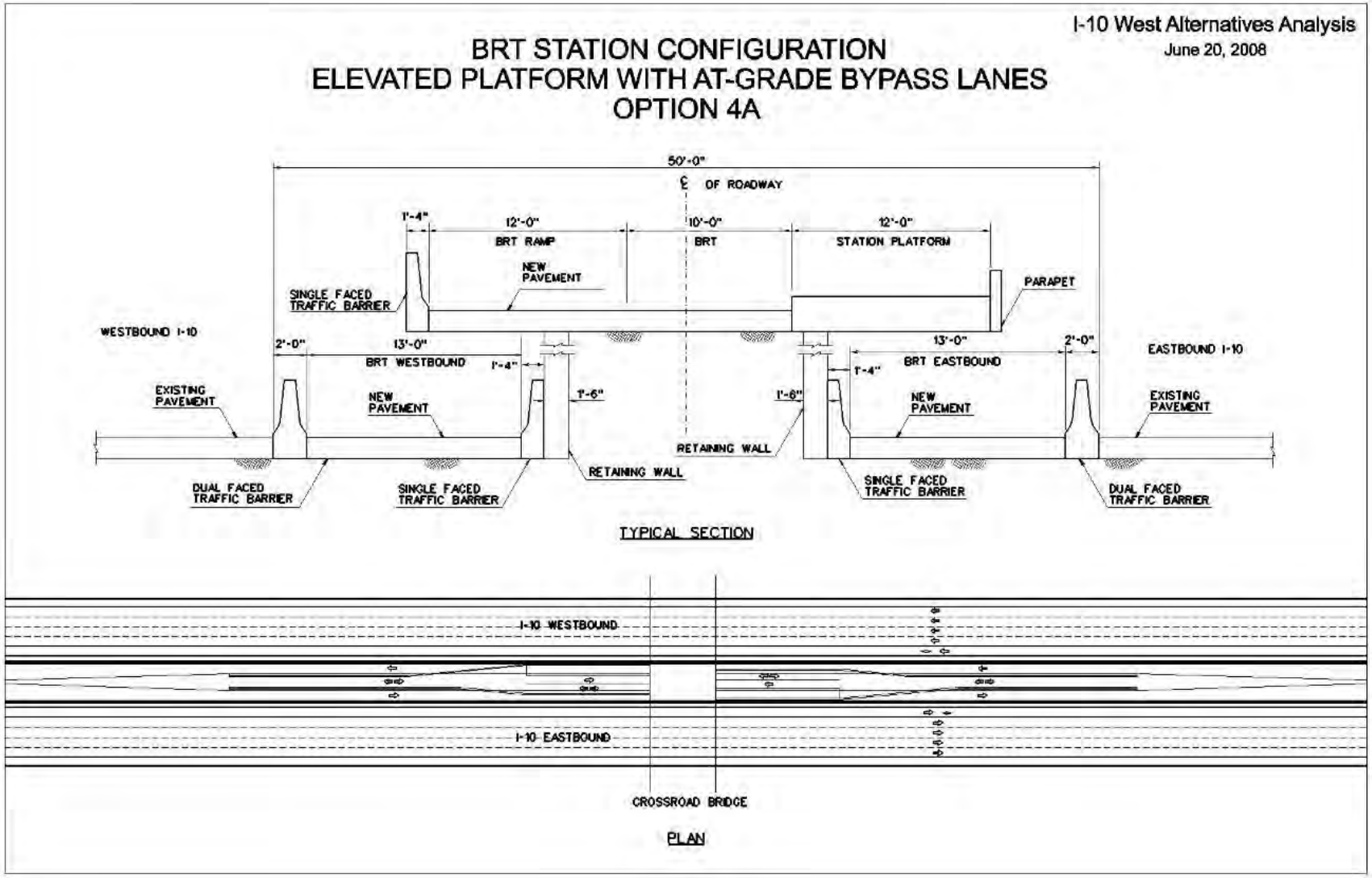
Station Configuration and BRT Operations

Option 3B consists of a ramp out of the median. The platform would be outside of the freeway right-of-way. The ramp provides two 20-foot six-inch lanes. Buses would merge or diverge at a cross road overpass. Traffic barriers are provided at wall locations and between the BRT lanes and the freeway lanes. Standard buses could be used.

Pedestrian Access

Option 3B is a variation of Option 3A, requiring an off line pickup and drop off of passengers at the park-and-ride lot and local bus drop-off areas. Express buses can continue across the cross street with a traffic signal on the elevated cross street bridge. Pedestrian circulation is the same as described in 3A.

Option 4A: Elevated platform with at-grade bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 4A: Elevated platform with at-grade bypass lanes

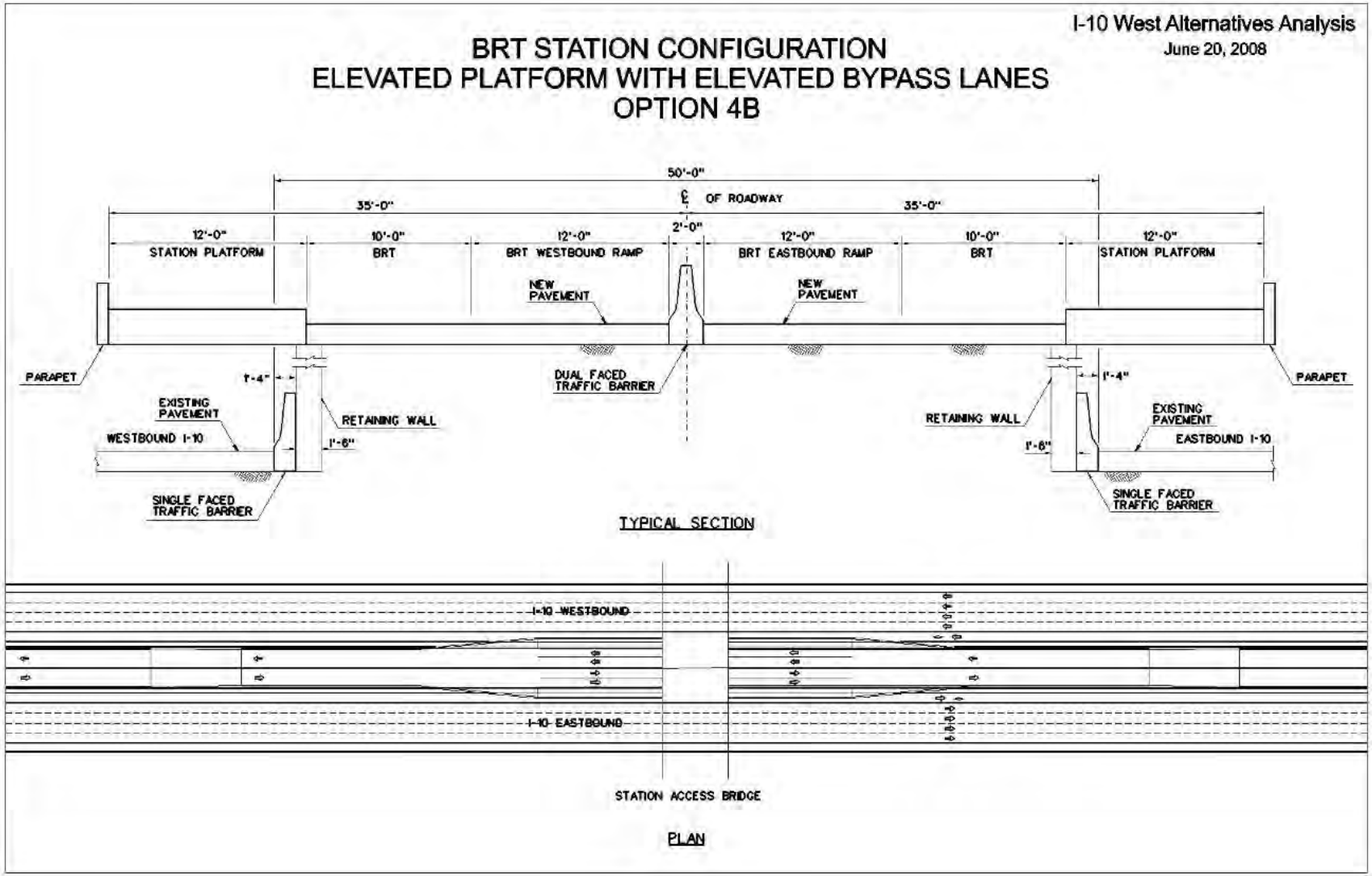
Station Configuration and BRT Operations

Option 4A consists of a ramp out of the median. Two 13-foot b7ypass lanes are provided at the freeway grade. Until clearance to adjacent lanes is accommodated, the ramp is a single 13-foot lane. The ramp would require metering to provide for two-direction operation. Once the ramp obtains clearance above the adjacent lanes the structure can be widened to provide for bypass lanes and platforms. Minimum through lane, lane adjacent to platform and platform widths are 12-feet, 10-feet and 12-feet respectively. The lanes and platform widths can be increased by adjusting the width of the structure. Traffic barriers are provided at wall locations and between the BRT lanes and the freeway lanes. Standard buses could be used.

Pedestrian Access

With platforms at the cross street level above the freeway, Option 4A does not require pedestrians to descend via elevators or stairs, but has buses travel up ramps east and west bound for pickup and drop-off. Underneath these platforms, bypass lanes move express or other transit through to the other stops along the route. To accomplish this however, the platforms must be staggered on either side of the cross street connection, allowing for no connection between the two platforms without traversing across traffic on the cross street. Adequate signage will also be important to ensure passengers locate the correct platform.

Option 4B: Elevated platform with elevated bypass lanes



Source: METRO I-10 West Project Team, 2008.

Option 4B: Elevated platform with elevated bypass lanes

Station Configuration and BRT Operations

Option 4B consists of a ramp out of the median. Until clearance to adjacent lanes is accommodated, the ramp provides two 20-foot six-inch lanes. Once the ramp is elevated enough to provide clearance over the adjacent freeway lanes the ramp is widened to provide a bypass lanes and platforms. Minimum through lane, lane adjacent to platform and platform widths are 12-feet, 10-feet and 12-feet respectively. The lanes and platform widths can be increased by adjusting the width of the structure. Traffic barriers are provided at wall locations and between the BRT lanes. Standard buses could be used.

Pedestrian Access

Option 4B essentially makes all the connections and bypasses elevated above the freeway at street level. All buses travel up the ramps to platforms, including those bypassing the station platform. For passengers, connections between the platforms requires crossing the street and negotiating the buses going through as well as those dropping off/picking up. A potentially larger structure could be designed here, one that provides a transit center above grade, with local bus drop-off at the elevated platform level, as part of a widened cross street. This still requires passengers to cross the street, increasing the possibility of bus and pedestrian conflicts. Pedestrian circulation to and from these platforms from park-and-ride lot would require routes that directed transit patrons to the cross street for platform access. Pedestrian overpass access away from the cross street might be a less conflicting option; overpasses at the end of each platform (west and east bound) would be needed.

4.4 Evaluation of BRT Station Configuration Options

4.4.1 Evaluation Criteria

The I-10 Mainline segment BRT station configuration options described in Section 4.3 were evaluated with the following questions:

Does it allow for express BRT service? Express BRT service is a feature of BRT routing that allows for some BRT routes to bypass certain stations. Depending on demand patterns, express service has strong potential to provide better travel times to riders and better distribution of capacity, so that, for example, inbound riders boarding at stations closer to downtown are less likely to have the bus arrive already full. For the purposes of this evaluation, the ability to provide Express BRT service was considered a requirement and was therefore a fatal flaw for those configurations that were unable to allow for Express BRT service.

Does it provide access points for BRT into and out of the median guideway? Intra-corridor access allows BRT routes to make use of part of the guideway, so that riders not parking at a station on the corridor are more likely to have a one-seat ride available.

Does it allow for use of standard buses that operate in the same direction as general traffic flow (i.e., no contraflow service or buses with left side doors)? The use of standard buses allows METRO to save costs because special buses are usually more expensive to purchase and maintain. Contraflow operation (on the left side of the roadway, as all roadways operate in Great Britain, for example) allows buses with right-side doors to serve center-platform stations, but require additional operator training and could confuse auto drivers in adjacent lanes.

Does it provide reasonable and convenient walking distance and wayfinding for pedestrians relative to other options? The station platform should not be located far from the overpass connection to the station parking, bus loading, and drop-off areas, regardless of whether the overpass connection is a street or a station-specific pedestrian bridge.

Does it grade-separate the pedestrian platform from freeway traffic? Grade-separating the place where pedestrians wait for BRT vehicles to arrive allows for a more comfortable pedestrian environment, more removed from the impacts of freeway noise and dust than an at-grade pedestrian platform.

The answers to these questions were used to identify the conceptual BRT station configuration options that should be carried forward for detailed evaluation.

4.4.2 Evaluation Results

The results of the screening of I-10 Mainline segment BRT station configuration options are shown in Table 5.

Table 5: I-10 BRT Station Configuration Evaluation

Evaluation Criteria	Option 1A Center Platform with No Bypass Lanes	Option 1B Staggered Center Platform with Bypass Lanes	Option 2A Adjacent Side Platforms with No Bypass Lanes	Option 2B Staggered Side Platforms with Bypass Lanes	Option 3A Off-Line Platform with At-Grade Bypass Lanes	Option 3B Off-Line Platform with Elevated Bypass Lanes	Option 4A Elevated Platform with At-Grade Bypass Lanes	Option 4B Elevated Platform with Elevated Bypass Lanes
Allows for Express BRT Service?	NO	YES	NO	YES	NO	YES	YES	YES
Provides Access Points for BRT Vehicles Into and Out of Fixed Guideway	NO	NO	NO	NO	YES	YES	YES	YES
Allows for Use of Standard Buses that Operate in Same Direction as General Traffic Flow (i.e. No Contraflow Service or Left-Side Door Vehicles)	NO	NO	YES	YES	YES	YES	YES	YES
Provides Reasonable Walking Distance & Wayfinding for Pedestrians	YES	YES	YES	NO	YES	YES	YES	YES
Grade Separates Pedestrian Platform from Freeway Traffic	NO	NO	NO	NO	YES	YES	YES	YES
Preliminary Recommendation	Remove from Consideration	Carry Forward	Remove from Consideration	Carry Forward	Remove from Consideration	Carry Forward	Carry Forward	Carry Forward

Evaluation Criteria	Option 1A Center Platform with No Bypass Lanes	Option 1B Staggered Center Platform with Bypass Lanes	Option 2A Adjacent Side Platforms with No Bypass Lanes	Option 2B Staggered Side Platforms with Bypass Lanes	Option 3A Off-Line Platform with At-Grade Bypass Lanes	Option 3B Off-Line Platform with Elevated Bypass Lanes	Option 4A Elevated Platform with At-Grade Bypass Lanes	Option 4B Elevated Platform with Elevated Bypass Lanes
Rationale for Preliminary Recommendation & Further Considerations	No express service	Most comparable to LRT station configuration Requires stairs, elevators and pedestrian bridge	No express service	Not as convenient for passenger access as Option 1B, but provides alternate at-grade station option for consideration Requires two sets of elevators, stairs, pedestrian bridges	No express service; Requires stops at cross roads	Creates more pleasant waiting environment for transit patrons Does not require stairs or elevators Requires freeway ramps Allows for express service but requires stops at cross roads	Creates more pleasant waiting environment for transit patrons Does not require stairs or elevators Requires freeway ramps Requires pedestrian bridge Allows for express service but requires stops at cross roads	Creates more pleasant waiting environment for transit patrons Does not require stairs or elevators Requires freeway ramps Requires pedestrian bridge Allows for express service but requires stops at cross roads

Source: METRO I-10 West Project Team, 2008.

4.5 Summary of Key Discriminators

The criteria associated with bypass lanes for Express BRT service, mid-corridor BRT route entry, and platform grade-separation provided the most useful information in determining which station configuration options would be carried forward for additional analysis. Bypass lanes and mid-corridor BRT route entry are important elements in maximizing the benefits provided by the flexibility of BRT.

Based on these findings, the following BRT station configuration options have been recommended to be carried forward for detailed evaluation:

- Option 1B: At-grade staggered center platform with bypass lanes. This option is most comparable to an LRT center-loading station configuration. It also allows for the operation of express BRT service, but would require left-side door vehicles or contraflow service.
- Option 2B: Staggered side platforms with bypass lanes. This option allows for the use of standard buses but also requires two sets of elevators, stairs and pedestrian bridges.
- Option 3B: Off-line platform with elevated bypass lanes. This option creates a more pleasant waiting environment for transit patrons, since the platform is not located in the freeway but within the park-and-ride or drop-off area. It also does not require stairs or elevators, but does require the construction of freeway ramps.
- Options 4A and 4B: Elevated platform with at-grade bypass lane. This option also creates a more pleasant waiting environment for transit patrons, since the platforms are located above freeway lanes. It does not require stairs or elevators, but does require both pedestrian bridges and freeway ramps. The primary difference between these two options is the location of BRT bypass lanes, with Option 4A bypass lanes located at-grade and Option 4B bypass lanes located at the elevation of the raised platforms.

4.6 BRT Station Platform Capacity

While the width of a typical LRT station platform—24-feet wide in the I-10 median—provides adequate platform capacity, BRT station platforms may be considerably narrower due to lane width requirements. Given that the available right-of-way within the median of I-10 is limited to 50 feet and split BRT platform widths could be as narrow as 10-feet 6-inces, as described in Option 1B, it is important to understand the platform width requirements needed to satisfy emergency evacuation standards as described by the National Fire Protection Agency (NFPA) standards. This section presents an analysis of the project team's technical findings.

4.6.1 BRT Platform Capacity Analysis

The platform capacity analysis assumes a split station platform is 120 feet long, in order to accommodate two 60 foot buses, and 10 feet wide. The gross platform area therefore would be 1,200 square feet. Subtracting from this area the two-foot tactile warning strip and another three feet on the other side for canopy/roof columns, benches, trash cans, fare vending machines, and wayfinding/schedule information display equipment, the effective width of platform area is five feet, or 600 square feet of net platform area.

For the purposes of this evaluation, the "design condition" is assumed to be 100 people on the platform at any given time. This design condition assumes that one bus load of people (40 - 60 persons) would be waiting to board a bus and one bus load of people (40 – 60 persons) would be waiting to disembark a bus. Using a load design of 100 persons, that equates to six square feet per person, which is in the Level of Service (LOS) D, or acceptable range for platforms and waiting areas (three to seven square feet/person) according to the TCRP Report 90, Vol. 2. The NFPA standards specifically relate to a LOS E/F conditions for emergency evacuation. The standards state that (a) the platform load (people) shall be evacuable in four minutes, and (b) the capacity of an egress stairway in the up direction is 1.31 persons per minute per inch of stairway width.

The following two questions were examined to understand if the design of a 10-foot-wide platform would meet these evacuation requirements.

1. *If the platform were holding two full buses full of people at one time, or 200 persons, how wide a stairway would be needed to meet the four-minute requirement?* The answer is a little over 38", or 3' 2". The required minimum stairway width regardless of capacity, in the standards, is 44" (3' 8").
2. *If the platform were seven feet wide, as drawn in the minimum 10-foot side platform case with a three-foot walkway to the elevator, how many people could be evacuated in four minutes?* The answer is 440 people, or over twice the number of people expected.

4.6.2 BRT Platform Capacity Findings

In summary, this analysis indicates that, in concept, a 10-foot-wide BRT platform should be acceptable in terms of egress capacity per NFPA standards.

5.0 HCT STATION DESIGN: PHYSICAL AND ENVIRONMENTAL FACTORS

5.1 Introduction

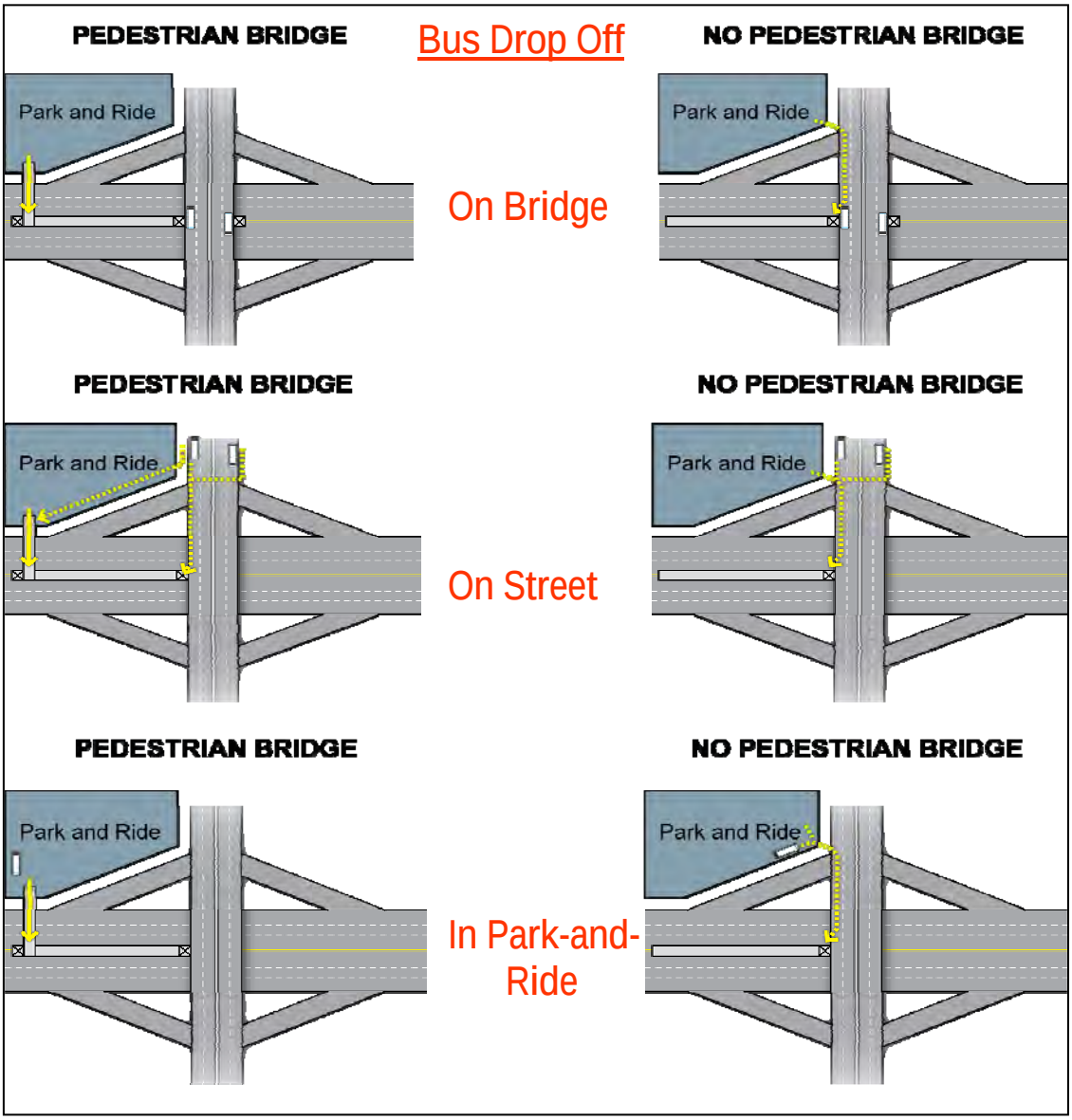
For the purposes of developing and comparing station locations in the Tier 2 evaluation, all station concepts described and shown in Section 3.3 assume that feeder buses stop on the I-10 bridges with HCT passengers accessing the station platform below via stairs and/or elevators. As station design advances however, various bus and pedestrian access will be considered for each station. The following section describes a number of bus and pedestrian access options and also discusses environmental factors, such as climate, noise, and air quality that will be important considerations as station designs advance.

5.2 Access and Circulation Factors

5.2.1 Bus and Pedestrian Access Options

Pedestrian access and bus drop off areas at potential interchange station locations being carried forward for further refinement and evaluation – 35th Avenue, 51st Avenue, 59th Avenue and 67th Avenue – will require a more detailed assessment as station design progresses. Factors that could influence the design of bus and pedestrian access include interchange traffic, pedestrian convenience, bus operations, and infrastructures costs such as the possible widening of interchanges, construction of pedestrian-only bridges, and provision of stairs and elevators. Figure 14 compares the pedestrian access implications with the possible combinations of bus stop locations and presence or absence of a separate pedestrian-only bridge directly to the median station platform. The dashed yellow lines represent pedestrian routes from the bus or park-and-ride to the platform. These access options could apply at any of the interchange stations with parking.

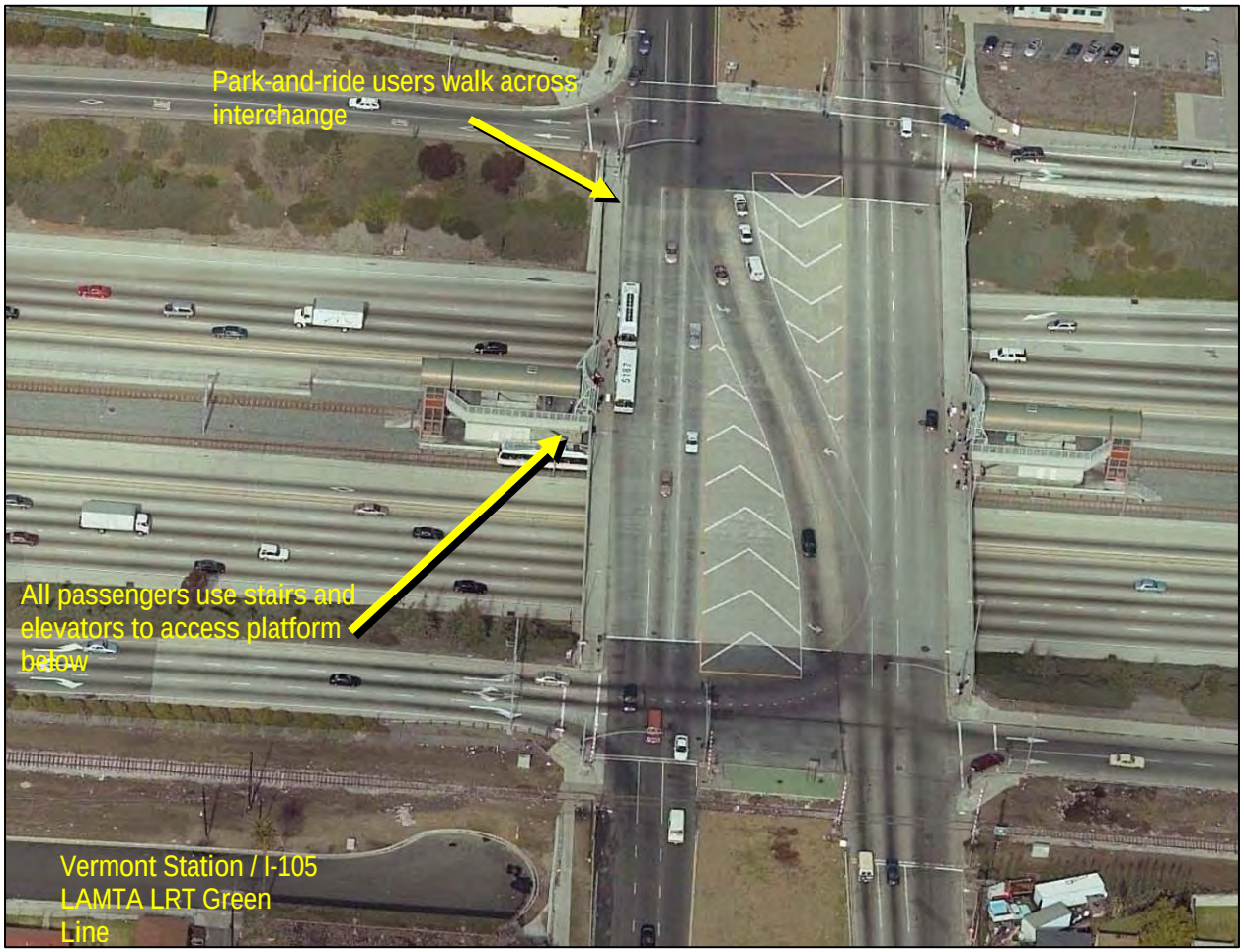
Figure 14: Bus and Pedestrian Access Options to Median Stations



Source: METRO I-10 West Project Team, 2008.

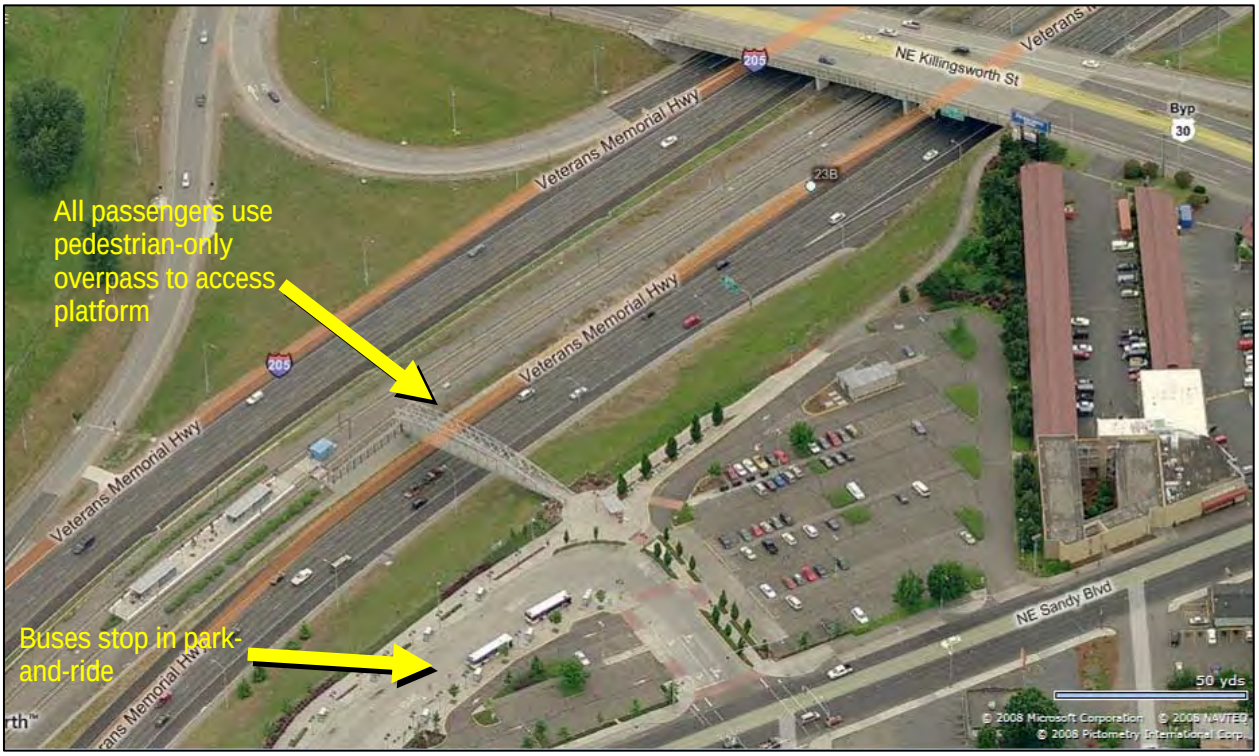
Each access configuration shown above is currently used in freeway transit systems nationwide. Figure 15 is a depiction of a freeway median station along the Los Angeles Green Line LRT system with bus stops on the bridge. By comparison, Figure 16 is a depiction of a freeway median station along the Portland Red Line LRT system with buses stopping in a park-and-ride lot and pedestrians accessing the platform via a pedestrian-only bridge. In these two examples that could be applied to I-10 Mainline stations, the bus stops could be located on the bridge over I-10 (as shown in the station concepts) or inside the park-and-ride lot. Riders using the parking lot, either because they drove themselves, were dropped off by a car, or got off a bus, could either use an enhanced walkway along the interchange bridge or a new pedestrian-only bridge to the median station platform.

Figure 15: Freeway Median Station with Pedestrian Access from Interchange Bridge



Source: http://maps.live.com/ and METRO I-10 West Project Team, 2008.

Figure 16: Freeway Median Station with Pedestrian Access from Pedestrian-Only Bridge



Source: http://maps.live.com/ and METRO I-10 West Project Team, 2008.

5.3 Environmental Factors

Given the challenges presented by the region's often inhospitable climate in the summer months and the location of station platforms in a freeway environment, designing stations to mitigate for these factors will be vital to the success of the HCT system. While the design of station features such as landscaping, building materials, screening and canopies is a component of the basic engineering process, it is important to consider particular elements of design that will require special attention as this project progresses from conceptual planning to more detailed design and engineering. The following sections describe physical conditions created by freeway traffic, noise, climate and air quality that should be considered in more detail as the station planning process progresses.

5.3.1 Climate/Weather Factors

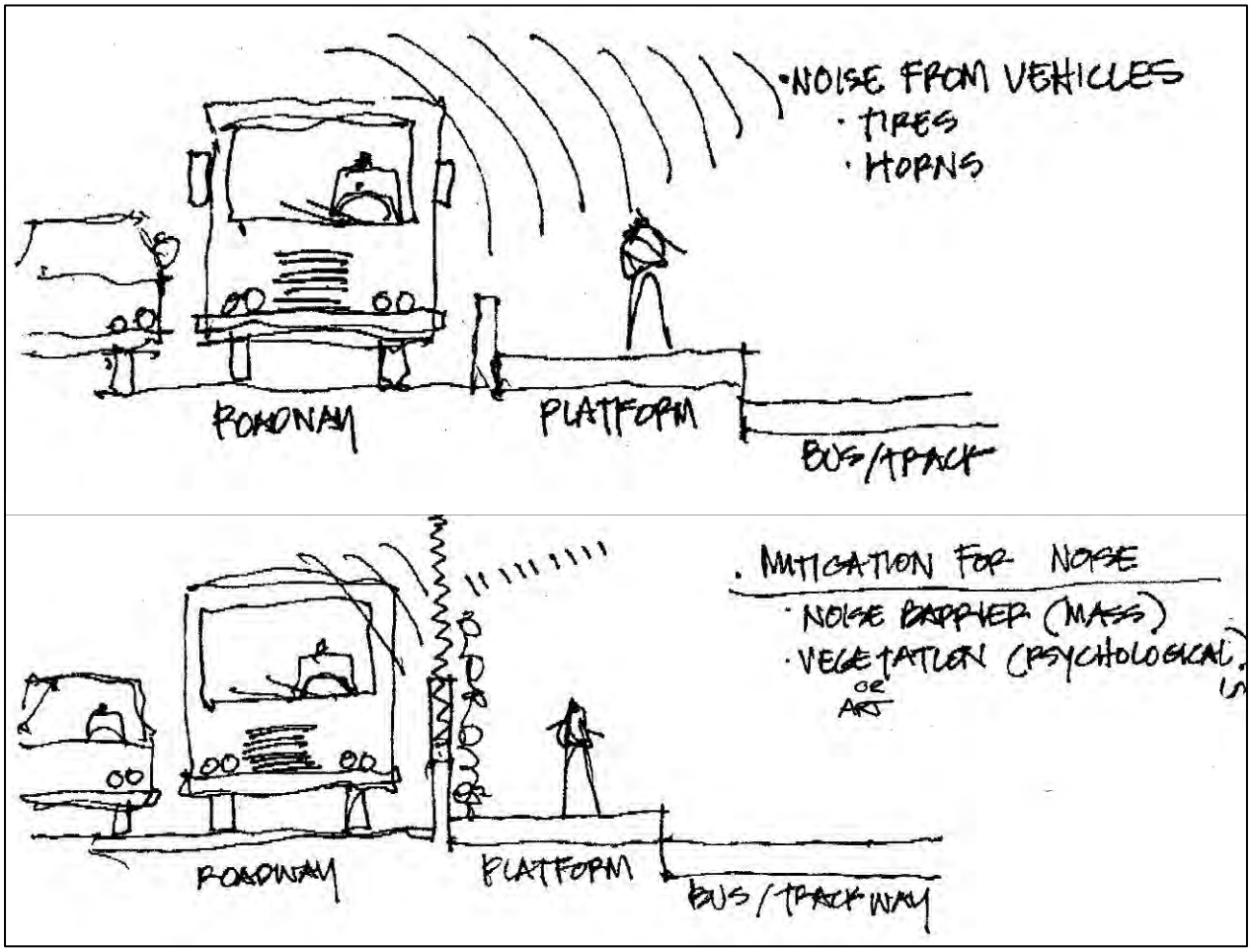
Traveling to and from the HCT station platform will necessitate either traveling from a park-and-ride or being dropped off by bus at the upper level entrance to the platform. Given the distance across freeway travel lanes and shoulders, passengers may be walking up to 1,400 feet or the equivalent of five minutes to and from the station platform. This route should include provisions for shade and all weather cover. Since most of the distance will be traveled in a north/south direction, a shade study of the likely path of travel should account for early morning low angle sun from the northeast, midday high angle sun, and late day low angle sun from the northwest as the worst travel condition. The desert environment can also be challenging in the summer months when the heat index for temperature and humidity increase to uncomfortable, even life-threatening levels. The challenge especially for this east/west corridor is that the summer sun is at its most intense and lowest angle during peak PM transit use. Summer monsoon storms

also bring dust and rain with short but strong intensity. Since overhead canopies are insufficient to provide any sun protection except at midday, vertical shade panels and windbreaks would be required to mitigate for exposure to these elements.

5.3.2 Noise Factors

Decibel levels adjacent to freeway lanes will be loud enough to make conversation difficult on platforms, especially if located immediately adjacent to travel lanes. Tire noise, vehicle horns, and muffler noise may approach uncomfortable, even damaging levels. Potential mitigation, as shown in Figure 17, might include vegetative barriers or sound attenuation materials that allow visibility but dissipate sound generated by passing traffic. In addition, rubberized asphalt could be utilized to pave median lanes to lessen noise impacts should BRT be the mode of choice. Rubberized asphalt has already been added to both eastbound and westbound I-10 in an effort to reduce noise throughout the corridor. Placing people as far from the noise generator, i.e. in the center of the median, rather than at the edges, would also mitigate noise impacts.

Figure 17: Potential Noise Impacts and Mitigation

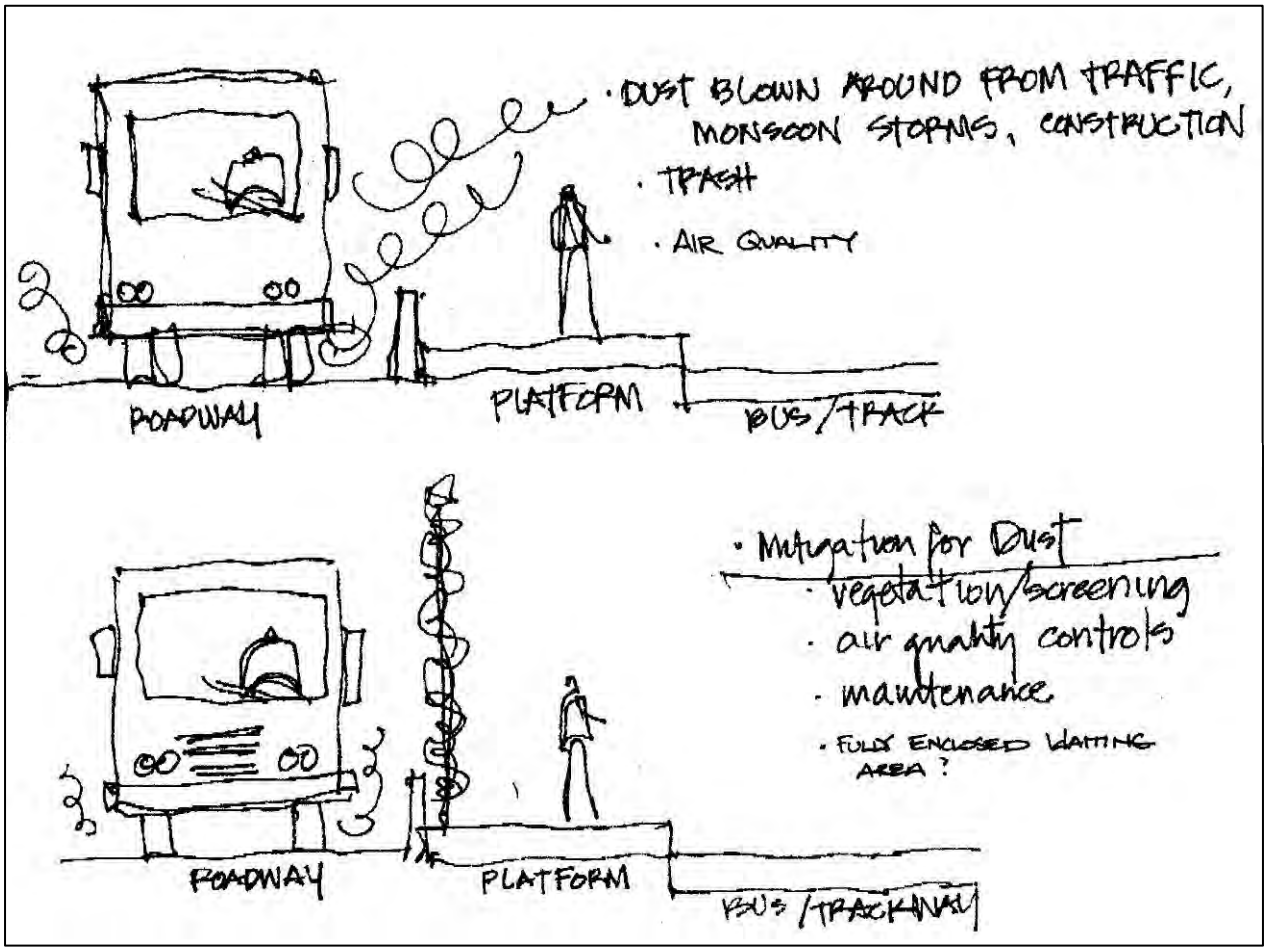


Source: METRO I-10 West Project Team, 2008.

5.3.3 Air Quality Factors

Given that the region is often in a Non-Attainment condition from EPA air quality standards for ozone in the summer, and PM10 in the winter, transit patrons will be exposed to general air quality degradation. In addition, standing on a platform next to traffic also exposes people to dust kicked airborne from tires running over construction trash, soil from tires, etc. on the roadway surface, monsoon storm clouds or *haboobs*, and other debris. Possible mitigation, as shown in Figure 18, could range from increasing maintenance of the HOV and shoulder lanes closest to the platform to adding plants (vines) to take up dirt and add oxygen to the platform environment or platform canopies that block dust and dirt.

Figure 18: Potential Air Quality Impacts and Mitigation

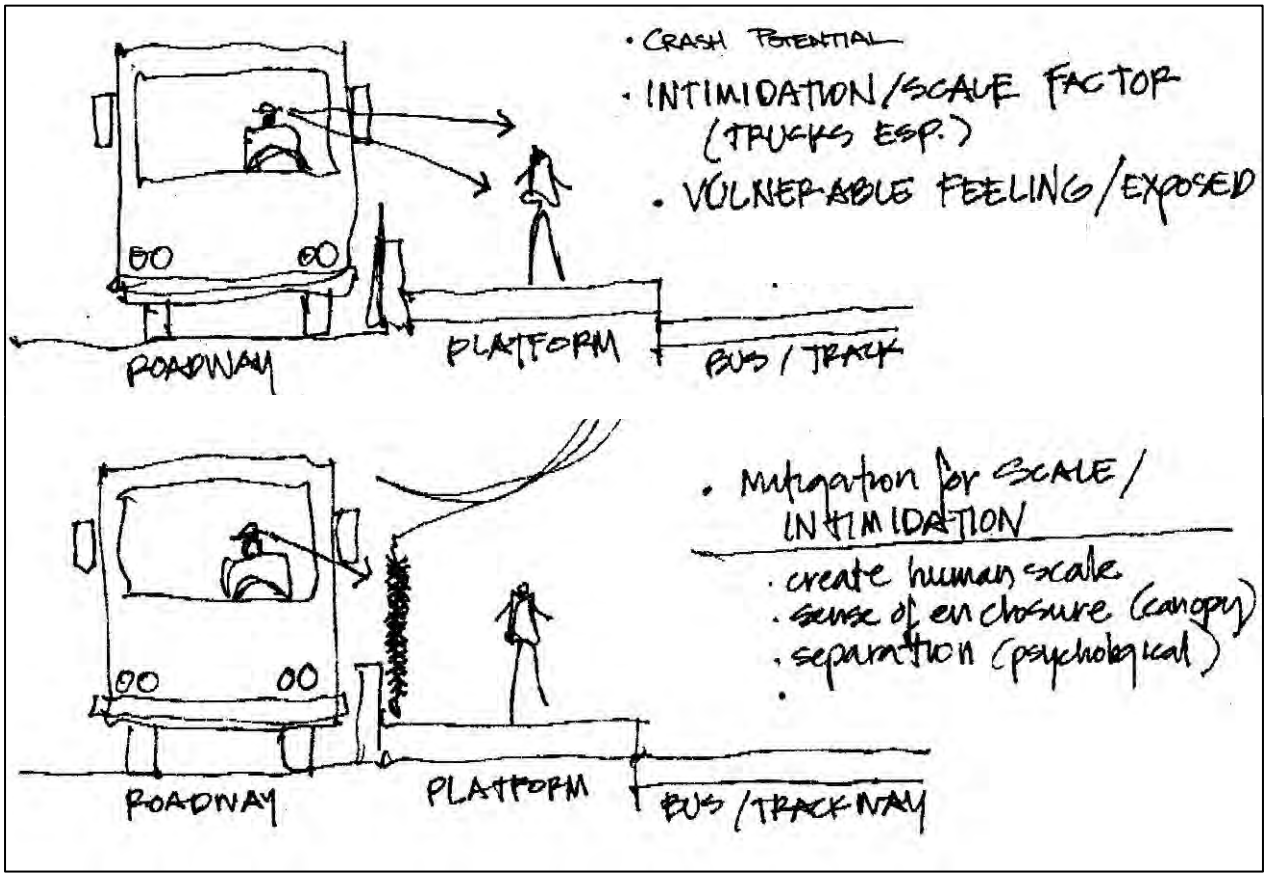


Source: METRO I-10 West Project Team, 2008.

5.3.4 Intimidation Factor

The scale of a single person placed amid semi-trucks and other vehicles traveling at 70 miles per hour five lanes deep in both directions creates a sense of vulnerability for transit patrons. Mitigation for this type of intimidation might include incorporating elements that add human scale such as canopies and plantings, as shown in Figure 19. Mitigation measures should add a sense of protection or enclosure from a canopy overhead and/or edges from walls or screens. They will add a sense of separation from the psychological bombardment by placement as far from traffic as possible, and/or adding humanizing elements such as plants. Patron safety is an issue as well. It is understood that transit stations located underneath freeway overpasses will be more intimidating and should be well lit. Well lit stations will help to provide passengers with the comfort of feeling protected and safe while waiting for service.

Figure 19: Potential Intimidation Factors and Mitigation



Source: METRO I-10 West Project Team, 2008.

5.3.5 Findings

Because I-10 Mainline stations will be located in a freeway environment surrounded by high-volume and high-speed traffic, the design of these transit facilities will require special attention to creating convenient and comfortable settings for pedestrians. As station locations are recommended to carry forward into the selection of a LPA and design of the stations progresses in the next phases of this process, the access, circulation and environmental factors described above will be key considerations for further investigation and study.

6.0 NEXT STEPS

Based on the findings included in this report, the project team will carry forward the following I-10 Mainline station locations for further concept plan refinement and detailed evaluation:

- 35th Avenue Station
- 51st Avenue and 59th Avenue Station Options
- 67th Avenue Station
- All End-of-Line Station Options

Station Concept Plan Refinement: As ridership forecasting is made available, the project team will refine the station concept plans so that each station is adequately sized to meet the demands for each mode of access. An important element of sizing the stations will be the estimated parking demand at each location, since parking requires the most land area, as well as the number of bus bays required. Access to the platforms will also be an important element of the station concept plan refinements. The project team will examine pedestrian access options—via interchange bridges and/or pedestrian-only walkways—and determine the most appropriate means of access to each station platform. The third element of the station concept plan refinement will be the design of the platforms themselves. With one typical LRT platform configuration and five BRT station configurations to consider, the goal of the project team will be to assess and carry forward one LRT and one BRT platform configuration at each station location.

Detailed Station Evaluation: Based on refined station concept plans and updated ridership forecasting and station cost estimates, the project team will conduct a detailed evaluation of those station options being carried forward. Both, which are key determinants in the evaluation and selection of station locations have yet to be completed at this time. The goal of this detailed evaluation will be to recommend I-10 Mainline station locations to carry forward into the selection of a LPA. In some cases, more than one station location option may be carried forward for further consideration. It is anticipated that this phase of the station planning process will conclude in the spring of 2009.

Station Planning Report Appendix A:
I-10 CWG Meeting Presentations and Comments

Appendix A includes:

1. I-10 CWG #1 – May 29, 2008
    - CWG #1 Presentation
    - CWG #1 Meeting Minutes
2. I-10 CWG #2 – July 28, 2008
    - CWG #2 Presentation
    - CWG #2 Meeting Minutes
3. I-10 CWG #3 – August 25, 2008
    - CWG #3 Handouts
    - CWG #3 Meeting Minutes
4. I-10 CWG #4 – September 22, 2008
    - CWG #4 Presentation
    - CWG #4 Meeting Minutes
5. I-10 CWG #5 – October 27, 2008
    - CWG #5 Presentation
    - CWG #5 Meeting Minutes

Station Planning Report Appendix B:
Preliminary Station Traffic and Access Evaluation

Introduction

The I-10 Station Planning team has developed conceptual station layouts that identify potential locations for primary HCT station elements along I-10. These layouts consider as primary elements the station platform on I-10, a kiss-and-ride area, bus platforms, a bus turnaround area, and for all locations except 35th and 39th Avenue, parking areas. The locations of these elements are independent of transit technology (BRT or LRT).

The bus turnaround area is anticipated to be needed where the McDowell bus route (Route 17) would divert south to serve the I-10 stations. The level of need for this diversion is currently under investigation. If projected ridership information indicates that few I-10 HCT riders would transfer from Route 17, the delay to Route 17 riders not bound for the I-10 HCT stations is likely to outweigh the benefit of diverting the route. Without the results of that analysis, the review documented here assumes that the Route 17 diversion is in place, and that the I-10 HCT stations will require a bus turnaround area.

This report documents a brief review of the proposed layouts with respect to traffic and access, and in some cases includes suggestions for alternate sites for certain station elements. The review is based on the Conceptual Station Target Area drawings produced by the station planning team in mid- to late August 2008, as shown in Section 3 of the document. Station locations are considered independently in this brief analysis, and are referred to as “interchange” stations or “half-mile” stations.

35th Avenue (Interchange)

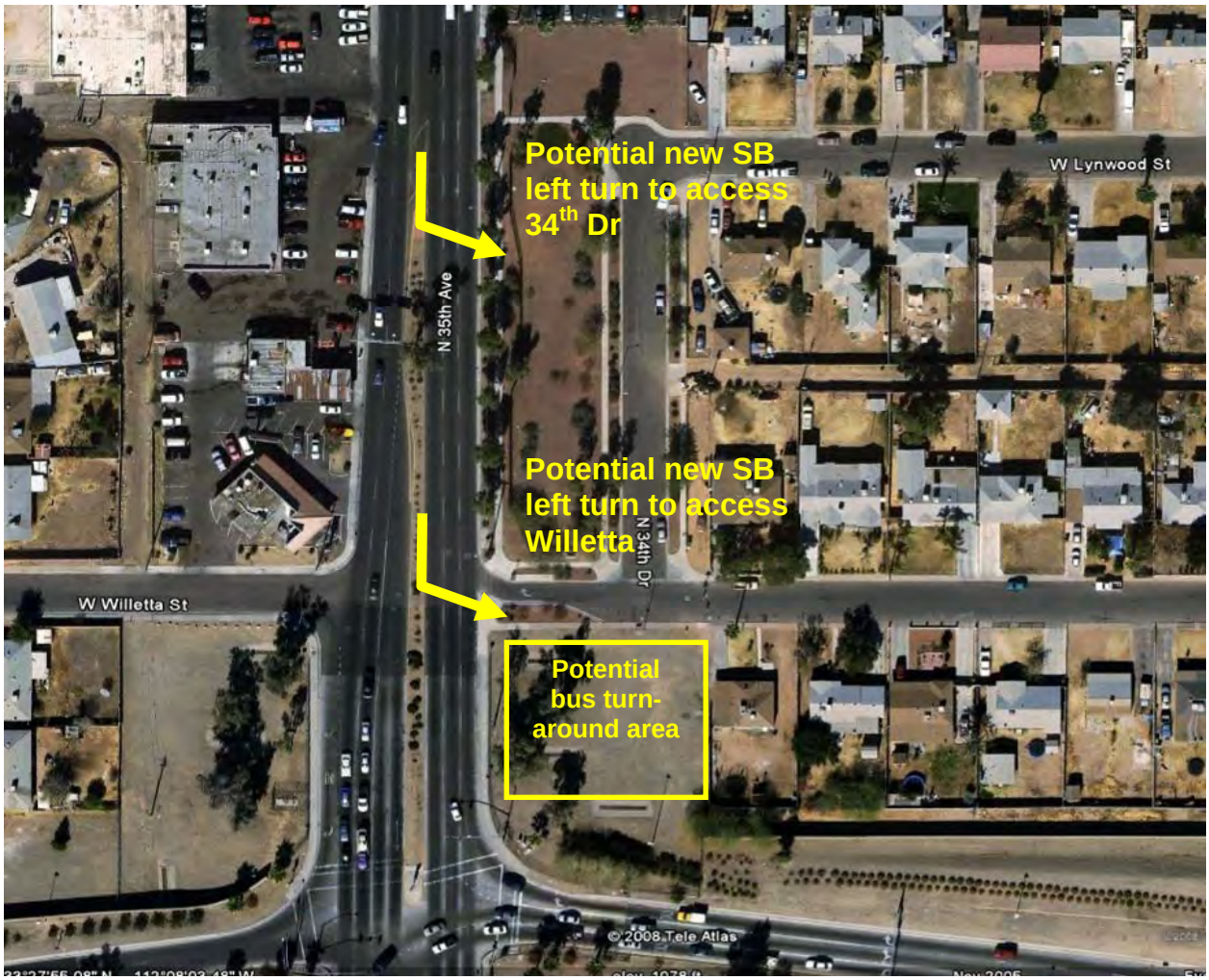
Because this station is a “neighborhood” or “walk-up” style station without parking, there are only limited vehicular access considerations involved. The station platform is likely to be centered under 35th Avenue, and Route 35 (north-south) buses would stop on the 35th Avenue bridge, directly above the I-10 HCT station. This type of operation will cause very minor impacts to north-south through traffic, as north-south buses will only arrive every 15-30 minutes in each direction (about one per 10-20 signal cycles). The Route 17 buses could either stop on the bridge or at the bus turnaround location. If they stop on the bridge, the traffic impacts would be greater than if only Route 35 buses did so.

Potential kiss-and-ride lots are shown in the immediate northwest and southeast quadrants of the interchange. The southeast location would be likely to have inbound vehicles access the lot via the eastbound I-10 on-ramp. This operation could be undesirable because while most vehicles on the ramp would be accelerating, those entering the kiss-and-ride lot would be decelerating. Vehicles leaving the lot are likely to be required to turn right on to northbound 35th Avenue. The northwest lot would have full access to Willetta Street, which has right-in/right-out access at 35th Avenue.

The northeast quadrant of the interchange has some vacant space that could provide a better location for a bus turnaround. This location would be better than one south of I-10 because Route 17 buses would (1) have less out of-direction travel and (2) cause less traffic impact to the I-10 interchange area. The intersection of 35th Avenue with Willetta Street to the east is configured for westbound right turns only—the northbound right turn from 35th Avenue is prohibited by signing and channelization. The potential use of this space would require a modification to the intersection to allow southbound Route 17 buses to turn left to enter. If modification of the Willetta intersection is not allowable, a potential new bus-only southbound left

turn could be considered to the north (see Figure B-1) that allows buses access to 34th Drive, the one-block long local street immediately east of 35th Avenue.

Figure B-1: 35th Avenue, North of I-10



Source: http://maps.live.com/ and METRO I-10 West Project Team, 2008.

39th Avenue (Half-Mile)

The area surrounding the 39th Avenue/I-10 crossing has almost no available right-of-way for station elements. The kiss-and-ride and bus turnaround indicated for the southeast quadrant of the crossing area would displace three single-family homes. Even if the bus turnaround were not required, the same space would be needed to accommodate the kiss-and-ride area there. This station has an advantage for bicyclists, in that 39th Avenue has striped on-street bike lanes from Roosevelt to Palm Lane (a quarter-mile North of McDowell). These lanes should be preserved if the 39th Avenue bridge is rebuilt. The bus drop-off area is assumed to be on the rebuilt/widened 39th Avenue bridge over I-10. The substantial diversion needed to provide bus transfer service to this station (by the Routes 35 and 43) will also be examined, similar to the Route 17 McDowell bus transfer analysis described above.

43rd Avenue (Interchange)

The 43rd Avenue station concept is characterized by apparently abundant vacant land to the west of 43rd, both north and south of I-10. Although travel demand modeling to date has not produced conclusive estimates of parking needs, the station concept shows parking for about 200 cars either immediately northwest or southwest of the interchange. In general, a birds-eye view of the corridor would appear to indicate that substantially more of the localized parking demand for traditional commute trips to I-10 stations would be generated north of I-10. As such, it would appear to be somewhat preferable to locate parking areas north of I-10 when there is an option to do so, because parking areas south of I-10 require north-oriented traffic to cross through the interchange area twice—once in the morning and once in the evening. The presence of a large park-and-ride lot affords a good opportunity for Route 17 buses to turn around without requiring land dedicated only to that purpose.

An advantage to the southern location for a parking area is that its primary driveway access could be located opposite Portland Street, which appears to be a logical location for a signal, given the design of the 43rd Avenue interchange. The northern location, which would likely share access to 43rd with the business just to the north (a Smart & Final store), might be more difficult to incorporate a signal at the Culver Street intersection.

The bus stops could be located on the bridge over I-10 (as shown on the station concept), on 43rd outside the interchange area, or inside the park-and-ride lot. Riders using the parking lot, either because they drove themselves, were dropped off by a car, or got off a bus, could either use an enhanced walkway along the west side of 43rd or a new pedestrian-only bridge to the I-10 median station area. Table B-1 compares the pedestrian access implications with the possible combinations of bus stop location and presence or absence of a separate pedestrian-only bridge directly to the median station platform. It could apply at any of the interchange stations with parking (43rd, 51st, and 67th).

Table B-1: Pedestrian Access at Interchange Stations

Buses Stop:	Separate Pedestrian Bridge	No Separate Pedestrian Bridge
On Interchange Bridge	Bus riders use street bridge, parked/drop-off riders use pedestrian bridge; 2 sets of elevators to station platform required	All pedestrians use street bridge
On Street, Outside Interchange	Bus riders might use either street bridge or pedestrian bridge	All pedestrians use street bridge
In Park-and-Ride Lot	All pedestrians use pedestrian bridge; might provide only stairs from street bridge for walk-up access	All pedestrians use street bridge

Source: METRO I-10 West Project Team, 2008.

51st Avenue (Interchange)

The 51st Avenue interchange currently has three options for parking areas: Option A would accommodate about 220 cars in a vacant lot immediately northeast of the interchange; Option B would accommodate about 360 cars southeast of the interchange in an area currently occupied by a Travelers Inn (large motel); and Option C would accommodate about 720 cars southwest of the interchange in the area currently occupied by a large truck stop. Some of the parking in the motel area (Option B) might currently be shared

with nearby restaurants, so if they remain, METRO would likely need to allow some of the 360 spaces to be used for restaurant parking at peak restaurant demand times such as evenings and weekends. Such an arrangement should be agreeable because those times do not coincide with peak transit demand times (weekday morning/afternoon).

At 51st Avenue, Option A nor Option B would have access to a currently signalized intersection. Option A northeast of the I-10 interchange would be closer to the localized residential demand for transit, but the position of the large SRP canal north of I-10 at this location means that Option A (north of I-10) would require a substantially longer pedestrian bridge than Options B and C (south of I-10) would.

It should also be considered that a 51st Avenue station has the potential to attract a significant portion of its ridership from the proposed South Mountain Freeway. Although its construction is not funded at this time, it is considered in the long-term planning of station locations for this project because it is a highway connection of regional significance. The proposed design of the SMF connection to I-10 would not allow direct access for SMF traffic to and from the I-10/59th Avenue interchange. Instead, SMF-oriented traffic using this station location would use a proposed half-diamond interchange at Van Buren.

Any of the three options would also accommodate the Route 17 bus turnaround and kiss-and-ride functions, as well as possibly housing the Route 51 bus drop-off function. However, it is important to note that the current land uses and design of the interchange area could limit the potential to add signalized access to 51st Avenue.

Option C has been developed in response to a constraint identified during the ADOT Design Concept Review process for its I-10 widening project. That process has determined that unlike the rest of the I-10 West project area the space between 51st and 55th Avenues would not have the full 46-47 feet available for a high-capacity transit guideway. Instead, a narrower space of about 36-37 feet would be available, and this amount of space might not be enough to accommodate a station immediately below 51st Avenue. To work around this constraint, the I-10 median station platform is located about 800 feet to the east of 51st Avenue.

In addition to a driveway to directly access 51st Avenue, Option C would access Roosevelt Avenue, which is signalized at 51st Avenue. This signal would facilitate all desired movements at the intersection, whereas the driveway that serves 51st Avenue directly (north of Roosevelt) would be likely to be restricted to right-in/right-out movements. Given the current use of the site proposed for Option C as a truck stop, it should be considered likely that the traffic impacts of a HCT station at this location would not result in substantial increases in delay for traffic at the 51st/Roosevelt intersection.

Because the pedestrian bridge to the station platform is located about 800 feet east of 51st Avenue, the bus turnaround facility in Option C has been proposed to be located near the bridge, not near 51st Avenue. This location would result in more out-of-direction travel for buses using the turnaround facility than would be required in Options A or B. The more eastern location of Option C also means that walking trips to the station would require more walking distance.

59th Avenue (Interchange)

Like the 51st Avenue interchange options, 59th Avenue would be expected to draw a substantial portion of its auto-oriented demand (parking and kiss-and-ride trips) from the proposed South Mountain Freeway connection. Also similarly to 51st Avenue, the proposed design of the SMF connection to I-10 would not allow direct access for SMF traffic to and from the I-10/59th Avenue interchange. Instead, SMF-oriented traffic using this station location would use a proposed half-diamond interchange at Van Buren. The orientation of the SMF is such that the Van Buren interchange would be located much closer to 59th than to 51st, so SMF traffic desiring to use this station to go east would require only a small distance of "out-of-direction" travel, or "backtracking".

Two options have been examined for providing parking and station services at 59th Avenue, both north of I-10. Option A would be located east of 59th and provide parking for about 460 cars, and Option B would be located west of 59th and provide parking for about 520 cars. Both would contain a bus-turnaround facility and both would also provide direct access to McDowell Road. This access to McDowell Road would be important for traffic using either parking area to complete inbound and outbound movements in all directions if a signalized access could not be provided on 59th between I-10 and McDowell Road. However, either option is likely to require that access to McDowell to be a "full-movement" access. Signalization of McDowell access would need to be evaluated for either Option A or B.

63rd Avenue (Half-mile)

Due to available land constraints, only locations south of I-10 are currently being considered for station elements at this time. One proposal indicated on the station concept drawing is to provide an enhanced pedestrian connection from I-10 to McDowell along 63rd Avenue, possibly in lieu of the diversion of Route 17. The Routes 59 and 67 would presumably divert to serve this station, probably between Roosevelt and McDowell, and buses could stop on the bridge without disrupting traffic. Bus turnaround and kiss-and-ride functions would be located south of the station, possibly with parking (depending on the results of travel demand analysis and the resolution of traffic safety concerns at the elementary school).

67th Avenue (Interchange)

Three of the four quadrants at the 67th Avenue interchange have large amounts of vacant land, and two of them, the northwest (north station) and southeast (south station), are identified as potential station parking areas. The north station is not likely to have a station access signal on 67th, so its primary vehicular access is likely to be to McDowell. The south station's primary access would likely be a fourth leg to the existing 67th Avenue/Latham Street intersection, and probably could be signalized if designed properly.

Bus turnaround and bus stop issues are similar at this station to the 51st and 43rd Avenue stations.

79th Avenue

The 79th Avenue station concept has not been evaluated at this time because its development depends to a strong degree on the configuration of the HCT guideway—specifically, whether it remains on I-10, flies out of the median and ends near McDowell, or flies out and extends north, presumably to Thomas Road. Traffic and access issues will be addressed in more detail when more information becomes available.

METRO

I-10 West AA/EIS
I-10 Community Working Group

Kick-Off Meeting

Sandy Zwick, City of Phoenix
Rick Pilgrim, Project Manager
Monica Hernandez, Public Involvement Coordinator

May 29, 2008

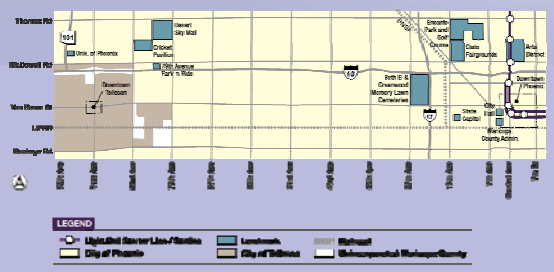
Today's Agenda

- Welcome and Introductions
- Project Overview and Status
- Purpose and Role of the Community Working Group and Project Decision Making Process
- Information Sharing Session
- Next Steps

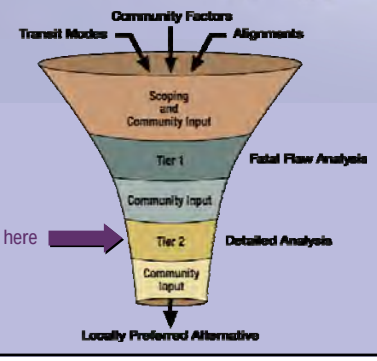
METRO

Project Overview and Status

I-10 West Study Area



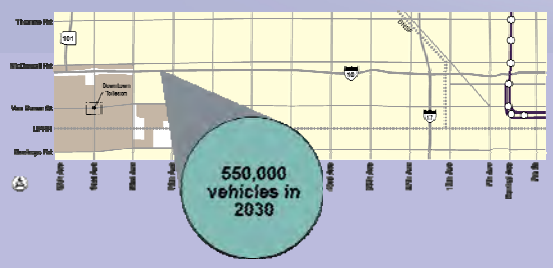
Alternatives Analysis Process



METRO

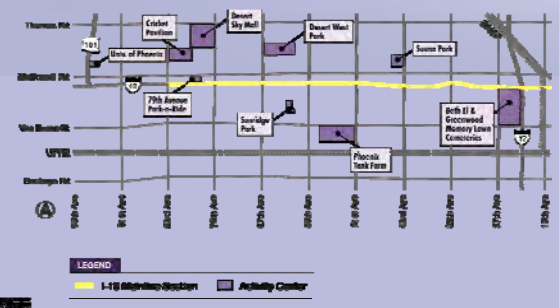
Tier 1 Alternatives Analysis Results

I-10 West Corridor Characteristics

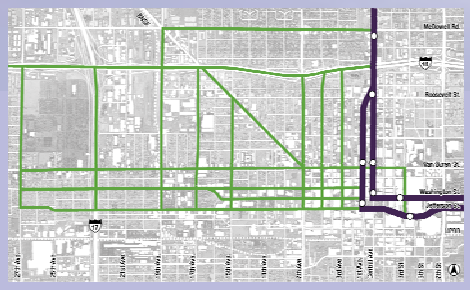


Mass Transit Median in I-10

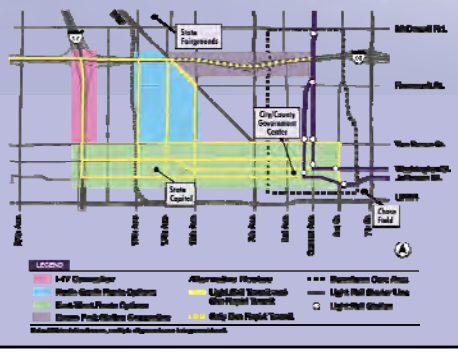
- 50' median for future mass transit preserved as part of I-10 completion (91st Ave to Buckeye Rd)
  - Identified in Environmental Impact Statement – 1978
  - Transit technology to be defined in the future
- 2006 METRO study confirmed median transit location



Universe of Downtown Alignments

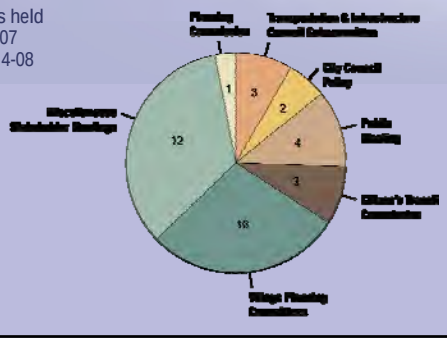


Tier 2 Downtown Route Options



Public Involvement

- Meetings held from 10-07 through 4-08



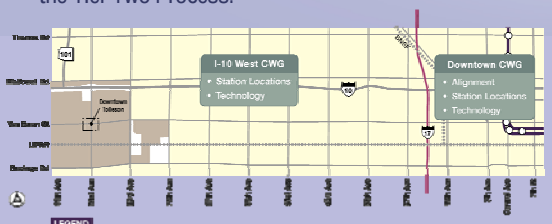
City of Phoenix Policy Actions

Approving Body	Date	Recommendation Alignment in the I-10 ROW west of I-17
Maryvale VPC	2/26/08	Approved
Encanto VPC	3/03/08	Approved
Estrella VPC	3/04/08	Approved
Citizens Transit Commission	3/06/08	Approved
Central City VPC	3/10/08	Approved
Alhambra VPC	3/25/08	Approved
Planning Commission	3/26/08	Approved
City Council Subcommittee	4/03/08	Approved
City Council	4/16/08	Approved

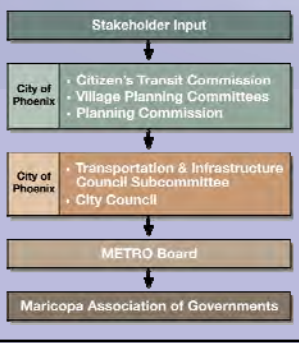
Purpose and Role of the Community Working Group and Decision Making Process

Purpose and Role of the Community Working Group

- Provide input and feedback to the Project Team during the Tier Two Process.



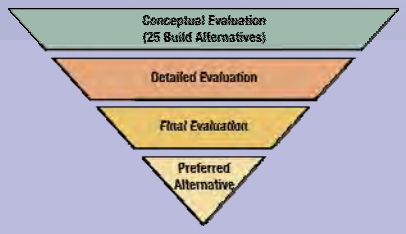
Project Decision-Making Process



Tier 2 Alternatives Definition and Screening Process:

Technology, Alignment & Station Locations

Tier 2 Process



Transit Technology Options
(Refer to Project Boards)

Possible Modes:
- Light Rail (LRT)
- Bus Rapid Transit (BRT)
- Local Bus (Baseline Alternative)

Planning Process

Station Planning Process

Process is highly interactive and seeks to determine:
- Station locations along alternative alignments:
  - Street running east of I-17
  - Freeway running along I-10 between I-17 and Loop 101
- Station functions:
  - Regional park-and-ride
  - Neighborhood service
  - Destination
  - Special generator
- Station appearances
  - Station elements
  - Context of the surrounding environment

Transit Improvement Goals

- Access
- Ridership
- Community Needs
- Cost Effective

Delta Center Station
Salt Lake City, UT, UTA LRT

Orange Line
Los Angeles, CA, METRO BRT

Planning Steps

1. Concept location, identification and assessment during conceptual definition
   - 8 Alternatives
   - Alignments
   - Stations
   - Modes

   (May – June 2008)
2. Candidate locations during detailed definition of alternatives

   (Complete by selection of Locally Preferred Alternatives – Fall 2008)
3. Locations selections and conceptual design

   During Preliminary Engineering / Environmental Impact Statement Phase

Tamien Station
San Jose, CA, VTA LRT

Station Planning Process

Step 1: Identify Station Target Area

Station Planning Process

Step 2: Identify Candidate Station Locations

Station Planning Process

Step 3: Select Station Site and Design

Conceptualization

Station Planning Process

Step 3: Select Station Site and Design

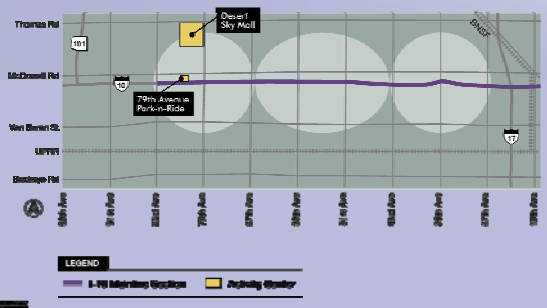
Refinement

Station Planning Process

Step 3: Select Station Site and Design

Station footprint delineation

Station Target Areas



METRO

Information Sharing Session

METRO

Information Sharing Session
(30 minutes)

- Why are you here?
- What are your interests?
- Provide input on neighborhood characteristics
- Identify issues to consider for alignments and station target areas
- Report back

METRO

Next Steps

METRO

Next Steps

- Refinement of criteria
- Refinement of ridership data
- Acquiring additional information on right-of-way needs
- Next meeting: June 2008
  - Standing Meeting (Frequency/Date/Time/Location)

METRO

I-10 West Corridor AA/EIS
Contact Information

Monica Hernandez

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101 N. 1st Avenue, Suite 1300
Phoenix, AZ 85003

METRO

MEETING MINUTES

Thursday, May 29, 2008

Re: **I-10 WEST ALTERNATIVES ANALYSIS**

I-10 West Community Working Group (CWG) Meeting #1
Monday, June 30, 2008 6:30 pm – 8 pm

In Attendance:

Project Team:
Albert Sanatana, Angela Dye, Monica Hernandez, Kammy Horne, Nate, Rick Pilgrim, Sandy Zwick, Wulf Grote

Community Working Group Members:
Ben Weisinger, Estrella VPC
Christine McRight, Westcor – Desert Sky Mall
Dwight Amery, Maryvale Revitalization / Maryvalle Village Planning Committee
Gerry Lusson, Citizen's Transit Commision / Carpenter's Union

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Minutes:

1. **Welcome and Introductions**

   Monica Hernandez (MH) welcomed the CWG and project team to the meeting. Each member of the project team and CWG introduced themselves.

   I-10 West Project Overview and Status

   Wulf Grote (WG) presented the CWG a PowerPoint explaining the status of the project and a brief overview. Following the presentation WG discussed with the group various items that were questioned including whether or not there were any options off of the table such as 59th Avenue; how the team would be addressing areas of sensitive use, and spacing considerations along the mainline. In addition, WG provided a general discussion on the experience with Transit Oriented Development in regards to the Mesa Extension.

2. **Purpose and Role of the CWG in the Project Decision Making Process**

   Rick Pilgrim (RP) presented the CWG a PowerPoint slide explaining the CWG's purpose and role in the decision making process.

3. **Community Goals and Issues Sharing Session**

   During this session the group provided markings/notes on a map of the I-10 West area and were also asked the following questions:

Why are you here?
What are your interests?
Provide input on neighborhood characteristics.
Identify issues to consider for alignments and station target areas.

Neighborhood Characteristics:

- Frys at 43rdAvenue is a major destination venue
    - Apartments in close proximity
    - People ride bus to Frys
- New village core at Estrella
- 79th Avenue park-n-ride
- Need to make sure route can be extended
- Leaving freeway may disrupt

Why are you here?

- Estrella Village
    - Industrial growth
    - Wants mass transit
    - Environmental/efficient benefits
    - Issues – not sufficient development or developers – need to bring good and compatible development with job opportunities
    - Need commercial and residential
    - Interested in how 801 HWY will develop
- Westcor
    - Estrella Falls 2010 at Goodyear/I-10
    - Employment center
    - Square mile look ahead 20 years to determine trade area
    - Regional retail = vertical mixed use current trend
    - do surveys to determine what people want
    - looking ahead to redevelop Desert Sky Mall (7 years for new uses/aesthetics)
- Maryvale VPC & Revitalization
    - North of I-10 to Camelback
    - Sustaining community
    - First impression rundown need to retain and attract new business
    - Better residential
    - 80,000 people < 18 years (40% < 19 years)
    - Working class
    - Biggest bus ridership
    - Work in Downtown Phoenix, south industrial warehouses, schools, hospitals,
    - Want high density
    - 1st core 75th / 2nd core 51st / i.s. (baseball)
    - Entertainment core – Cricket – Baseball training
    - Planning to moderate amphitheatre and combine two communities areas (Westcor)
    - 2 school districts, 2 hospitals, churches, YMCA, small large business
    - Lots going on
- CTC / Carpenter's Union
    - How to get to work place during construction
    - Improvements need to serve neighborhoods and industrial areas
    - Moreland corridor displacement memories

    - Community impact concern
- Light rail is preferred
- Need to move more people
- Gas prices
- Hotels being developed along I-10
- Apartment development
- Need more information on riders, zoning
- Market pros and cons for freeway
- Stations at major / minor roads
- LA Gold Line

4. **Stakeholder Participation Outreach Efforts**
   MH asked for input on stakeholder outreach efforts. The suggestion was made to possibly hold meetings during the business day work hours; however that did not seem to meet the needs of the participants. Holding the meetings at various locations in the study area was suggested (specifically the Carpenter's Union).

5. **Next Steps**
   - Refinement of criteria
   - Refinement of ridership data
   - Acquiring additional information on right-of-way needs

Action Items:

1. Next **I-10 West CWG Meeting** will be held on Monday**, July 28, 2008 at 6:00 p.m.** at the Desert West Community Center.

2. CWG Members are encouraged to identify other potential participants for the CWG's future meetings – please contact Monica Hernandez at 602.322.4427 with recommendations.

I-10 West AA/EIS
CWG Meeting #2
DRAFT

July 28, 2008
Phoenix, AZ

Station Planning Process & Schedule

Station Planning Process

This process is highly interactive and seeks to determine:

- Where stations should eventually be located along alternative alignments: street running east of I-17 and freeway running along I-10 between I-17 and Loop 101
- What functions each station will serve (regional park-and-ride, neighborhood serving, destination, special generator, etc.); and,
- What size, shape and appearance the station and its various elements should be to best serve transit patrons, while fitting into the context of the surrounding environment.

Station Planning Goals

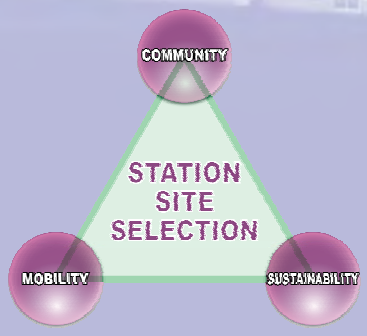
- Select sites for stations which will provide transit patrons with convenient access to the transit system;
- Provide opportunities for increased ridership without threatening the integrity of existing neighborhoods;
- Ensure stations provide benefits to adjacent areas by increasing access and becoming community assets; and
- Select sites which can be cost-effectively implemented within the funding allocated in the METRO financial plan.

Station Planning Steps

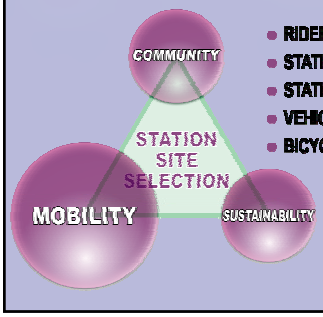
1. Target Area Identification and Assessment
   (June 2008)
2. Candidate Station Locations and Screening
   (July – August 2008)
3. Site Selection and Conceptual Design
   (Summer/Fall 2008)

Candidate Station Locations: Site Selection Process for Steps 2 and 3

Station Evaluation Criteria

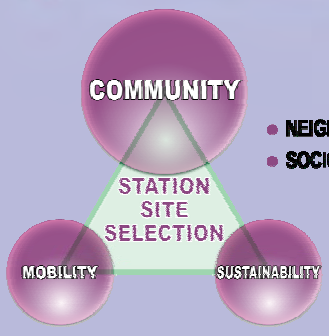


Station Evaluation Criteria



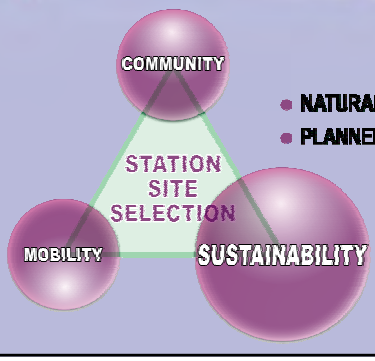
- RIDERSHIP PROJECTIONS
- STATION SPACING
- STATION LAYOUT & PARKING
- VEHICLE ACCESSIBILITY & CONNECTIONS
- BICYCLE & PEDESTRIAN CONNECTIONS

Station Evaluation Criteria



- NEIGHBORHOOD COMPATIBILITY
- SOCIO-ECONOMIC ENVIRONMENT

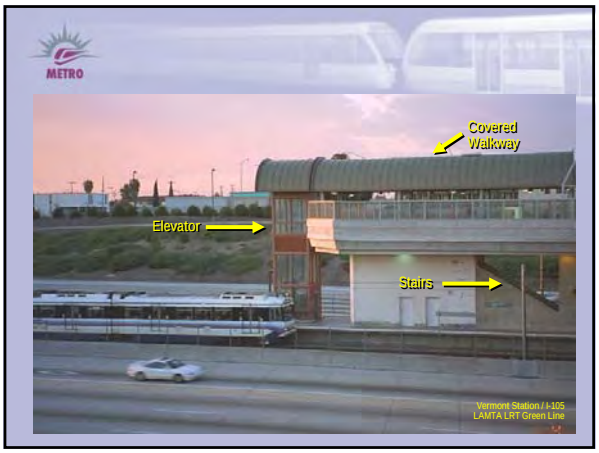
Station Evaluation Criteria



- NATURAL ENVIRONMENT
- PLANNED ENVIRONMENT

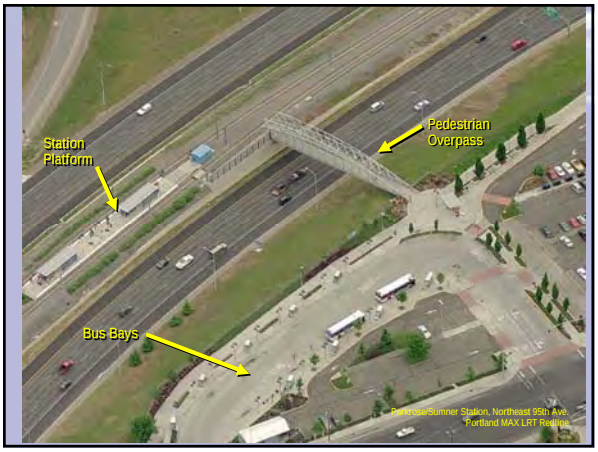
Sample Station Evaluation Matrix

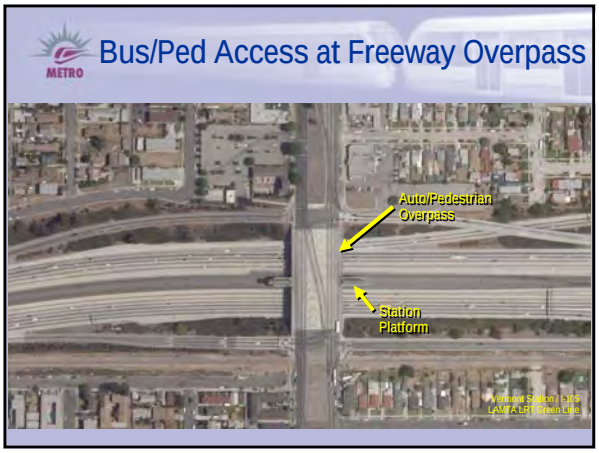
Examples of Freeway LRT and BRT Stations


METRO
Covered Walkway
Elevator
Stairs
Vermont Station / I-105
LAMTA LRT Green Line

METRO
Covered Platform
Lighting
Signage
To Marine Ave
Redondo Beach Ave
Elevator
Benches
Long Beach Blvd. Station / I-105
LAMTA LRT Green Line

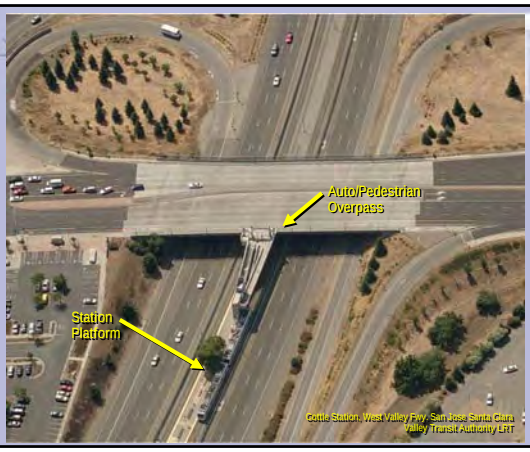
METRO
Pedestrian Overpass
Station Platform
Pedestrian Overpass
Park-and-ride
Parkrose/Sumner Station, Northeast 95th Ave.
Portland MAX LRT Redline


Station Platform
Pedestrian Overpass
Bus Bays
Parkrose/Sumner Station, Northeast 95th Ave.
Portland MAX LRT Redline

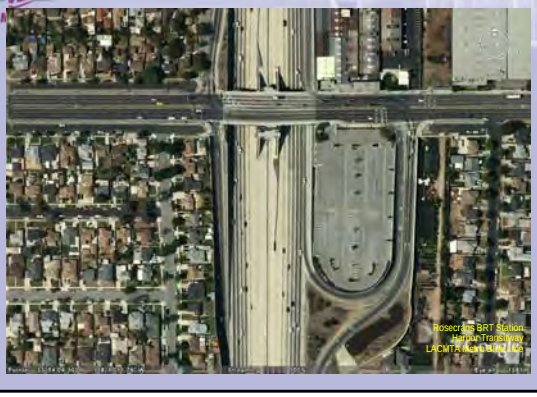

METRO
Bus/Ped Access at Freeway Overpass
Auto/Pedestrian Overpass
Station Platform
Vermont Station / I-105
LAMTA LRT Green Line

Auto/Pedestrian Overpass
Station Platform
Vermont Station / I-105
LAMTA LRT Green Line

Gettle Station, West Valley Fwy, San Jose, Santa Clara Valley Transit Authority LRT



Gettle Station, West Valley Fwy, San Jose Santa Clara Valley Transit Authority BRT



Rosecrans BRT Station, Harbor Transitway LACMTA Metro Blue Line, Los Angeles, CA

Rosecrans BRT Station, Harbor Transitway LACMTA Metro Blue Line, Los Angeles, CA

Slauson BRT Station Harbor Transitway LACMTA Metro Blue Line, Los Angeles, CA

Addicks Transit Center P&R Metro Express Bus HOV Lanes Houston, TX

MEETING MINUTES

Monday, August 18, 2008

Re: **I-10 WEST ALTERNATIVES ANALYSIS**

I-10 West Community Working Group (CWG) Meeting #2
Monday, July 28, 2008 6 pm – 8 pm

In Attendance:

Project Team:
Abhishek Dayal, Albert Sanatana, Angela Dye, Jean Sanson, Kammy Horne, Monica Hernandez, Nate Larson, Sandy Zwick

City of Phoenix: Olga Soto, Neighborhood Services; Eric Johnson, Downtown Development Office

Community Working Group Members:

Chrisine	McRight	Westcor - Desert Sky Mall
Dee	Elston	Amberlea Fight Back
Diane	Sandoval	Amberlea Fight Back
Dwight	Amery	Maryvale Revitalization / Maryvale Village Planning Committee
Ed	Lehman	Amberlea Fight Back
Elodia	May	Amberlea Fight Back
Gerry	Lusson	Carpenter's Union Training Center
Lorri	Kinnan	Stable Farms
Lydia	Hernay	Maryvale Village Block Watch Alliance
Nancy	Johnston	New Life Fight Back
Oscar	Sandoval	Amberlea Fight Back
Paul	Johnston	New Life Fight Back
Roger	Ramos	New Life Fight Back
Roy	Vega	New Life Fight Back
Stevie	Walton	Golden Corral Restaurant
Sylvia	Rodriguez	
Terry	Lehman	Amberlea Fight Back
Victor	Quezada	

Minutes:

1. Monica Hernandez (MH) welcomed the Community Working Group (CWG) and project team to the meeting. Each member of the project team and CWG introduced themselves.

2. Kammy Horne (KH) presented the CWG a PowerPoint explaining the status of the project and a brief overview.

3. Jean Sanson provided an overview of the station planning process/schedule and discussed station types and design elements. Jean Sanson went on to discuss the various stations

locations that are currently under consideration. Jean Sanson provided an overview of the station drawings and pointed out the various elements shown on each map (i.e. pedestrian walking patters, bus routes, bus pick-up & drop-off locations).

Comments/Questions

- Stakeholder Question: Are there any pros and cons that can be assessed from different systems in the country? Metro Response: Yes these will be taken into account as part of the evaluation process.

- For the median running High Capacity Transit (HCT) routes, concern about the need for physical barriers to prevent accidents and crashes.

- Stakeholder Question: If the decision is made to put a station at a location, will the communities and neighborhoods get appropriate notification? Metro Response: Yes, the I-10 Team discussed the overall process including the environmental process where additional community input is sought.

- Bus access to stations is very important, even within the quarter-mile circle.

<u>35th/39th/43rd Ave. Station Target Area</u>

- Safety/security issues w/ parking and walking in this area.
- Park-and-ride at 35th Ave or 39th Ave may not be safe (to park cars). A bus or car drop-off area near the station may be better.
- CWG participants commented that they are more likely to feel safe parking their. vehicles at the 63rd/67th Ave park and ride than at the 35th/39th Ave park and ride.
- Security needs to be of quick response – this is crucial – cannot rely on cameras
- Low income demographic.
- Traffic volume issue south of the I-10 on 39th Avenue (streets are narrow)
- Large size semi trucks operate in this area.
- A station in this area would provide mobility to high school students.
- The canal should be considered for placement of station elements (i.e. parking).
- 43rd Avenue has low density with industrial developments south of the I-10.
- 51st and 59th Avenues could be difficult due to the unknowns regarding the new freeway connection.
- Stations near freeway junctions could use excess space inside or near ramps.
- 51st Avenue is an employment destination and is also a secondary core with growth plans
- Bus transfers are not convenient.
- Elder demographic.
- Right of way availability at 59th Avenue.

- Neighborhoods will be impacted by station traffic if a station is put on 39th Ave; 35th Ave may be a better location.
- Stakeholder Question: Will 51st Ave and 43rd Ave be considered as potential station locations? Metro Response: Yes-these are still under consideration.
- Stakeholder Question: What is the extent of bridge reconstruction on 39th Ave pedestrian bridge? Metro Response: Coordination with ADOT is ongoing. If 39th Ave is selected as a station location, METRO will work with ADOT to take that into consideration during bridge reconstruction.

63rd/67th Ave. Station Target Area

- Security concerns are lower at this area.
- Elementary school expressed concerns about how to make area safer.
- Residents living in the multi-family housing between 63rd Ave and 67th Ave already walk more than half a mile to get to the bus stops.
- Park and ride location on the north side of the freeway on 67th Ave may be better to avoid truck stops located at the Southwest corner of I-10 and 67th Ave.
- 67th Ave might be too close to 79th Ave to be effective as a park and ride.
- Lower income riders will most likely walk beyond a quarter-mile radius.

79th Ave. Station Target Area

- Existing park-and-ride facility is at full capacity – now look at structured parking.
- Large master planned development potential for the southwest of 79th Avenue and the I-10.
- Apartments east of existing park-and-ride facility are new.

Action Items:

1. Next **I-10 West CWG Meeting** will be held on Monday**, August 25, 2008 at 6:00 p.m.** at the Desert West Community Center.
2. CWG Members are encouraged to identify other potential participants for the CWG's future meetings – please contact Monica Hernandez at 602.322.4427 with recommendations.

35TH AVE./39TH AVE. STATION TARGET AREA EVALUATION

I-10 WEST HIGH CAPACITY TRANSIT STUDY

DRAFT - WORKING DOCUMENT

	CRITERION	I-10 & 35TH AVE. OPTION	I-10 & 39TH AVE. OPTION
MOBILITY	Projected daily station boardings (2030)	To be determined	To be determined
	Proximity to regional north-south arterials	Good - located alon 35th Ave., which is one of the longest north-south regional arterials, connecting north Phoenix to South Mountain and Laveen	Fair – located along 39th Ave., which is a minor arterial that terminates at Van Buren Street to the south and Osborn Road to the north
	Number of bus routes serving the station	Fair - station would be served by two bus routes (Routes #17, #35)	Good - station would be served by three bus routes (Routes #17, #35, #43)
	Number of bus routes requiring diversion to the station	Good – would require diversion of one bus route (Route #17)	Fair – would require diversion of three bus routes (Routes #17, #35, #43)
	Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks to the north of I-10; but intermittent sidewalks to the south	Good – existing bicycle lanes and continuous sidewalks north and south of I-10
TRAFFIC	Ease of traffic ingress/egress	Poor – southbound buses and vehicles turning left into drop-off area would cross three traffic lanes	Good – southbound buses and vehicles turning left into drop-off area would cross one traffic lane and low traffic volumes on 39th Avenue, which is a minor arterial, would allow for easier ingress and egress
	Existing traffic congestion in the station area	Poor - high traffic volumes in and around the 35th Avenue interchange	Good – low traffic volumes within the station area
COMMUNITY	Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Good – bus turnaround and kiss-and-ride facilities would be surrounded by existing and planned commercial and public/quasi-public land uses, which are generally more compatible than residential land uses	Fair/Poor – bus turnaround and kiss-and-ride facilities would be surrounded by existing and planned residential land uses, which are generally less compatible than other land uses
	Vacant land available to meet parking requirements, bus facilities, etc.	Fair - constrained by lack of vacant parcels; area needed to accommodate bus facilities and kiss-n-ride would require acquisition or shared use of Naval Training Center parking area on the south side of I-10	Poor – constrained by lack of vacant parcels, area needed to accommodate bus facilities and kiss-n-ride would require acquisition of residential property on south side of I-10
DEMOGRAPHICS *	Future population within ½ mile of station (2030)	Fair – between 4,000 – 5,500 persons	Good – greater than 5,500 persons
	Future employment within ½ mile of station (2030)	Good – greater than 2,000 employees	Fair – between 1,000 – 2,000 employees
	Percentage of households that are transit dependent within a ½ mile of station (zero car households)	Good – greater than 6.3% of households are transit dependent	Good – greater than 6.3% of households are transit dependent
STATION COSTS	Station development/ property acquisition costs	To be determined	To be determined
ENVIRONMENTAL	Impacts to historic structures/buildings	Good - no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
	Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	To be determined	To be determined
PUBLIC INPUT	Support of station concept received at stakeholder meetings	To be determined - Comments noted at CWG Meeting #2 include: • 35th Avenue was a preferred station location because it would have fewer neighborhood impacts • A station in this area would provide mobility to high school students • Safety/security features should be incorporated into station facilities	To be determined. Comments noted at CWG Meeting #2 include: • Residential neighborhoods may be impacted by station traffic • Increased traffic volumes may create congestion on narrow streets south of I-10 • Safety/security features should be incorporated into station facilities

08/25/08

*Note: Ratings are assigned as follows:

Population:
Poor: Below 4,000 persons
Fair: 4,000 – 5,500 persons
Good: Above 5,500 persons

Employment:
Poor: Below 1,000 employees
Fair: 1,000 – 2,000 employees
Good: Above 2,000 employees

Zero Car Household:
Poor: Below 3.0% households
Fair: 3.0%-6.3% households
Good: Above 6.3% households

43RD AVE./51ST AVE. STATION TARGET AREA EVALUATION

I-10 WEST HIGH CAPACITY TRANSIT STUDY

DRAFT - WORKING DOCUMENT

	CRITERION	I-10 & 43RD AVE. OPTION	I-10 & 51ST AVE. OPTION
MOBILITY	Projected daily station boardings (2030)	To be determined	To be determined
	Proximity to regional north-south arterials	Fair – located along 43rd Ave., which terminates at West Lower Buckeye Road to the south	Good – could provide direct connection to future South Mountain Freeway; also located along 51st Ave., which is on of the longest north-south arterials, bridging the Salt River to the south
	Number of bus routes serving the station	Fair - station would be served by two bus routes (Routes #17, #43)	Good - station would be served there by three bus routes (Routes #3, #51, MARY)
	Number of bus routes requiring diversion to the station	Good – would require diversion of one bus route (Route #17)	Fair – would require diversion of two bus routes (Routes #3, MARY)
	Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks north and south of I-10	Fair – no bicycle lane or route; continuous sidewalks north and south of I-10
TRAFFIC	Ease of traffic ingress/egress	Fair – northbound buses and vehicles turning left into the park-and-ride would cross two traffic lanes	Poor – northbound buses and vehicles turning left into the park-and-ride would cross three traffic lanes
	Existing traffic congestion in the station area	Poor - high traffic volumes in and around the 43rd Avenue interchange	Poor - high traffic volumes in and around the 51st Avenue interchange
COMMUNITY	Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Fair – park-and-ride facility would be surrounded by existing industrial and/or commercial land uses to the west, which are generally compatible, but residential land uses to the east are less compatible	Good – park-and-ride facility would be surrounded by existing industrial and/or planned commercial land uses that would be compatible
	Vacant land available to meet parking requirements, bus facilities, etc.	Good – vacant parcels are available; either a 15-acre vacant parcel on the southwest corner of the interchange or vacant land at the northwest corner of the interchange could accommodate a 200+ car park-and-ride as well as the potential to support transit-oriented development	Fair/Poor – constrained by lack of vacant parcels; preferred park-and-ride location is already developed and would require business acquisitions to accommodate a 200+ car park-and-ride; an alternate park-and-ride location on the northeast corner of the interchange is vacant
DEMOGRAPHICS *	Future population within ½ mile of station (2030)	Good – greater than 5,500 persons	Fair – between 4,000 – 5,500 persons
	Future employment within ½ mile of station (2030)	Good – greater than 2,000 employees	Good – greater than 2,000 employees
	Percentage of households that are transit dependent within a ½ mile of station (zero car households)	Good – greater than 6.3% of households are transit dependent	Good – greater than 6.3% of households are transit dependent
STATION COSTS	Station development/ property acquisition costs	To be determined	To be determined
ENVIRONMENTAL	Impacts to historic structures/buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
	Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	To be determined	To be determined
PUBLIC INPUT	Support of station concept received at stakeholder meetings	To be determined. Comments noted at CWG Meeting #2 include: • Frys supermarket at 43rd Ave. is a major destination venue • Many apartments are located in close proximity to I-10 • Station would provide a direct connection to the secondary Maryvale Village Core	To be determined. Comments noted at CWG Meeting #2 include: • Could be difficult due to the unknowns regarding the new South Mountain freeway connection • A station near a freeway junction could use excess space inside or near ramps • Station could provide a connection to the Maryvale Secondary Village Core (Maryvale Hospital, Maryvale Stadium, ASU West Campus) located north of the study area along 51st Avenue • Semi trucks that access industrial facilities south of I-10 add to traffic levels along 51st Avenue

08/25/08

*Note: Ratings are assigned as follows:

Population:
Poor: Below 4,000 persons
Fair: 4,000 – 5,500 persons
Good: Above 5,500 persons

Employment:
Poor: Below 1,000 employees
Fair: 1,000 – 2,000 employees
Good: Above 2,000 employees

Zero Car Household:
Poor: Below 3.0% households
Fair: 3.0%-6.3% households
Good: Above 6.3% households

63RD AVE./67TH AVE. STATION TARGET AREA EVALUATION

I-10 WEST HIGH CAPACITY TRANSIT STUDY

DRAFT - WORKING DOCUMENT

	CRITERION	I-10 & 63RD AVE. OPTION	I-10 & 67TH AVE. OPTION
MOBILITY	Projected daily station boardings (2030)	To be determined	To be determined
	Proximity to regional north-south arterials	Poor – located along 63rd Ave., which is intermittent both north and south of I-10 and terminates at West Broadway Road to the south	Good – located along 67th Ave., which is on of the longest north-south arterials, bridging the Salt River to the south
	Number of bus routes serving the station	Fair - station would be served there by two bus routes (Routes #59, #67)	Fair – station would be served by one bus route (Route #67)
	Number of bus routes requiring diversion to the station	Fair – would require diversion of two bus routes (Routes #59, #67)	Good - would not require diversion of bus routes
	Proximity to existing or planned bicycle/pedestrian routes	Fair – no bicycle lane or route; continuous sidewalks to the north of I-10; but intermittent sidewalks to the south	Good – existing bicycle lane south of I-10 and continuous sidewalks to the north and south of I-10
TRAFFIC	Ease of traffic ingress/egress	Good – lower traffic volumes on 63rd Avenue, which is a minor arterial, would allow for easier ingress and egress	Fair – added bus volumes in congested interchange area may restrict ease of ingress and egress
	Existing traffic congestion in the station area	Good – low traffic volumes within the station area	Fair - relatively higher traffic volumes in and around the 67th Ave. interchange
COMMUNITY	Compatibility of park-and-ride and/or bus loading areas with existing and planned surrounding land uses	Poor – park-and-ride facility would be surrounded by existing and/or planned residential land uses on all sides, which are less compatible than other land uses	Fair - park-and-ride facility would be surrounded by existing and/or planned residential land uses to the south and east, but would be located across from an industrial land use to the west, which is generally more compatible than residential land uses
	Vacant land available to meet parking requirements, bus facilities, etc.	Good – a portion of a 35-acre vacant parcel on the southwest corner of the overpass could accommodate a 500-1,000 car park-and-ride as well as the potential to support transit-oriented development	Good – a portion of a 27-acre vacant parcel on the southeast corner of the interchange or an 11-acre vacant parcel on the northwest corner of the interchange could accommodate a 500-1,000 car park-and-ride as well as the potential to support transit-oriented development
DEMOGRAPHICS *	Future population within ½ mile of station (2030)	Good – greater than 5,500 persons	Good – greater than 5,500 persons
	Future employment within ½ mile of station (2030)	Poor – less than 1,000 employees	Fair – between 1,000 – 2,000 employees
	Percentage of households that are transit dependent within a ½ mile of station (zero car households)	Fair – between 3% - 6.3% of households are transit dependent	Fair – between 3% - 6.3% of households are transit dependent
STATION COSTS	Station development/ property acquisition costs	To be determined	To be determined
ENVIRONMENTAL	Impacts to historic structures/buildings	Good – no impacts to historic structures or buildings	Good – no impacts to historic structures or buildings
	Proximity to sensitive land uses (e.g., schools, parks, churches, residential, etc.)	To be determined	To be determined
PUBLIC INPUT	Support of station concept received at stakeholder meetings	To be determined. Comments noted at CWG Meeting #2 include: • Sunridge Elementary School is located within ½ mile of proposed station • Station location could allow for continuation of transit service south on 63rd Ave. • West Roosevelt St. may not have the capacity to accommodate additional traffic	To be determined. Comments noted at CWG Meeting #2 include: • Station location could provide direct access to Desert West Community Center • Existing traffic congestion could be amplified south of I-10; vacant parcels north of I-10 could accommodate transit-related facilities • West Roosevelt St. may not have the capacity to accommodate additional traffic

08/25/08

*Note: Ratings are assigned as follows:

Population:
Poor: Below 4,000 persons
Fair: 4,000 – 5,500 persons
Good: Above 5,500 persons

Employment:
Poor: Below 1,000 employees
Fair: 1,000 – 2,000 employees
Good: Above 2,000 employees

Zero Car Household:
Poor: Below 3.0% households
Fair: 3.0%-6.3% households
Good: Above 6.3% households

MEETING MINUTES

August 25, 2008

Re: **I-10 WEST ALTERNATIVES ANALYSIS**

8-25-08 I-10 West Community Working Group Meeting #3

In Attendance:

Project Team: Abhishek Dayal, Deron Lozano, Kammy Horne, Jean Sanson, Jeremy Stapleton Monica Hernandez

City of Phoenix Staff: Maria Hyatt, Olga Soto, Sandy Zwick

Community Working Group Members:

Dwight	Amery	Maryvale Revitalization / Maryvale Village Planning Committee
Stan	Armstrong	Amberlea Fight Back
Lucas	Cabrera	Wesley Community Center
David	Elston	Amberlea Fight Back
Walt	Gray	St. Augustine Church
Nancy	Johnston	Amberlea Fight Back
Paul	Johnston	Amberlea Fight Back
Gerry	Lusson	Carpenter's Union Training Center
Elodia	May	Amberlea Fight Back
Lisa	Pittman	New Life Fight Back
Diane	Sandoval	Amberlea Fight Back
Oscar	Sandoval	Amberlea Fight Back
Zeke	Valenzuela	Westcor - Desert Sky Mall
Ben	Weisinger	Estrella VPC

Minutes:

1. Welcome and Introductions

Kammy Horne led introductions and provided an update on the project schedule. Kammy Horne also summarized comments made at the previous I-10 Community Working Group (CWG) using the Station Working Map.

2. Overview of General Transit Terminology that we use to Describe the Project

A handout was provided to the CWG participants that summarized terminology frequently used by METRO that apply to the I-10 West Alternatives Analysis/ Environmental Impact Statement study.

Frequently Used Terms

Elements of a Transit Station

- **Station Platform:** A pathway alongside LRT tracks or a BRT stop at which passengers wait for and board or alight from trains. Current thinking is that station platforms would be located within the median of the I-10 freeway.

- **Park-and-ride:** A parking facility for commuters to leave their cars in a lot and transfer to and from the BRT/LRT system.

- **Kiss-and-ride:** An area in which cars drop-off and pick up transit passengers. A kiss-and-ride facility allows drivers to stop and park temporarily, instead of the longer-term parking associated with "park and ride" facilities.

- **Bus Loading Area:** An area where local buses park to drop-off and pick up LRT/BRT passengers.

Potential Station Types along I-10

- **Median Station:** LRT or BRT platform located in the middle of I-10, between east-bound and west-bound traffic lanes.

- **Off-Line Station:** LRT or BRT platform located on the side of I-10, such as the 79th Ave. park-and-ride.

- **1-Mile Station:** A transit station located at an I-10 interchange. Interchanges are generally located one mile apart. Potential locations could include 35th Ave., 43rd Ave., 51st Ave., 59th Ave., 67th Ave.

- **1/2-Mile Station:** A transit station located at a freeway overpass between I-10 interchanges. Freeway overpasses are generally located one-half mile from an interchange. Potential locations could include 39th Ave., 63rd Ave. and 79th Ave.

Other Frequently Used Terms

- **ADA:** Americans with Disabilities Act of 1990. Would require that stairs and elevators be provided for be provided to allow for disabled access to station platforms.

- **ADA Accessible Stations:** Public transportation passenger facilities, which provide ready access, and do not have physical barriers that prohibit and / or restrict access by individuals with disabilities, including individuals who use wheelchairs.

- **At Grade, Exclusive Right-of-Way (ROW):** Railway right-of-way (ROW) from which

all other traffic, mixed and cross, is excluded. Median strip right-of-way (ROW) is included provided all crossings of the right-of-way (ROW) pass over or under the median. The median of I-10 would be considered an at grade exclusive right-of-way (ROW).

- **Grade Crossing:** An intersection of roadways, railroad tracks, or dedicated transit rail tracks that run across mixed traffic situations with motor vehicles, light rail (LR), commuter rail (CR), heavy rail (HR) or pedestrian traffic. Either mixed traffic or semi-exclusive situations.

- **Guideway:** A public transportation facility using and occupying a separate right-of-way (ROW) or rail for the exclusive use of public transportation including the buildings and structures dedicated for the operation of transit vehicles such as at grade, elevated and subway structures, tunnels, bridges, track and power systems for rail modes, and paved highway lanes dedicated to bus (MB) mode. Guideway does not include passenger stations and transfer facilities, bus (MB) pull-ins or communication systems.

- **High Occupancy Vehicle (HOV):** Vehicles that can carry two or more persons. Examples of high occupancy vehicles (HOV) are a bus, vanpool, and carpool.

- **SOV:** Single Occupancy Vehicle

- **FTA:** Federal Transit Administration

3. Review and Open Discussion on Station Location Evaluation Criteria

Jean Sanson went over the evaluation criteria the study team used to analyze the proposed station locations along I-10, west of I-17. Jean Sanson indicated the criteria was developed based on the example provided at the previous meeting for a separate transit study and comments from the CWG were also included in the criteria where possible. CWG participants were handed evaluation matrices for each of the station locations under consideration so they could follow along with the presentation. CWG participants were asked to comment on the evaluation criteria as to whether they thought anything should be added or if criteria should be removed. No one responded to this request and participants were invited to bring any comments to the next CWG meeting. The station evaluation criteria and the evaluation matrices for each of the station locations under consideration are available upon request.

4. Conceptual Station Layouts and Preliminary Evaluation Results

Jean Sanson discussed conceptual designs and evaluation criteria for each potential station layout. Jean Sanson presented a comparison of nearby station layouts by comparing them side by side and relating the results of the evaluation criteria to each layout. By presenting

the information in this manner, it provided the CWG participants an opportunity to recommend/ agree with one station location over another. Jean stressed the results from the evaluation was not a quantitative assessment, rather the intent was to characterize the benefits of each potential station location.

- 35th Avenue

Stakeholder Comment: Bus looping from McDowell to the station seems redundant and impacts the ridership that is not bound for a station.

Stakeholder Question: Having a station at 35th Avenue seems redundant since you could use an existing bus route along McDowell Road or Van Buren Street to get into Downtown. What are the complications of the added transit stations?

Metro Response: It could be possible to examine the possibility of a kiss-and-ride at McDowell – possibly use as circulator/shuttle service to the bridge. This option will need to be analyzed in greater depth.

Stakeholder Comment: Some type of access improvements will need to be incorporated to improve access from the south along the arterials.

Stakeholder Comment: Look at what impacts will be of bus ridership/routes due to those who do not want to go on the freeway.

Stakeholder Comment: Bus turn around is right where National Guard is located. It is a constrained area with trucks that appears to be in use. The Marines are possibly moving out of the facility – this could be a potential opportunity for a transit facility.

Stakeholder Comment: Provide shuttle from McDowell down to 35th Avenue bridge.

Stakeholder Question: Would LRT impact or provide new business potential/opportunities?

Metro Response: Transit does not by itself bring redevelopment. Development along a transit system needs to have a good planning. A comment was made that vacant property along freeway has been unable to attract private property owners for a particular reason, therefore they were skeptical that LRT alone could bring in development. They have been vacant for a while so LRT will not bring development.

Stakeholder Comment: 39th Avenue is a more established residential neighborhood compared to 35th Avenue that includes businesses. It was noted that mom and pop businesses are located along 35th Avenue all way to Van Buren.

Stakeholder Comment: A turn around located along 35th Avenue would be tough for a bus to cross several lanes of traffic. It would be impossible since it is already congested, especially during the rush hour commute.

Stakeholder Question: What about locating a kiss-and-ride on either McDowell or Van Buren to minimize the amount of travel time and limit the deviation from current Valley Metro bus routes?

Metro Response: If this were to be considered an option, using McDowell would be better to reduce the impact on neighborhoods and it was acknowledged that this could reduce the impact on interchanges.

Stakeholder Comment: 35th Avenue seems to be a better location due to access and there would be no property displacements or property acquisitions. Also, 35th Avenue has many apartment buildings, and is not a typical single-family home neighborhood.

- 39th Avenue

Stakeholder Comment: It is a minor arterial that has fewer traffic and does not provide good regional access.

Stakeholder Comment: Infrastructure improvements are needed traveling in each direction. METRO will need to see what the extent of the proposed ADOT improvements to the 39th Avenue bridge will be. Kammy Horne noted the study team will have a better idea of what ADOT will be doing by the end of September.

Stakeholder Comment: Concern about the schools – How will transit facilities impact kids (walking, school buses, etc?)

Stakeholder Comment: The Golden Gate Community Center is located approximately ¼-mile north of the I-10 Freeway along 39th Avenue

Stakeholder Comment: There is a need to be sensitive to schools. Maria Hyatt (City of Phoenix) commented the study team will coordinate with representatives from local school districts. She commented that the Central Phoenix/East Valley (CP/EV) light-rail corridor includes 3 high schools, 4 elementary schools, 2 universities, and 1 community college. The northwest extension has 5 schools on a 3 mile stretch. She noted that a transit system is not necessarily incompatible with nearby schools.

Stakeholder Comment: Those who live along Camelback Road that will experience the light-rail operations are used to traffic impacts (noise, vehicles, etc.)– What about the neighborhoods that are not?

Stakeholder Comment: The existing businesses along 39th Avenue are mom & pop oriented.

Stakeholder Comment: 39th Avenue is a better choice due to easy access and less congestion.

- 43rd Avenue/51st Avenue

Stakeholder Question: If 39th Avenue used – it should stand to reason that you should have another ½ mile street as a station location? Also, if a station is located at 35th Ave, would you want to add another one at 43rd (within a mile?)

Metro Response: The model will provide information about proper station locations in terms of ridership, appropriate start/stop times, etc..

Stakeholder Comment: 51st Avenue is a major truck route heading south. That will change when the Loop 202 opens.

Stakeholder Comment: Based on the 43rd Avenue concept plan, the location for "Parking option A" is adjacent to the Super Value Hotel location.

Stakeholder Comment: 35th Avenue has lots of small businesses and 51st Avenue has vacant parcels and larger size businesses.

Stakeholder Question: What is the relationship of land use to LRT?

Metro Response: Sandy responded that you need to have stations where people will get on and where opportunities for transit-oriented development are. These considerations were taken into account on CP/EV Starter Line with development opportunities.

Stakeholder Comment: 35th/43rd/51st – These areas will see intense development in future. Maybe locate a kiss-and-ride at McDowell – connect to bus lines. If 51st Avenue is selected for a station, it as recommended that the lot north of I-10 (Option A) is selected as the park-and-ride location.

Stakeholder Comment: Consider the impacts of intense transit related development in already busy/developed areas.

Stakeholder Question: Do you want light rail on 51st Avenue with all the traffic volume?

Metro Response: The Project Team will be assessing traffic impacts at all potential station locations.

- 63rd Avenue/67th Avenue

Stakeholder Question: 63rd Avenue – Why put in a park-and-ride so close to the one at 79th Avenue?

Metro Response: 67th would probably work better.

Stakeholder Question: 63rd Avenue – Why put in a park-and-ride so close to the one at 79th Avenue?

Metro Response: The Project Team will use model forecasting to understand if this station spacing warrants two park-and-rides at these locations.

Stakeholder Comment: The West Phoenix Revitalization Board is looking at new improvements to streetscape and facades, as well as south of I-10 village core.

Stakeholder Comment: 63rd is too restricted and there are no destinations to go to. The 63rd Avenue bridge is currently blocked off on both sides at I-10. 67th has vacant land that could be used for future dense development

Stakeholder Comment: The system should be consistent with all stations located ½ mile apart – this will make the system predictable.

- 79th Avenue

Jean Sanson reminded the CWG that the mode (Light rail or bus rapid transit) is still under consideration and indicated the project team is analyzing an alignment that travels north on 79th Avenue up to the Cricket Pavilion area.

Stakeholder Question: To go north on 79th – would I-10 be designed to have a ramp from the freeway to accommodate traffic coming from the west?

Metro Response: Implementing a ramp to the west of 79th Avenue is under consideration as part of the I-10 West study.

Stakeholder Comment: The Baker property located northwest of McDowell/79th Avenue would be a good location for additional parking, as noted in the concept plan.

Stakeholder Comment: The study should look to expanding the transit system beyond 79th Avenue – bring Avondale representatives into the discussion.

Stakeholder Comment: 67th Avenue seems more appropriate due to available land and compatible land use.

Stakeholder Comment: 63rd Avenue lacks traffic and development

Kammy noted that funding for the I-10 West Study allocated in the RTP passed by voters extends to 83rd Avenue, even though the study area extends to Loop 101. Other studies are being conducted for connections farther west and north from the I-10 end of line.

Stakeholder Comment: Develop a 79th Avenue Connector/shuttle to connect Cricket Pavilion/ Desert Sky Mall - possible connect to the Avondale Auto Mall

Stakeholder Comment: What is the cost of expanding the current 79th Avenue park and ride compared to purchasing an adjacent vacant lot?

Metro Response: The cost is approximately 3 to 1, with purchasing the adjacent property being the more expensive alternative. An incentive to expanding the current park and ride is the City already owns the property.

Stakeholder Comment: The study should consider a possible 75th Avenue station and not base the end-of-line on the 79th Avenue Park and Ride alone.

General: At the next I-10 CWG Meeting (September 22nd), the study team will provide maps and concept plans to participants. It was suggested representatives from the I-10 West project team attend the next Maryvale Neighborhood Meeting, scheduled for September 23rd, and provide an update.

Stakeholder Comment: 79th Avenue has ease and mobility.

5. Open Discussion

Stakeholder Comment: 55th Avenue/ Loop 202 - should be that more appealing for traffic from Ahwatukee to access the light rail at this location. It is an asset to get more people to the train. However, someone posed the question if a commuter would really drive all the way from the south and transfer to a high-capacity option rather than just continuing to Downtown.

Stakeholder Question: What is the volume of traffic north/south of I-10 to Downtown?

Metro Response: We do have ADOT traffic counts for the present and forecasts for 2030. This information is used to indicate how many stations should serve the Study Area. Also, this information will be used to determine potential ridership and help determine the appropriate park-and-ride sizes. Ridership numbers will be available and presented to the CWG likely at the end of October. The study team is also looking at travel heading east past Downtown. The goal is to connect to overall transit for Phoenix.

Stakeholder Question: Community impacts – will traffic to kiss-and-rides create twice as much traffic in the nearby area since vehicles will travel to and from the same location twice a day, compared to a park-and-ride where vehicles have one inbound and one outbound trip per day?

Metro Response: Depends on the traffic volume – the travel model will help determine this.

Stakeholder Question: Are there schools along 39th Ave?

Metro Response: Yes and they are mapped and have been acknowledged during the study.

Stakeholder Question: How reliable are the numbers for future employment?

Metro Response: The numbers are based on projected future development provided by the Maricopa Association of Governments (MAG), which is based on potential development provided by individual municipalities provided to MAG.

6. Items for Next Meeting (September 22)

The I-10 West study team will plan to bring revised concept plan maps based on the discussion at this evenings meeting and modify evaluation criteria as necessary.

ADOT update on 39th Avenue.

I-10 West

Alternatives Analysis/ Environmental Impact Statement

I-10 CWG Meeting #4

September 22, 2008

Agenda

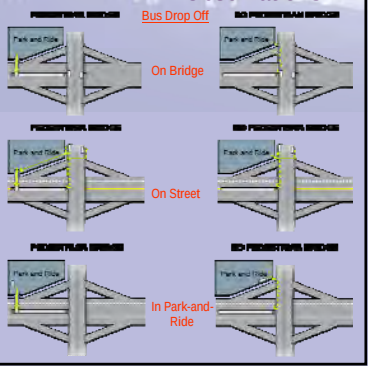
- I-10 Station Planning Update and Observations
- Review of Station Location Options and Key Discriminators
- Review of Station Refinements
- Next Steps

I-10 Station Planning Update and Observations

- Considered stations at both major arterial interchanges and minor arterials
  - Perceived traffic impacts to neighborhoods and primary schools are a major disadvantage to minor arterial locations
- Evaluated possible fourth station location in vicinity of 43rd/51st Ave.
  - Purpose is to pick up commuter trips east of 63rd/67th Ave. for transit patrons wouldn't travel out-of-direction to park-and-ride

I-10 Station Planning Update and Observations

- Pedestrian access and bus drop off areas at interchange locations requires further refinement because of interchange traffic
- Access options are shown here with and without pedestrian bridges



Ridership Forecasting

- Travel demand model to predict future travel patterns
  - Where will people come from?
  - Where will they go?
- What mode (transit, vehicles, walk, etc.) will they use to make those trips?
- Use MAG population and employment projections to estimate the total number of trips

Bus Considerations for Ridership Forecasting

- Deviate Valley Metro bus routes to serve BRT/LRT stations along the I-10 median
  - East-west connections (Route 17)
  - North-south connections (Routes 83, 75, 67, 59, 43, 35)
  - Express bus connections
- Adjust frequencies to better match BRT/LRT schedules
- Shuttles to be provided to major activity centers located off the BRT/LRT line
  - Desert Sky Mall shuttle at 79th Avenue
  - MARY Neighborhood Circulator at 51st Avenue

For More Information Contact:
Monica Hernandez at (602) 322-4427 or
mhernandez@metrolightrail.org

Range of Bus Volumes

Time of Day	Major Arterial 35th, 43rd, 51st, 59th, 67th Avenues Buses Per Hour (Both Directions)	Minor Arterial 31st , 39th, 63rd Avenues Buses Per Hour (Both Directions)
Peak Hours 6am-9am 3pm-7pm	6 (Existing)– 24	9 (Existing) – 36
Off-Peak Hours	4 (Existing) – 12	6 (Existing) - 18

Buses Stop on Interchange Bridge

Buses Stop in Park-and-Ride Lot

35th Ave. Station Option

39th Ave. Station Option

35th/39th Ave. Station Options: Key Discriminators

Criterion	35th Ave. Station	39th Ave. Station
Mobility	35th Ave. connects north Phoenix to South Mountain and Laveen	Limited regional mobility
Traffic	Congested interchange	Less congestion
Property Acquisition	Partial acquisition of Naval Training Center parking area (owner is possibly vacating site)	Acquisition of residential properties
Compatibility	Buffered from residential neighborhoods by commercial uses	Surrounded by existing and planned single-family neighborhoods
CWG Input	Preferred location because it would have fewer neighborhood impacts and would provide mobility to high school students	Residential neighborhoods and primary school may be impacted by station traffic Increased traffic volumes may create congestion narrow streets south of I-10
Preliminary Recommendation	Carry forward for further analysis and refinements	Set aside

For More Information Contact:
Monica Hernandez at (602) 322-4427 or
mhernandez@metrolightrail.org

35th Ave. Station Refinements and Next Steps

- Assess need for diversion of McDowell bus route (#17) and consequent bus turn around area
- If bus turn around area is needed, evaluate a site northeast of interchange to minimize traffic impacts and out-of-direction travel

35th Ave. Station Refinements and Next Steps

- Evaluate two bus turn around options
  - Southeast of interchange (as shown in concept plan)
  - Northeast of interchange (as shown in previous slide)
- Consider provision of pedestrian-only overpass to facilitate a more comfortable walk to and from the station platform
- Continue to refine station design based on updated ridership forecasts, mode of access and right-of-way information

43rd Ave. Station Option

51st Ave. Station Option

43rd/51st Ave. Station Options: Key Discriminators

Criterion	43rd Ave. Station	51st Ave. Station
Mobility	43rd Ave. terminates at Lower Buckeye Rd.	Provide connection to South Mountain Freeway and 51st Ave., which is one of the area's longest north-south arterials
Property Acquisition	Vacant sites are available	Vacant site available north of I-10, but south site may be advantageous to intercept South Mountain traffic
CWG Input	Not perceived as a strong regional connector to activity centers, but good connections to nearby grocery stores and apartment complexes	Preferred location because of potential connection to South Mountain Freeway and connection to Maryvale Secondary Village Core
Preliminary Recommendation	Set aside	Carry forward for further analysis and refinements

51st Ave. Station Refinements and Next Steps

- Assess need for diversion of McDowell bus route (#17) and consequent bus turn around area
- Consider provision of pedestrian-only overpass to facilitate a more comfortable walk to and from the station platform
- Continue to refine station design based on updated ridership forecasts, mode of access and right-of-way information; and ADOT plans for South Mountain Freeway
- Evaluate new potential station location at 59th Ave., as requested by Estrella VPC member at CWG meeting

For More Information Contact:
Monica Hernandez at (602) 322-4427 or
mhernandez@metrolightrail.org

51st Ave. Station Refinements and Next Steps

- Develop third park-and-ride location option southeast of interchange (small vacant corner of truck stop) with access from east-bound I-10 ramp
  - Continue to evaluate two park-and-ride options shown in concept plans

63rd Ave. Station Option

67th Ave. Station Option

63rd/67th Ave. Station Options: Key Discriminators

Criterion	63rd Ave. Station	67th Ave. Station
Mobility	63rd Ave. is intermittent north and south of I-10	67th Ave. is one of the area's longest north-south arterials
Compatibility with park-and-ride	Surrounded by existing and planned residential land uses on all sides	Surrounded by planned residential land uses and existing industrial uses
CWG Input	Strong opposition due to proximity to Sunridge Elementary School and traffic impacts to W. Roosevelt St.	Preferred location due to planned economic development activity along 67th Ave. and better access to activity centers
Preliminary Recommendation	Set aside	Carry forward for further analysis and refinements

67th Ave. Station Refinements and Next Steps

- Assess need for diversion of McDowell bus route (#17) and consequent bus turn around area
- Carry forward both park-and-ride location options (north and south of I-10) for further consideration in DEIS
- Consider provision of pedestrian-only overpass to facilitate a more comfortable walk to and from the station platform
- Continue to refine station design based on updated ridership forecasts, mode of access and right-of-way information

79th Ave. Station Option

For More Information Contact:
Monica Hernandez at (602) 322-4427 or
mhernandez@metrolightrail.org

79th Ave. Station Refinements and Next Steps

- Carry forward both park-and-ride location options (north and south of I-10) for further consideration in DEIS
- Develop additional park-and-ride location options at the following locations:
  - Vacant land southeast of overpass
  - Land at or adjacent to the Cricket Pavilion – requires alignment to go north approximately ½ mile
- Continue to refine station design based on updated ridership forecasts, mode of access and configuration of transit guideway

Next Steps

- Further refine station concept plans to be carried forward
  - In some cases, more than one park-and-ride location at a station location should be carried forward for further evaluation
  - Use updated modeling forecasts to appropriately size park-and-rides and determine if number of stations and station locations are optimized

For More Information Contact:
Monica Hernandez at (602) 322-4427 or
mhernandez@metrolightrail.org

MEETING MINUTES

September 23, 2008

Re: **I-10 WEST ALTERNATIVES ANALYSIS**

9-22-08 I-10 West Community Working Group (CWG) Meeting #4

In Attendance:

Project Team: Abhishek Dayal, Angela Dye, Deron Lozano, Kammy Horne, Jean Sanson, Monica Hernandez, Nate Larson, Wulf Grote

City of Phoenix Staff: Robert Cox, Sandy Zwick

Community Working Group Members:

Ben	Weisinger	Estrella VPC
Dolores	Elston	Amberlea Fight Back
Nancy	Johnston	Amberlea Fight Back
Pat	Patterson	Community Information & Referral
Paul	Johnston	Amberlea Fight Back
Roy	Vega	New Life Fight Back
Stan	Armstrong	Amberlea Fight Back
Walt	Gray	St. Augustine Church

Minutes:

1. Jean Sanson opened the meeting and provided a power point presentation overview on the various station design concepts for the I-10. (Power point presentation is available upon request.) The group provided comments on the need for safety and indicated they would prefer the concept that includes a dedicated pedestrian bridge. Jean Sanson indicated that infrastructure cost will be considered in selecting station designs. Wulf Grote added that Metro will be developing a cost effectiveness assessment to help determine where value engineering applications may help reduce overall cost.

2. Abhishek Dayal provided a power point presentation overview of the ridership forecasting and explained the various bus considerations that are considered in this equation. (Power point presentation is available upon request.)

3. Jean Sanson presented a power point presentation with the preliminary station location recommendations and station concept plan refinements. (Power point presentation is available upon request.) Overall the CWG supported the station location recommendations as presented by Jean Sanson. Jean Sanson noted the station locations that are not recommended may still be considered based on the development of new information and/or new findings from the evaluations that will be applied to the recommended station locations. The following outlines the Metro recommended station locations and the input proved by the community working group.

   <u>35th Avenue</u>

   - This location has opportunities for transit oriented development.
   - US Marine's will be vacating property on the southeast corner of the I-10 and 35th Avenue.

- US Marine's property allows for McDowell turnaround north of the I-10 and Van Buren turnaround south of the I-10.

51st Avenue and 59th Avenue

- A bus circulator should also be added at non major arterials to serve and connect to the neighborhoods in this area.
- 59th Avenue is located within the Estrella Village core where there are plans for a future redevelopment of the area.
- 59th Avenue connects directly to the Arizona State University west campus

67th Avenue

- 67th and 63rd Avenues should be considered as fourth options.
- A bus circulator should also be considered for this area.

79th Avenue

- Street improvements are being discussed for 79th Avenue
- This area has good options for stations location elements
- 79th Avenue will go further south of the I-10

4. Open Discussion

- Wulf Grote explained that the I-10 West study does not include the addition of local neighborhood bus circulators.
- The CWG suggested the station platform should be closer to 83rd Avenue along with extending the proposed 79th Avenue park and ride further west.

5. Next Steps/Action Items

- Further refine station concept plans for the recommended station locations (35th Avenue, 51st Avenue, 67th Avenue).
- A station concept will developed for 59th Avenue and two concepts will be developed for 79th Avenue
- Next meeting will be held on Monday, October 27, 2008 from 6 to 7 pm to discuss the 59th and 79th Avenue station concepts.
- Sandy Zwick will follow-up with City of Phoenix regarding the US Marine property on 35th Avenue and present back to the CWG.

DRAFT

I-10 West

Alternatives Analysis/ Environmental Impact Statement

I-10 CWG Meeting #5

October 27, 2008

Agenda

- Overview of Preliminary Station Location Recommendations from CWG Meeting #4
- Review of New Station Concept Plans and Evaluations
  - 59th Ave. Station Options
  - 79th Ave./End-of-Line Station Options
- Update on Downtown Alignment Recommendations
- Next Steps

I-10 Mainline Stations

Preliminary Station Location Recommendations

- Carry forward the following station concept plans for further evaluation:
  - 35th Ave. (walk-up, bus/auto drop-off)
  - 67th Ave. (park-and-ride)
  - 79th Ave. (park-and-ride)
- Develop a concept plan at 59th Ave.
- Evaluate 51st Ave. and 59th Ave. station locations in relation to each other

43rd Ave. Station Option

51st Ave. Station Option

DRAFT

59th Ave. Station Option

43rd/51st/59th Ave. Station Options: Key Discriminators

Criterion	43rd Ave. Station	51st Ave. Station	59th Ave. Station
Mobility	43rd Ave. terminates at Lower Buckeye Rd.	Provide connection to South Mountain Freeway and 51st Ave., which is one of the area's longest north-south arterials	59th Ave. terminates at West Broadway Road, but Route #59 bus has double the ridership of Route #51
Property Acquisition	Vacant sites are available	Vacant site available north of I-10, but may be advantageous to intercept S. Mountain traffic on south	Two large vacant sites available to the north of I-10
CWG Input	Not perceived as a strong regional connector to activity centers, but good connections to nearby grocery stores and apartment complexes	Preferred location because of potential connection to S. Mountain Fwy. And connection to Maryvale Secondary Village Core	Could connect to the Estrella Village Core, but may not be as strong a regional connector as 51st Ave. station option

79th Ave. Station Options

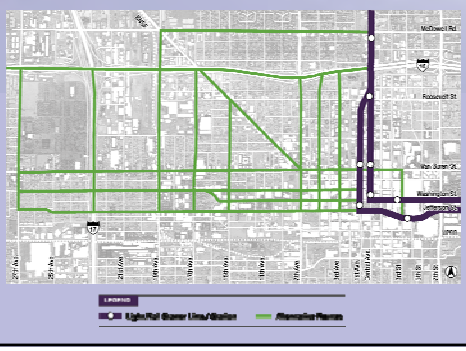
79th Ave./End-of-Line Station Recommendations

Carry forward two end-of-line design options:

- Station along I-10 with extension to the west or north
- Station along 79th Ave. (in the vicinity of Desert Sky Mall) with extension to the north

Downtown Alignment

Universe of Downtown Alignments



DRAFT

I-10 West High Capacity Transit Project Goals

- Rush Hour travel capacity
- Transit system connectivity
- Access to corridor destinations and employment
- Cost-effectiveness
- Reinforce economic development opportunities
- Technical feasibility

Tier 2 Conceptual Alternatives

Tier 2 Conceptual Evaluation Results

- Remove: I-10 BRT to Hance Park
  - Does not serve Capitol directly
  - Unwieldy transfer to CP/EV
- Remove: 17th Avenue
  - Very limited space
  - Heavy truck traffic
  - Neighborhood and elementary school impacts
- Modify: Van Buren (turn South on 7th Ave)
  - Unable to make direct connection to CP/EV
  - Substantial width constraints 7th to Central

Key Issues - CWG

- Which Side of I-10, for Grand Avenue Station
- Integration with Centennial Plan for the Capitol Mall Area
- Avoiding Capitol Elementary School
- Minimizing Impacts to Historic Neighborhoods
- How to Best to Serve Employment Centers
- Transit Technology (BRT vs. LRT)

Key Issues - Technical

- Direct Connection to CP/EV Line at 1st/Central
- Utility Relocation Concerns on 15th Avenue
- Right of Way Constraints
- Reduction in Traffic Lanes
- ADOT I-17 Widening Project
- Separation from Rail Yard and Tracks West of 19th Avenue
- Transit Technology (BRT vs. LRT)

Next Steps

- Present preliminary recommendations at upcoming public meetings
- Further refine station concept plans to be carried forward
  - In some cases, more than one park-and-ride location at a station location should be carried forward for further evaluation
  - Use updated modeling forecasts to appropriately size park-and-rides and determine if number of stations and station locations are optimized

MEETING MINUTES

October 29, 2008

Re: **I-10 WEST ALTERNATIVES ANALYSIS**

10-27-08 I-10 West Community Working Group (CWG) Meeting #5

In Attendance:

Project Team: Abhishek Dayal, Angela Dye, Kammy Horne, Jean Sanson, Nick Karcz, Monica Hernandez, Wulf Grote

City of Phoenix Staff: Sandy Zwick

Community Working Group Members:

Dwight	Amery	Maryvale Revitalization / Maryvale Village Planning Committee
Gerry	Lusson	Carpenter's Union Training Center
Jackie	Waters	Crime Busters Blockwatch
Marie	Vaughan	Crime Busters Blockwatch
Maureen	Williams	Crime Busters Blockwatch
Nancy	Johnston	Amberlea Fight Back
Pat	Patterson	Community Information Refferal Service
Paul	Johnston	Amberlea Fight Back
Roy	Vega	New Life Fight Back
Stan	Armstrong	Amberlea Fight Back
Walt	Gray	St. Augustine Church

Minutes:

1. Kammy Horne opened the meeting and provided details on date/time/location for the November Tier 2 public meetings. Kammy also reviewed the project's decision making process.

2. Jean Sanson provided an overview of the recommended station locations areas that were discussed at the September community working group meeting. Jean also presented information on the 59th and 79th station location design concepts. Community working group members provided the following questions and comments:

   <u>59th Avenue</u>

   - CWG Comment – The existing pedestrian walkway on 59th Avenue will due. A traffic signal to allow for pedestrian crossings can be added.

   - CWG Question - Will southbound 59th Avenue require any widening?

     Metro Response – Street widening requirements will be accessed as part of the next step in the evaluation process.

   - CWG Question – Will park and ride traffic impacts to the northern and southern traffic counts be looked at to access impacts and mitigation?

     Metro Response – Yes

79th Avenue

- CWG Question - How many stations will be located along the mainline area?

  Metro Response – Two or four depending on ridership demand.

- CWG Comment: - A western extension would help create ridership demand.

- CWG Question – What are the impacts with creating a median?

  Metro Response – This is an ADOT item. It is most likely a difficult option.

- CWG Question – Can the Maryvale feeder be connected to the north on 79th Avenue alternative?

  Metro Response – A rescheduling of the existing feeder would need to be evaluated. We are evaluating a feeder to connect the I-10 and Desert Sky Mall area as part of the 79th Avenue alternative.

- CWG Comment – The ridership is located south of Buckeye Road and a northern connection (i.e. at I-10) does not provide a benefit to those located south of Buckeye Road. I work in downtown Phoenix – why go out of your way to travel north when I can reach downtown Phoenix within the same travel duration.

  Metro Response – We are looking at ridership numbers to help identify park and ride locations in this area.

3. Nick Karcz provided power point presentation regarding the route alignments that are currently under evaluation for the downtown area.

4. Next Steps

   - CWG will meet on Monday, Dec. 1, 2008 to review the feedback obtained from the public during the November Tier 2 public meetings.

Appendix B
Deck Park Technical Memorandum

DRAFT

METRO

MEMO

To: Marc Soronson, Wulf Grote

From: I-10 West Project Team

Date: 3 October 2008

Re: **I-10 West Alternatives Analysis**
Deck Park Facility Assessment

Introduction

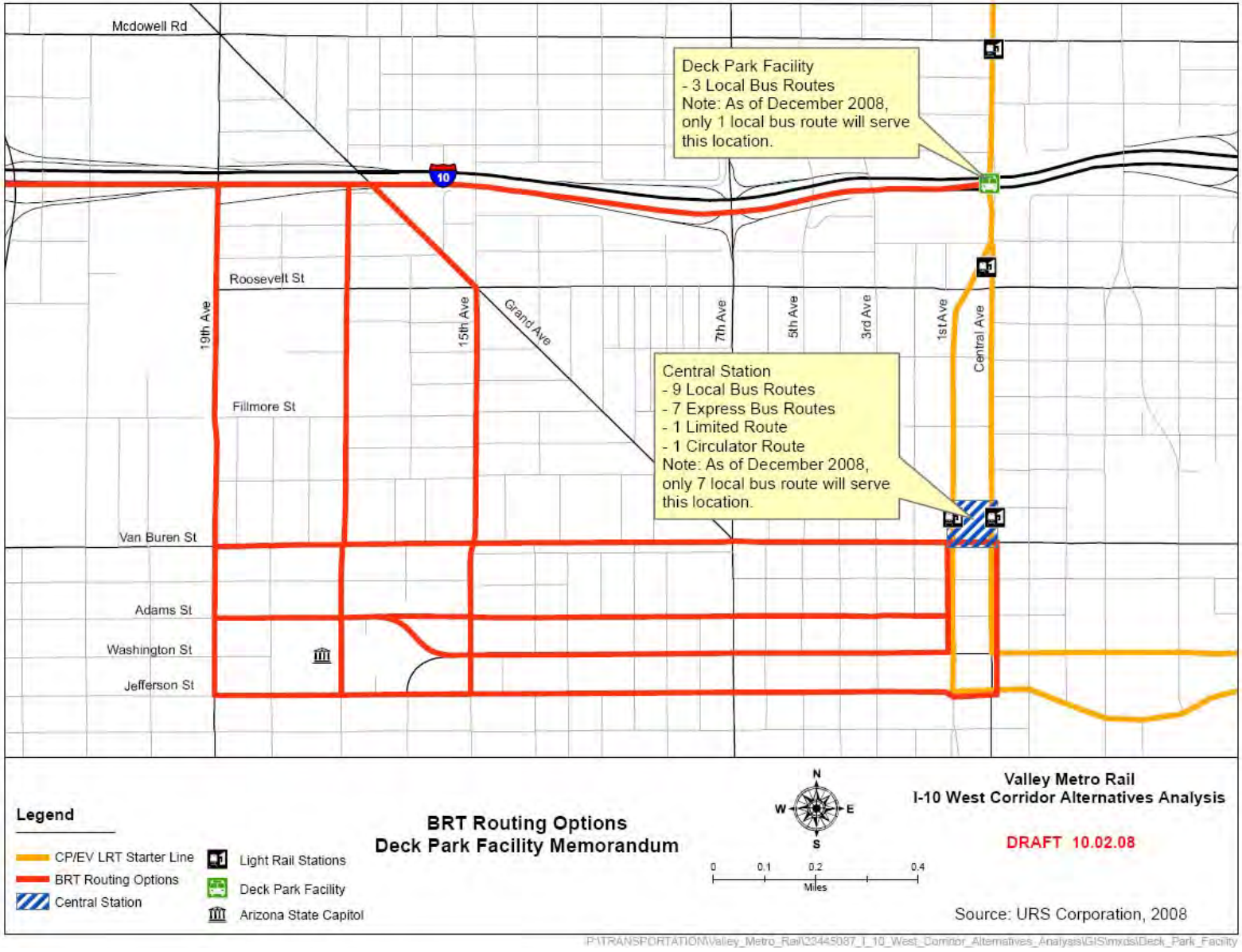
During the construction of the Interstate 10 freeway in the late 1980's, the Arizona Department of Transportation (ADOT) began construction of an express bus facility in a tunnel located below Hance Park within the freeway median between 3rd Street and 3rd Avenue, known as the Deck Park Facility. This facility was designed to allow express buses to access the facility from exclusive bus-only entrance and exit lanes from the high occupancy vehicle (HOV) lanes. The bus facility is centered at Central Avenue.

As part of the I-10 West Alternatives Analysis, Interstate 10 (between Interstate 17 and Central Avenue) was identified as one of several alternatives retained for Tier 2 evaluation for bus rapid transit (BRT) technology. This technical memorandum assesses the viability of the Deck Park Facility with respect to I-10 West project goals and includes an overview of the facility, a discussion of system configuration, bus operations, rider convenience and station construction. The goals of the I-10 West Alternatives Analysis include:

1. Improve regional mobility along the I-10 West Corridor.
2. Connect the local and express bus system and the CP/EV LRT system with the West Valley.
3. Provide cost-effective transit improvements.
4. Serve major employment centers, including the State Capitol, and support economic development.
5. Minimize environmental impacts.

Figure 1 illustrates the different routing options for the BRT alternatives.

Figure 1 – BRT Routing Options



Overview of the Deck Park Facility

The Deck Park Facility was originally envisioned as an on-line transfer facility from express buses along I-10 to local bus service that runs north/south along Central Avenue. The facility consists of an area in the median where eastbound and westbound buses could depart from the HOV lanes and reach a center platform to drop-off and pick-up transit riders.

Once on the platform, transit riders would use stairways or elevators to reach the level of Central Avenue to transfer to local buses. With the construction of the Central Phoenix / East Valley Light Rail Starter Line (CP/EV LRT Starter Line) along Central Avenue, transit riders would be able to access that transit service as well.

Because of the center platform, and the fact that buses have doors on the right side of the vehicles, buses would have to use crossover lanes to reach the appropriate side of the platform. Leaving the platform, the buses would crossover again to access the correct HOV lane.

The unfinished "shell" of the station currently exists in the median. The lane layout through the Deck Park tunnel would require buses to merge / diverge from the HOV lanes in less than the desirable length at the expected operating speeds. The initial tunnel construction allowed for adequate merge distances, but ADOT has since re-striped the roadway to add a highway lane through the tunnel, thereby reducing bus merge capability.

Papago Intermodal Transfer Station Feasibility Study

Since the construction of the freeway, one major study has been conducted to examine the suitability of the facility for bus service. Most recently, the Papago Intermodal Transfer Station Feasibility Study (November 2004) was conducted by the Regional Public Transportation Authority (RPTA). Key findings of that report include:

- Interstate 10 general purpose and HOV lanes would need to be moved away from the facility and the downstream ends of the 3rd Street and 5th/3rd Avenue ramps would need to be rebuilt in order to extend the acceleration lanes out of the facility so transit vehicles could achieve an acceptable speed needed to safely merge onto the HOV lanes.
- Existing and future express bus routes would need to be substantially reconfigured to justify the opening of the facility.
- The size of the station platform could need to be reduced to meet the minimum requirements of the fire/life/safety requirements of the Uniform Building Code, due to the amount of square footage of the platform and the limited widths of the stairwells that would expedite the movement of transit riders in an emergency.

System Configuration

This section discusses how buses would operate into and out of the facility as well as how transit riders would transfer to light rail.

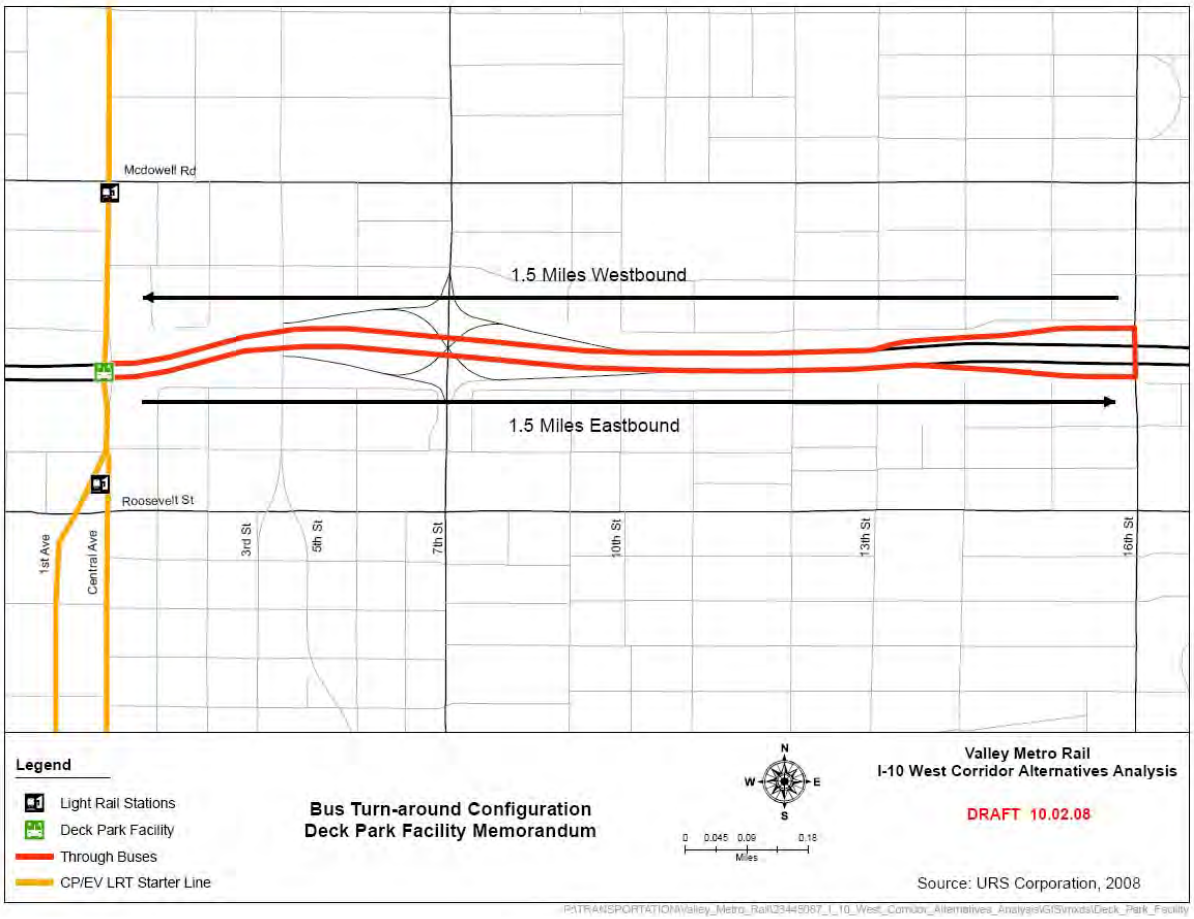
Through Buses

When the facility was initially designed, there was an assumption that Express buses or BRT vehicles from the West Valley (or north I-17) and the East Valley would be interlined through the station, continuing on after serving the Deck Park Facility (for example, buses from Metrocenter would end their trip at ASU). It was also envisioned, before LRT became a viable option, that a frequent Central Avenue shuttle would take passengers to destinations along Central (north and south) and to the State Capitol.

Currently, no plans are in place that would create such interline operations. In addition, there are no other similar on-line stations planned in other segments of I-10. Because of this fact, the express or BRT routes would be focused on a single location at the Deck Park, limiting the flexibility of the service.

Without well-balanced interlined operations, the utilization of the Deck Park Facility would increase the number of non-revenue, or “deadhead” miles. The express buses traveling east from the West Valley would enter the facility at the west portal and drop transit riders off at the platform located under Central Avenue. Due to the limited space inside this facility, the transit vehicle cannot turn around. Instead the vehicle must exit at the east portal, turn around off the freeway (at 16th Street) and re-enter at the east portals, in order to travel back through the Deck Park Facility to the West Valley. This approach would create a roundtrip total of three deadhead miles (shown in **Figure 2**) for each express bus operating from the West Valley to the Deck Park Facility.

Figure 2 – Bus Turn-around Configuration from the Deck Park Facility



Transfer to Light Rail

The Papago Intermodal Transfer Station Feasibility Study identified several criteria that should be met before the facility could be used. One criterion was that an LRT station should be constructed above the Deck Park Facility to allow for a seamless connection. Currently, there is no light rail transit (LRT) station located above the Deck Park Facility. The closest LRT station to the Deck Park Facility is approximately 530 feet to the south, located at Central Avenue between Portland Street and Roosevelt Street. The time to walk from the Deck Park Facility to the LRT station including vertical circulation from the facility to street level would be approximately 5 minutes. Even though the length between the Deck Park Facility and the LRT station is less than an eighth of a mile, a patron would be expected to walk to the transfer station which could reduce ridership during the hot summer months. A second consideration is that patrons traveling to areas along North Central Avenue would be walking south to eventually go north. This out of direction travel might be perceived as a travel penalty, reducing potential ridership. This is inconsistent with Goal 2 of the I-10 West project goals (Connect the local and express bus system and the CP/EV LRT system with the West Valley)

because this facility does not allow for a direct connection to the CP/EV LRT Starter Line.

Bus Operations

This section discusses the number of buses that would be needed to support the Deck Park Facility as well as the merge/diverge operations for buses entering/exiting the facility.

Buses Needed to Support Station

The Papago Intermodal Transfer Station Feasibility Study stated that seven express routes from the East and West Valleys would need to be reconfigured to serve the Deck Park Facility. Currently, these routes serve Central Station at Central Avenue/Van Buren Street. In addition to modifying seven existing routes, new service from both the East and West Valleys would also need to be modified to serve the Deck Park Facility. The I-10 West Alternatives Analysis would provide service only from the West Valley to downtown Phoenix, and not from the East Valley. No regional plans are in place to provide service from the East Valley.

Merge/Diverge Operations

The acceleration lanes would need to be extended to allow transit vehicles to reach an acceptable operating speed to safely exit the facility and safely merge onto the HOV Lanes. When the Deck Park was originally constructed, buses traveling into and out of the facility would have to travel on the I-10 HOV lanes and then merge onto a bus-only lane in the I-10 freeway median to access the facility. Since the construction of Deck Park, an additional general purpose lane was added by ADOT to I-10, thus encroaching on the length and width available for the bus-only lane. This resulted in a decreased length of the acceleration and deceleration lanes that are needed to safely access/egress the HOV lanes from the facility.

The Papago Intermodal Transfer Station Feasibility Study identified no issues with buses decelerating into the facility from either the east or west portals. The major issue is the limited distance available for buses to accelerate out of the facility to safely merge onto the HOV lanes (particularly the westbound exit). The study concluded that opening the facility with the existing access ramps would not be feasible because buses would have to accelerate near the platform (making it unsafe and uncomfortable for passengers) and exit the tunnel at high speeds.

The solution identified in the study was to realign I-10 freeway lanes away from the facility (to the north and south) in order to extend the tunnel ramps. This solution also requires the rebuilding of the downstream ends of the 3rd Street and 5th/3rd Avenue HOV ramps to allow for more distance for transit vehicles to achieve a safe operating speed to merge onto the HOV lanes. This is inconsistent with Goal 3 of the I-10 West project (Provide cost-effective transit improvements) because the rebuilding of the downstream

ends of the 3rd Street and 5th/3rd Avenue ramps would be very expensive compared to the level of transit benefit provided.

Rider Convenience

This section provides an overview of the destinations available around the Deck Park Facility and transfers that will be required by passengers utilizing the Deck Park Facility.

Destinations for Transit Riders

When the Deck Park Facility was initially designed, the City was planning for significant high rise development (including a proposal for a 114-story building) around the Deck Park. The site now occupied by the Burton Barr Central Library was originally envisioned as the location of a high-rise building. Without this development in and around Deck Park, the desirability of the site as a transit destination is substantially reduced.

Use of the Deck Park Facility requires most transit riders to make at least one more transfer to reach their destination. This is compared to service that would travel through downtown Phoenix that would allow transit riders more access to destinations. The Deck Park Facility is located in close proximity to the Burton Barr Central Library and Margaret T. Hance Park. The area around this facility includes a mix of single-family residential, apartment buildings, and some office/retail. No large employment centers are located near the station. While this area offers two points of interest, the major destinations for commuters in the area are downtown Phoenix and the North Central Avenue corridor, which are reflected in the current express bus and local bus configurations.

In downtown Phoenix, Central Station is a major transfer point for all transit riders. This station serves nine local bus routes, seven RAPID/express routes, one limited route, one circulator route, and light rail (in December 2008). It is important to note that two of the routes will be discontinued in December 2008 when the CP/EV LRT Starter Line begins operation, resulting in seven routes serving the Central Station. The routes that serve Central Station include:

- Red Line Route (Discontinued December 2008) – Metrocenter to University at Gilbert;
- Blue Line Route (Discontinued December 2008) – Ed Pastor Transit Center to Phoenix Mayo Hospital;
- Route 0 – Central Avenue;
- Route 3 – Van Buren Street;
- Route 7 – 7th Street;
- Route 8 – 7th Avenue;
- Route 10 – Roosevelt/Grant Street;
- Route 12 – 12th Street;

- Route 15 – 15th Avenue;
- Route 560 – Avondale Express;
- Route 571 – Surprise Express;
- Route 573 – Arrowhead/Downtown Express;
- I-10 West RAPID – Desert Sky Mall to downtown Phoenix;
- I-10 East RAPID – 40th Street/Pecos Rd PnR to downtown Phoenix;
- I-17 RAPID – Deer Valley Pool to Arizona Center;
- SR-51 RAPID – Bell Road PnR to State Capitol;
- Grand Avenue Limited – Tierra Buena Lane to downtown Phoenix;
- Downtown Area SHuttle (DASH) – Downtown Phoenix/State Capitol Circulator; and
- Light Rail – 19th Ave/Montebello to Sycamore/Main Street.

The Deck Park Facility, which is approximately one mile away from Central Station, has three local bus routes that could potentially serve transit riders. It is important to note that two of the routes will be discontinued in December 2008 when the CP/EV LRT Starter Line begins operation, resulting in only one bus route serving the facility. These routes include:

- Route 0 – Central Avenue;
- Red Line Route (Discontinued December 2008) – Metrocenter to University at Gilbert,
- Blue Line Route (Discontinued December 2008) – Ed Pastor Transit Center to Phoenix Mayo Hospital; and
- Light Rail – Station at Roosevelt/Central Avenue.

The greater number of routes offered at Central Station provides transit riders with the added convenience of connecting to various routes and locations throughout the valley, while the Deck Park Facility has few local bus routes, which could limit the mobility of transit riders. The utilization of the Deck Park Facility is inconsistent with Goal 1 of the I-10 West project (Improve regional mobility along the I-10 West corridor) because this option does not provide a substantial overall improvement the mobility of transit riders.

Transfer Requirements

Utilizing the Deck Park Facility would increase the travel time for commuters traveling from the West Valley to downtown Phoenix. Express bus routes that travel to downtown Phoenix stop at Central Station, and then proceed to the State Capitol (with the exception of the I-17 RAPID which stops at the State Capitol, then Central Station). If utilizing the Deck Park Facility, West Valley commuters that generally travel to downtown Phoenix would have to exit the facility, and then board the light rail at the Roosevelt/Central Ave Station to access downtown. West Valley commuters that travel to the State Capitol would have to board the light rail at the Roosevelt/Central Ave Station and then transfer at Central Station to the DASH (Downtown Area SHuttle)

route. While accessing downtown Phoenix requires only one transfer, accessing the State Capitol would require two transfers. Because of the transfers, the utilization of the Deck Park Facility would also eliminate the one-seat ride to which many West Valley commuters have become accustomed. This is inconsistent with Goals 1 (Improve regional mobility along the I-10 West corridor) and 4 (Serve major employment centers, including the State Capitol, and support economic development) of the I-10 West project because the facility would not provide a substantial improvement to regional mobility and it would not provide a connection to major employment centers, including the State Capitol.

Station Construction

The Deck Park Facility was constructed using design standards from 1986 and currently does not meet some portions of the national fire/life/safety code. The Papago Intermodal Transfer Station Feasibility Study stated that the large amount of square footage of the platform and the limited widths of the stairwells does not properly expedite the movement of transit riders in an emergency. In order for the facility to comply with the current fire/life/safety code, the square footage of the platform would need to be further reduced to limit the number of patrons that could be at the platform level at one time.

When the station was constructed in 1988, three areas within the Deck Park Facility were “roughed in” for vertical circulation (stairs and elevators). There are three openings in the Deck Park Facility: one near Central Avenue and the other two at either end of the station platform.

The report concluded that the cost to make the facility operational would be between $30M and $60M. This cost estimate includes the construction of an LRT station above the facility. Construction of the vertical circulation at the three locations, modifications of the platform and acceleration/deceleration lanes, and to finish the station “shell” would require about $15M to $30M depending upon the extent of the I-10 general lane realignment. The cost involved with the construction of a station at Deck Park is inconsistent with Goal 3 of the I-10 West project (Provide cost-effective transit improvements) because the facility would not provide a cost-effective option.

Findings and Conclusions

This technical memorandum examined the viability of the Deck Park Facility as a potential station for the Express Bus and BRT Alternatives for the I-10 West Alternatives Analysis. The findings from this study include:

- Transit vehicles would have to exit the Deck Park Facility at the east portals and exit at 16th Street in order to turn around and return back to the West Valley.
- The previous study of the Deck Park Facility identified a need for a LRT station directly above the facility. The closest LRT station is 530 feet to the south which is a substantial distance to walk to transfer.

- Buses would need to be routed from both the West and East Valleys to support the Deck Park Facility. No regional plans are in place for such service from the East Valley and significant modifications would be needed for the West Valley.
- The utilization of the Deck Park Facility would require the rebuilding of the 3rd Street and 5th/3rd Avenue HOV ramps and the relocation of general purpose and HOV lanes away from the facility to allow longer acceleration lanes for transit vehicles to safely exit the facility and merge onto the HOV lanes.
- Central Station allows transit riders more access to destinations and increases the mobility of the transit rider throughout the Valley compared to the Deck Park Facility.
- The use of the Deck Park Facility would eliminate the one-seat ride currently enjoyed by patrons to downtown and the Capitol Mall and would increase travel times for West Valley commuters traveling to downtown Phoenix.
- The Deck Park Facility currently does not meet key fire/life/safety code standards. The patrons standing area on station platforms would need to be reduced to meet current standards.
- Capital costs of $15M to $30M would be required to finish the station. Realignment of the I-10 general purpose lanes to provide the required acceleration/deceleration length for bus operations would be complex and costly because of the construction requirements within the Deck Park tunnel and the daily traffic volumes on I-10 in this segment.
- The use of the Deck Park Facility would be inconsistent with four of the five I-10 West project goals.

The original intent of the Deck Park Facility was to serve as both a development destination and a transfer station for the region's express bus system. Since the construction of the facility, the express bus and local bus system has expanded; however, service has been focused on Central Station in downtown Phoenix, away from the Deck Park Facility. In addition, the implementation of the CP/EV LRT Starter Line along North Central Avenue through downtown to the east has provided a strong linkage for transit patrons to easily access other areas of the Valley. Furthermore, the large amount of development planned in the 1980s near the Deck Park Facility never materialized.

Due to the local and express bus routes converging at Central Station, the use of the Deck Park Facility would limit the mobility of transit riders, including those who transfer to various bus routes throughout the Valley and those who seek a one-seat ride to Central Station and the Capitol Mall. Therefore, the use of the Deck Park Facility will not be considered further in the I-10 West Alternatives Analysis.

Appendix C
Tier 2 Downtown: Madison/Jackson LRT Alternatives Technical Memorandum

DRAFT

Technical Memorandum

To: I-10 West Project Team

From: Nate Larson

Date: 18 November 2008

Re: Tier 2 Downtown: Madison/Jackson LRT Alternatives

In the course of the I-10 West Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) project, the Tier 2 detailed Light Rail Transit (LRT) alignment alternatives for the downtown segment were presented to the State Historic Preservation Office (SHPO) in September 2008. SHPO expressed initial concern over the potential impacts to historic resources of all three east-west LRT alignment alternatives (Van Buren, Adams, and the Washington/Jefferson couplet), particularly in the vicinity of the Arizona State Capitol. In response to this concern, the I-10 West project team examined two additional east-west LRT alignment alternatives downtown—Madison Street (one block south of Jefferson) and Jackson Street (two blocks south of Jefferson). Neither Madison nor Jackson was included the original "universe" of alignment alternatives as they did not serve the core employment areas identified in downtown. Therefore, these alternatives were not addressed in the Tier 2 Conceptual Screening analysis conducted in July 2008. This technical memorandum documents the application of the conceptual screening criteria to Madison and Jackson Streets.

Conceptual Screening Process/Criteria

The following two basic considerations were applied to the project alternatives under the Tier 2 process:

- Determine whether the subject alternative would have substantial construction or operational costs or complexities that would be obviously greater than other conceptual alternatives, such that the subject alternative is not likely to become part of the Locally Preferred Alternative (LPA); and

- Determine whether the subject alternative would perform the same or similar transportation function as the other conceptual alternatives, but with obviously greater impacts, such that the subject alternative is not likely to become part of the LPA.

These determinations were applied within the framework of the five project goals to the Downtown segment alignment alternatives as described below.

Each Downtown segment alignment alternative was evaluated with respect to these questions and assigned a qualitative rating of Good, Fair, or Poor. The focus in assigning these ratings is not necessarily the standalone merit of an alternative, but its suitability relative to other alternatives as a potential candidate to be part of the LPA. Goals were not weighted, and no numerical values were assigned in the aggregation of ratings to results.

Project Goal	Conceptual Screening Application
1. Improve regional mobility	How does the alignment alternative compare to the others in its potential to improve regional mobility, with respects to traffic impacts and rider travel time?
2. Connect the west valley to the Central Phoenix/East Valley (CP/EV) LRT system.	How well does the alignment alternative connect to the CP/EV LRT line compared to other alignment alternatives?
3. Provide cost-effective transit improvements	Does the alignment alternative feature substantially more complex engineering challenges than other alignment alternatives while providing similar benefit?
4. Serve corridor destinations, including the State Capitol, and support economic development	How well does the alignment alternative serve corridor employment destinations and support economic development compared to other alignment alternatives? Supporting economic development relates to the alternative's ability to potentially generate transit oriented development, connect population and employment centers, and support higher density land uses.
5. Minimize environmental impacts	Does the alignment alternative feature substantially greater visual, cultural, and property acquisition impacts than other alignment alternatives while providing similar benefit?

Existing Aerial Photo/Map of Downtown Phoenix, 19th Avenue to 7th Avenue

Conceptual Screening Results

The conceptual screening results for the three east-west LRT alignment alternatives carried forward under the Tier 2 analysis are repeated here to facilitate comparisons of Madison/Jackson performance to the other east-west alternatives.

Alignment Alternative	Goal 1: Improve Mobility		Goal 2: Connect the West Valley to CP/EV	Goal 3: Provide Cost-Effective Transit	Goal 4: Serve Destin's and Support Economic Devmt	Goal 5: Minimize Environmental Impacts			Initial Recommendation
	Travel Time	Traffic Impacts				Visual	Cultural	Property	
Van Buren	Fair	Poor	Poor	Good	Fair*	Poor	Fair	Fair	Carry Forward, Revised
Adams	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Carry Forward
Washington/ Jefferson	Good	Fair	Good	Poor	Good	Poor	Poor	Fair	Carry Forward
Madison	Poor	Fair	Poor	Not Analyzed	Fair	Fair	Poor	Fair	Remove from Consideration
Jackson	Poor	Fair	Fair	Not Analyzed	Poor	Fair	Poor	Poor	Remove from Consideration

* This rating for Goal 4 on Van Buren is revised based on input from the Downtown Community Working Group indicating that because most of the available land along Adams, Washington, and Jefferson is publicly owned, Van Buren has better economic development potential than the other alternatives.

Both Madison and Jackson are relatively narrow streets with little traffic on them, similar to Adams Street. They would require a fair amount of out-of-direction travel, and therefore longer travel time, for LRT riders going through downtown (i.e., not destined to or originating from downtown). Jackson Street is not viable as a standalone east-west alternative because it is not a continuous roadway due to the presence of the cemeteries located between 15th and 13th Avenues.. As noted previously (when discussing its dismissal from the Tier 1 Universe of Alternatives); it does not directly serve many of the employment and entertainment destinations along Washington and Adams Streets. A Madison Street LRT guideway would be very difficult to connect to the CP/EV LRT line at 1st Avenue and Central Avenue. However, the eastern portion of the Jackson Street alternative could be part of a potential downtown LRT connection alternative using 1st Street.

Neither Madison nor Jackson has been included in detailed Tier 2 analysis at this time. If an LRT connection is not determined to be cost-effective as part of either the Adams or Washington/Jefferson alternatives (recalling that Van Buren would use Adams or Washington/Jefferson east of 7th Avenue), Jackson Street could be used in some fashion east of 11th Avenue in conjunction with a 1st Street-based LRT connection option.

Appendix D
Tier 2 Downtown LRT Connection Options Review

DRAFT

Technical Memorandum

To: I-10 West Project Team

From: Abhishek Dayal

Date: 28 January 2009

Re: Tier 2 Downtown LRT Connection Options Review

Background

The Tier 2 LRT alternatives connect the I-10 portion of the LRT alignment to activity centers in Downtown Phoenix and the State Capitol complex. The alignments would leave the freeway alignment and head south towards the State Capitol and then head east towards Downtown Phoenix to interline with the CP/EV alignment. Thus there are three "transition areas" that have been evaluated in the Tier 2 process: The transition from the freeway environment to the arterial streets environment (from east-west travel to north-south travel); transition from north-south travel to east-west travel in the arterial streets environment (towards Downtown Phoenix) and finally; connection to the Central Phoenix/East Valley (CP/EV) LRT "starter line" in Downtown Phoenix.

This analysis details the evaluation process for the third transition area in which alternatives were examined based on the ability to provide track connections to the CP/EV LRT alignment. Twelve connection options were evaluated. The connection options were evaluated based on criteria such as cost/engineering issues, ease of operation (transit and traffic), destinations served and ability to make other connections in the future.

The conceptual engineering work associated with these connections is very basic in nature, but yields valuable information as to which connection option(s) show the most promise for inclusion as part of the preferred LRT alternative. This memo documents basic evaluation of the options examined to date with respect to a few critical criteria. This evaluation of LRT connections will be incorporated into the Tier 2 process and integrated with the evaluation of other transition areas (consisting of North-South and East-West connection options).

LRT Connection Options

The LRT connection options were defined using a few key constraints and assumptions:

1. It has been assumed that the existing CP/EV LRT line and its stations would not be relocated as part of any I-10 West connection option.

2. Large downtown buildings (4 stories or taller), or any part of them, will not be altered to accommodate a proposed connection.

3. This analysis assumes that direct connections to both North Central Phoenix and Tempe/Mesa are a primary goal of any I-10 West connection option. This would limit transfers for patrons not

destined for Downtown. However, options that involve a hard transfer to Northbound CP/EV alignment have also been analyzed.

Finally, in light of these assumptions, out-of-direction travel and the use of additional streets to make connections are considered necessary and definition parts of these connection options.

The connection options that were defined are considered compatible with at least one of the following east-west (E-W) LRT alignment alternatives:

- Van Buren Street
- Adams Street 2 Track
- Adams/Monroe Couplet
- Washington/Jefferson Couplet
    - Using 1st Street to Connect to CP/EV LRT Starter Line
    - Using Central/1st Ave to Connect to CP/EV LRT Starter Line
    - Forced Transfer to CP/EV Northbound LRT Starter Line
    - Forced Transfer to CP/EV Northbound LRT Starter Line (with 1st Street turnaround)
- Jefferson Street 2-Track

The downtown LRT connection options considered are presented in Table 1, with a description of whether the connection can be made directly to/from the primary E-W street or additional streets would be required.

Other combinations of Connection Options with east-west alternatives could be possible (such as Jefferson Street using 6th, 4th, or 3rd Avenue to go north to Adams to make the connection), but they have not been evaluated at this time.

Graphics for the alternatives being evaluated are shown in Appendix A. The types of connection options are also shown in the graphics attached. Connection option 'C' uses Adams/Monroe couplet to connect to the CP/EV starter LRT line. Adams Street connects to the eastbound LRT starter line at 1st Avenue and to the Northbound LRT starter line at Central Avenue. Monroe Street is used to connect from the Northbound LRT starter line using Central Avenue, while 1st Avenue is used to connect from the Southbound LRT line going west on Monroe Street. Connection 'C" is used for the Van Buren Street option as well as the Adams/Monroe option.

Connection option 'A' uses Washington/Jefferson couplet to connect to the LRT Starter line. Eastbound train to Mesa stays on Jefferson and interlines with the Starter line whereas Westbound train from Mesa continues on Washington. To go Northbound, the train connects to the starter line using Central Ave whereas trains coming from North Central turn west on 1st Avenue to Washington Street.

Connection option 'E' uses 1st Street to make the connections to Northbound CP/EV LRT Starter line as well as to turn west from North Central.

Connection option 'B' uses 1st Street to make all eastbound and westbound connections to the CP/EV LRT Starter line.

Table 1. LRT Connection Option Definition

Connection Option	Train Route Path				
	Option Name	I-10 to N. Central	I-10 to Tempe/Mesa	N. Central to I-10	Tempe/Mesa to I-10
Van Buren Street	VB	Via 7th Ave to Monroe to Central	Via 7th Ave to Monroe to 1st Ave	Via Adams to 7th Avenue to Van Buren	Via 1st Street to Adams to 7th Ave to Van Buren
Adams/Monroe Couplet	AM	Via Adams	Via Adams	Via Monroe to 5th Ave to Adams	Via Monroe to 5th Ave to Adams
Washington/Jefferson Couplet	WJeff	Direct	Direct	Direct	Direct
Washington/Jefferson Forced Transfer	WJeffFT	None	Direct	None	Direct
Washington/Jefferson Couplet 1st Street	WJeff1st	Via 1st Street to Washington	Direct	Via Jefferson to 1st Street to Washington	Direct
Washington/Jefferson 1st Street Forced Transfer	WJeff1stFT	None	Direct	None	Direct
Jackson - Adams	JA	Via 10th Ave to Jackson to 1st Street to Washington	Via 10th Ave to Jackson to 1st Street to Jefferson	Via Jefferson to 1st Street to Jackson to 10th Ave to Adams	Via Washington to 1st Street to Jackson to 10th Ave to Adams
Jackson - Jefferson	JJeff	Via 9th Ave to Jackson to 1st Street to Washington	Via 9th Ave to Jackson to 1st Street to Jefferson	Via 1st Street to Jackson to 9th Ave to Jefferson	Via 1st Street to Jackson to 9th Ave to Jefferson
Harrison - Adams	UPA	Via 10th Ave to Harrison (UPRR) to 1st Street to Washington	Via 10th Ave to Harrison (UPRR) to 1st Street to Jefferson	Via Jefferson to 1st Street to Harrison (UPRR) to 10th Ave to Adams	Via Washington to 1st Street to Harrison (UPRR) to 10th Ave to Adams
Harrison - Jefferson	UPJeff	Same as UPMad	Same as UPMad	Via 1st Street to Harrison to 9th Ave to Jefferson	Via 1st Street to Harrison to 9th Ave to Jefferson

VB = Van Buren; WJeff = Washington Jefferson Couplet; Jeff = Jefferson; Adams Monroe Couplet = AM; Jackson Adams = JA; Jackson Jefferson = JJeff; Harrison Adams = UPA; Harrison Jefferson = UPJeff

LRT Connection Evaluation Criteria

The process for evaluating downtown LRT connections subjected the alternatives to the following broad criteria:

– Engineering Issues/Cost

These criteria consider engineering challenges, construction impacts as well as costs associated with the construction of the LRT alternative. Right-of-way impacts and length of trackwork required are used as proxies to costs.

- ROW Impacts. Evaluates the potential number of properties that may be impacted along the alignment.
- Construction Impacts. Looked at the overall impacts on streets such as traffic operations, street delays and closures etc. due to construction and utility relocation.
- Trackwork. The track length in feet required for each alternative. This is intended to serve as a proxy to capital cost differentials between different downtown connection options. To account for the need for standardized units for comparison, single track length was multiplied by a factor of 0.75 and added to the double track length.
- Engineering Constraints. Need for building ramps/bridges or other structures along the LRT alignments.
- Impacts to Parking. Measures the impacts to on-street parking near Downtown Phoenix and State Capitol complex.

– Operations

These set of criteria evaluate the ease of operating the LRT system. Criteria include complexity of operation, directness of travel and impacts to adjacent vehicular traffic

- Complexity. LRT junction required should be reasonably simple to operate. This criteria looked at the number of turns and loops a route had to negotiate to make the connection to both Eastbound CP/EV and Northbound CP/EV LRT.
- Traffic Impacts/ Traffic Lanes Lost. Track connections that use more streets or displace travel lanes have a higher degree of negative impact to traffic.
- Travel Times. Measures the directness of travel to destinations such as Downtown Phoenix and connections to the CP/EV alignment. Alignments involving out-of-direction travel will be assigned a lower rating than those that don't.
- Ability to Short Turn. Evaluates an alignment's ability to short turn. "Short turning" allows a train to cross from one track to the other track (or essentially to turn the trains back to where they came from). This allows for additional flexibility in operational and delay management, particularly during peak hours or special events when the demand on one segment of the route is significantly higher. Alignment options that use the existing 11th Street turnaround to short turn were assigned "-" rating, options using a proposed 1st Street turnaround were assigned "0" rating and options using Central Ave were assigned "+" ratings.

– Destinations Served

The following set of criteria evaluates the alternatives based on its ability to serve major activity centers within the study area as well as in the metropolitan region.

- Connection to/from North. The North Central Phoenix travel pattern has shown slightly higher demand for overall trips to and from I-10. A good connection does not require substantial out of direction travel. Connection options that required passengers to transfer to Northbound CP/EV LRT (or in other words do not interline with the Northbound CP/EV LRT) were assigned the lowest (-) rating, those options that required substantial back-tracking (or out of direction travel) were assigned medium (0) ratings while those that required less back-tracking were assigned positive (+) ratings.

- Serves Downtown. The alternatives were evaluated based on the ability to serve the major employment centers in Downtown Phoenix particularly the City, County and State facilities along Washington and Jefferson east of 7th Ave. Alignment options that use Washington, Jefferson or Adams/Monroe east of 7th Ave to make the connection to CP/EV LRT were assigned highest (+) ratings whereas other alignments (Jackson, Harrison) were assigned medium (0) ratings. No alignment option was given low rating since all of them serve Downtown Phoenix to some extent.

- Serves State Capitol. The alternatives were evaluated based on the ability to serve the major concentrations of employment within the State Capitol complex. Alignment options that used Washington, Jefferson or Adams as the east-west alignment were assigned "+" ratings whereas other east-west options (Madison, Van Buren) were assigned "0" or "-" depending on the distance from the State Capitol complex.

– Future Connections

This set of criteria evaluates the alternatives' ability to connect to other possible future corridors or destinations e.g. South Central Phoenix, Commuter Rail connection through Union Station etc.

- Connection to South Central. Alternatives that allow for LRT extensions going to South Phoenix.

- Connection to Commuter Rail. Alternatives that allow for connections to the Historic Union Station were rated higher than those away from the station.

– Other Issues

Issues such as impacts to view corridors along Washington were considered here.

- Impacts to View Corridors. Alternatives that used Washington were seen to have the greatest impact on view corridors and were thus assigned poor (-) ratings, those along Jefferson (closer to Washington) were assigned medium (0) ratings and alternatives on other streets (Van Buren, Adams, Jackson and Madison) were assigned good (+) ratings.

Each downtown LRT connection option was evaluated and assigned a qualitative performance rating of Good (+), Fair (0), or Poor (-), as shown in Table 2. Criteria were not weighted.

Table 2. Evaluation of Downtown Connection Options

Criteria	VB	AM	WJeff	WJeffFT	WJeff1st	WJeff1stFT	JA	JJeff	UPA	UPJeff
Engineering Issues/Cost										
ROW Impacts	-	+	+	+	+	+	0	-	-	-
Construction Impacts	-	-	-	-	-	-	-	-	-	-
Trackwork	+	+	0	0	0	0	0	0	-	-
Engineering Constraints	0	0	0	0	0	0	-	-	-	-
Impacts to Parking	-	0	0	-	0	-	-	-	-	-
Operations										
Complexity	+	+	+	-	+	-	0	0	0	0
Traffic Impacts/Traffic Lanes Lost	-	+	-	-	-	-	+	0	+	0
Travel Times	0	+	+	-	+	-	0	0	0	0
Ability to "Short Turn"	+	+	+	-	+	0	0	0	0	0
Destinations Served										
Connections To/From North	+	+	+	-	+	0	+	+	+	+
Serve Downtown	+	+	+	+	+	+	0	0	0	0
Serve State Capitol	-	+	+	+	+	+	+	+	+	+
Future Connections										
Connection to South Central	0	0	+	0	+	0	0	0	-	-
Connection to Commuter Rail	-	-	-	0	-	0	+	0	+	+
Other Issues										
Impacts to View Corridors	+	+	-	-	-	-	+	0	+	0
OVERALL RATING	0	+	+	-	+	-	+	0	0	-

Findings and Conclusion

Overall, Adams/Monroe couplet (AM) outperformed all other alternatives, particularly in terms of ease of operation and destinations served. Other top performers that are recommended for further evaluation are: Washington/Jefferson alternative with both the 1st street turnaround option (WJeff1st) as well as Central Ave connection (WJeff) and Jackson/Adams (JA). The eventual choice of a connection option could depend to some degree on the choice of an overall east-west LRT alternative alignment downtown.

Alternatives that have been recommended for elimination are:

- Washington/Jefferson couplet (with forced transfer required to go North Central and 11th street turnaround) (WJeffFT)
- Washington/Jefferson couplet (with forced transfer required to go North Central and 1st street turnaround) (WJeff1stFT)
- Van Buren Street with Adams/Monroe connection (VB)
- Harrison - Jefferson connection (UPJeff)
- Harrison – Adams connection (UPA)

Jefferson – Jackson alternative was assigned medium overall rating, however; it is recommended to be carried forward due to a high rating assigned to Jefferson Street as an East-West alternative.

APPENDIX A – Downtown LRT Connection Option Graphics

Figure A1. Van Buren Street (VB)

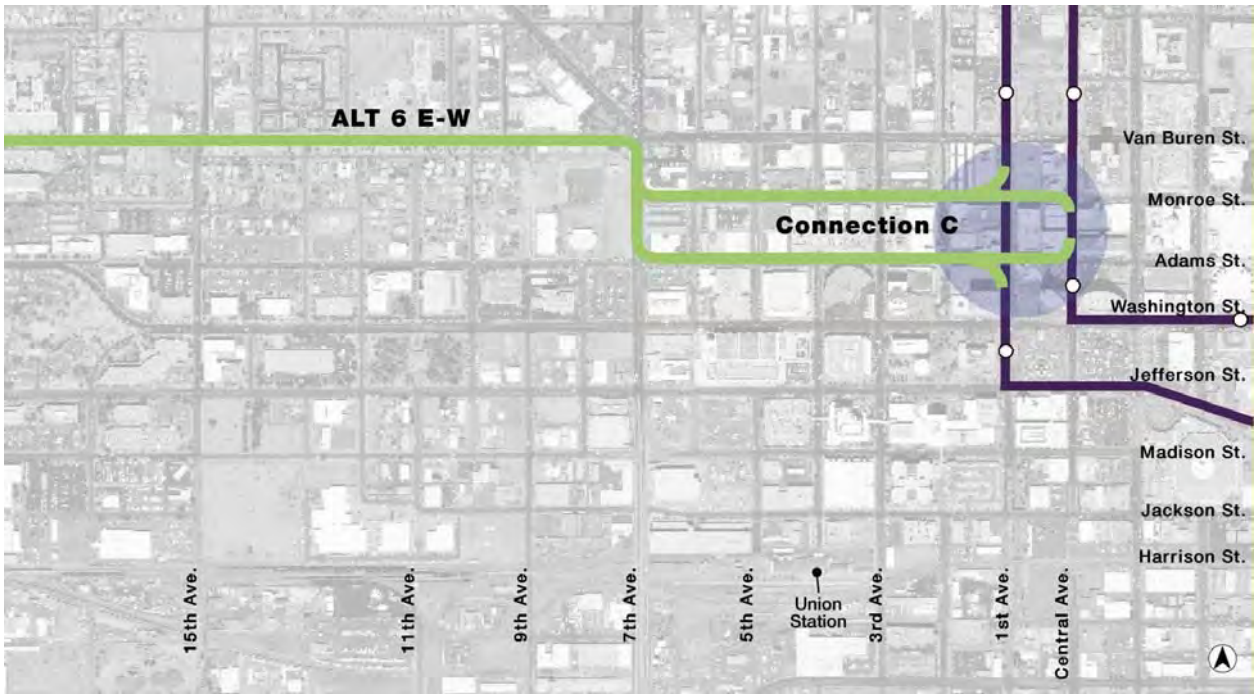


Figure A2. Adams/Monroe Couplet (AM)

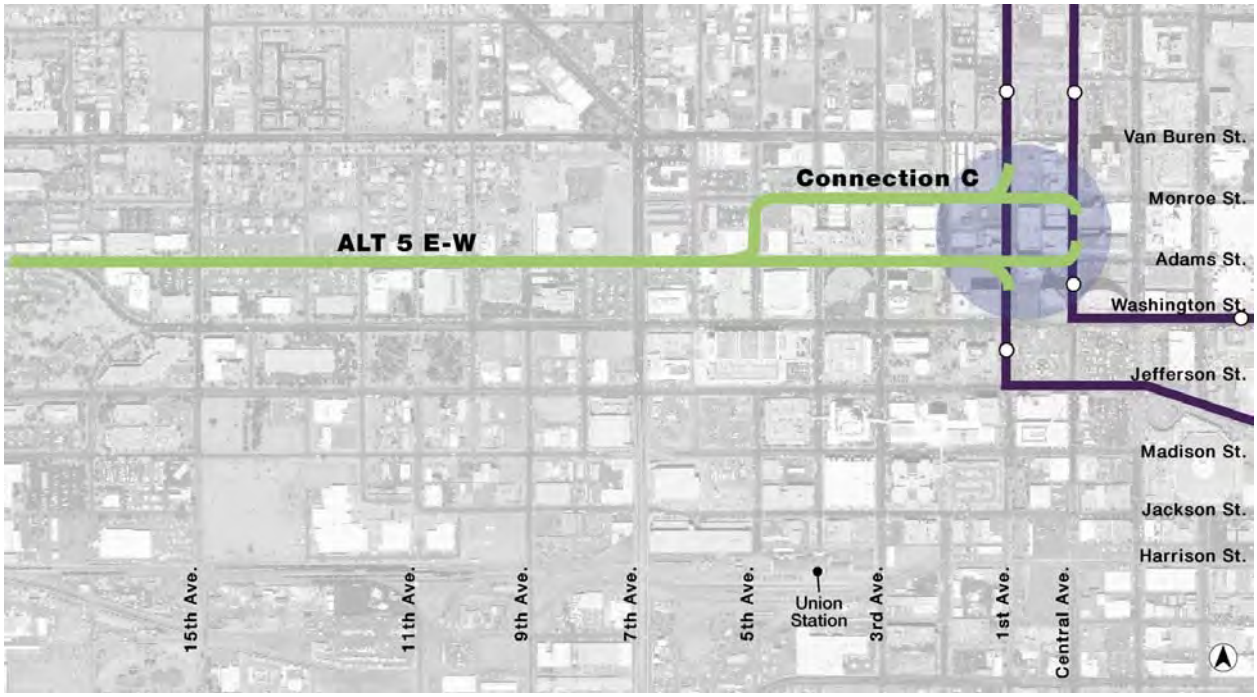


Figure A3. Washington/Jefferson Couplet (WJeff) – Washington/Jefferson Couplet 1st Street (WJeff1st) – Washington/Jefferson Forced Transfer (WJeffFT) – Washington/Jefferson 1st Street Forced Transfer (WJeff1stFT)

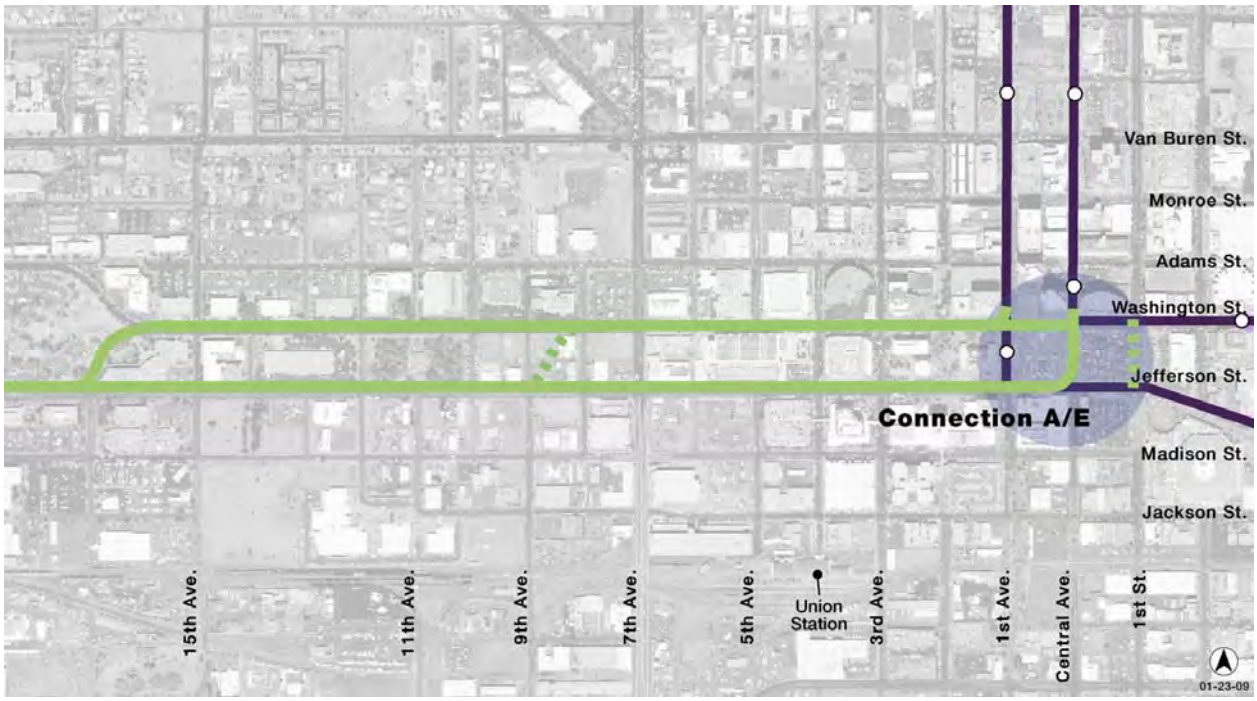


Figure A5. Jackson/Adams (JA) – Crossover A
UPRR/Adams (UPA) – Crossover B

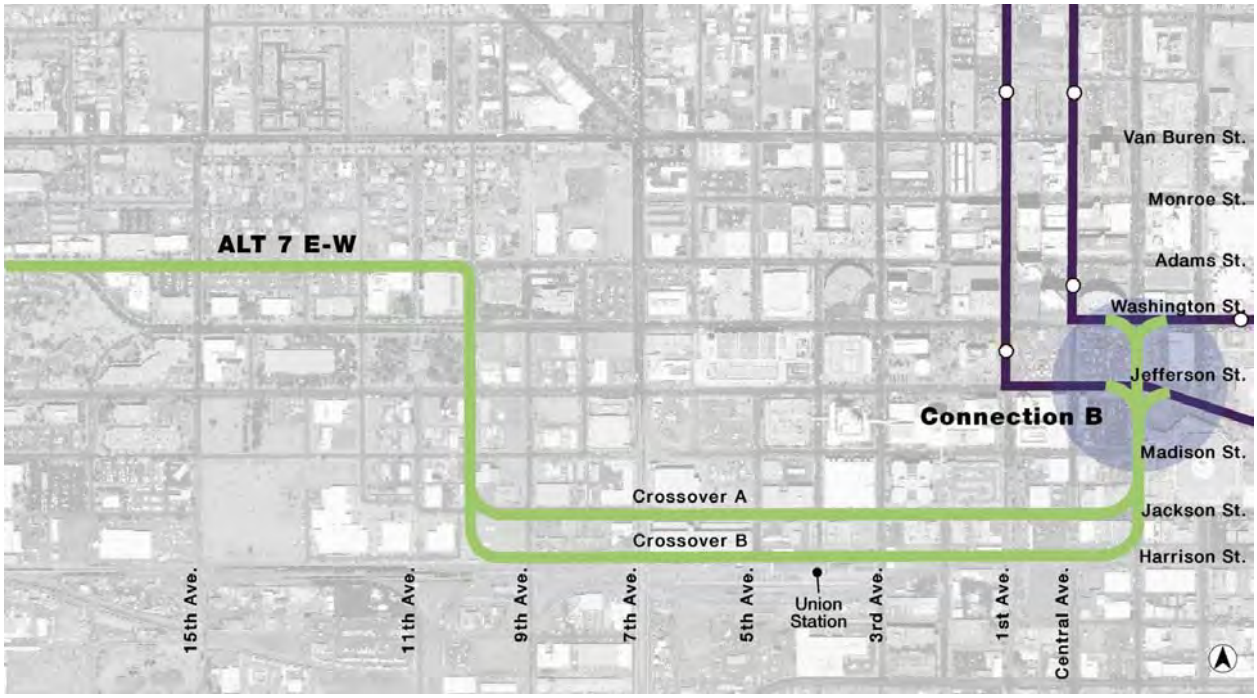


Figure A6. Jackson/Jefferson (JJeff) – Crossover A
UPRR/Jefferson (UPJeff) – Crossover B

Appendix E
Tier 2 Alternatives Analysis – Energy and Air Quality Technical Memorandum

DRAFT

MEMO

To: Kammy Horne, URS

From: Cari Anderson, CAC

Date: February 2, 2009

Re: I-10 West High Capacity Transit Study

Tier 2 Alternatives Analysis – Energy and Air Quality

A qualitative energy and air quality analysis has been conducted for the various alternatives being evaluated as part of Tier 2 of the high capacity transit study. A more detailed energy and air quality analysis of alternatives will be completed as part of the environmental documentation required pursuant to the National Environmental Policy Act (NEPA) once the locally preferred alternative(s) is identified.

For the I-10 West High Capacity Transit Study, METRO is considering two separate high capacity transit modes for the I-10 West Corridor. These options include expanding BRT service in high occupancy vehicle (HOV) lanes shared with buses, carpoolers, vanpoolers, and permitted fuel-efficient vehicles or creating a separate guideway that would be exclusively reserved for either BRT or LRT service.

The number of vehicle miles traveled (VMT) is often used to estimate fuel consumption and/or motor vehicle emissions resulting from a transportation project. The Maricopa Association of Governments (MAG) travel demand model is used to predict VMT in this region. The mode choice component of the model is currently being updated, which may impact transit estimates. Therefore, the VMT estimates, as well as other pertinent travel demand data, such as level-of-service and speed estimates, will be reported in the upcoming NEPA environmental document for the locally preferred alternative(s) and any other alternatives that may be considered in that document.

To provide some context of the contribution of the high capacity transit project improvement on regional daily VMT, total VMT in analysis year 2030 is projected to be approximately 206 million. Regional transit typically provides less than 0.1 percent of total VMT. Preliminary results indicate very small differences in regional VMT for the proposed build alternatives, perhaps in the range of only 1,000 and 5,000 daily VMT, which is much less than the 0.1 percent of the total transit VMT in the region.

<u>Qualitative Energy Analysis</u>

The number of VMT is directly related to energy use and is the main contributor to air quality pollutants in the Maricopa County region. VMT are also important in determining the demand for infrastructure improvements.

The methodology that will be used for the NEPA document to assess energy consumption impacts of the preferred alternatives will be based on the Federal Transit Administration (FTA) report entitled *Reporting Instructions for the Section 5309 New Starts Criteria* published in May 2006 or the most recent update available at the time of the study. Direct energy consumption involves energy used by operation of vehicles (automobile, truck, bus, or train) within the region. The methodology considers the VMT traveled as well as energy consumption factors specific to each mode of travel.

In general, the annual regional VMT for passenger vehicles and trucks in the No-Build scenario is anticipated to be slightly higher than for the Build Alternatives resulting in higher energy usage for these modes in the No-Build Alternative, and this will be confirmed in the detailed NEPA studies. Note that any of the high capacity transit alternatives, in coordination with other regional public transportation improvements, would help to reduce dependency on single-occupant vehicles. Buses, light rail vehicles, and modern streetcars can all carry many more people per vehicle than automobiles with the rail modes having the highest capacities per vehicle. All of the high capacity transit alternatives serve major activity centers within the study area, and because all can connect with the LRT starter line, they also serve major activity centers within the region. This high level of connectivity has the potential to make any of the transit alternatives a desirable alternative compared to traveling by auto. All of these factors, in turn, point to anticipated reductions in fossil fuel energy consumption as well as improvements to roadway congestion.

Qualitative Air Quality Analysis

All of the high capacity transit alternatives being considered are located in Maricopa County; portions of which are designated nonattainment for 8-hour ozone, PM-10 and maintenance for carbon monoxide (CO).

The Clean Air Act requires that Federal agencies and Metropolitan Planning Organizations (MPOs) not approve any transportation project, program, or plan which does not conform to the approved State Implementation Plan. The Federal Transportation Conformity Rule requires that Federal Highway Administration (FHWA) and FTA projects must be found to conform before they are adopted, accepted, approved, or funded. The rule requires both a regional and project-level hot-spot analysis. The criteria states that FHWA and FTA projects must not cause or contribute to any new localized CO and/or PM-10 violations or increase the frequency or severity of any existing CO and/or PM-10 violations in nonattainment and maintenance areas.

Regional Analysis: The Maricopa Association of Governments is the designated MPO in Maricopa County, Arizona, and is responsible for regional transportation and air quality planning. In July 2007, MAG adopted the 2007 MAG Conformity Analysis for the FY 2008-2012 MAG Transportation Improvement Program (TIP) and the MAG Regional Transportation Plan - 2007 Update (RTP).

The analysis demonstrates that the criteria specified in the federal transportation conformity rule for a conformity determination are satisfied by the TIP and RTP. A finding of conformity for the TIP and RTP is therefore supported. It is important to note that the Tempe South, I-10 West, and Central Mesa high capacity transit studies are included in the TIP/RTP and conformity analysis.

The MAG regional emissions analysis was conducted for the horizon year 2028 for CO, eight-hour ozone, and PM-10. The conformity demonstration complies with the Federal Transportation Rule and indicates that the TIP/RTP will not (i) cause or contribute to any new violation of any standard in any area; (ii) increase the frequency or severity of any existing violation of any standard in any area; or (iii) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area. The TIP/RTP and conformity analysis was approved by the MAG Regional Council in July 2007. Federal approval by the FHWA and FTA was issued August 2007.

Project-level Analysis: It is important to note that the project-level requirements will be addressed as part of the NEPA environmental documentation once a locally preferred alternative(s) is identified. The alternatives to be studied in the NEPA document will be screened for both CO and PM-10; there are no requirements for addressing localized ozone concentrations and the Maricopa County area is in attainment for PM2.5. The hot-spot analysis will comply with the Federal Transportation Rule and must confirm that the locally preferred alternative(s) will not (i) cause or contribute to any new violation of any

standard in any area; (ii) increase the frequency or severity of any existing violation of any standard in any area; or (iii) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

On January 5, 2005, EPA redesignated the Phoenix metropolitan area to attainment for CO, as well as approved the attainment demonstration and maintenance plan showing maintenance of the CO standard through 2015. The Phoenix metropolitan area has not had an exceedance of the CO standard since 1996 and has been reporting clean monitoring data for over ten years. In addition, it is important to note that the Federally approved Final Environmental Impact Statement for the LRT Starter Line[1] included a CO project-level analysis which demonstrated that there would be no location where emissions would approach or exceed the Federal and State air quality standards for CO. Although this does not definitively indicate that no adverse impacts will occur as a result of this high capacity transit project, it does indicate that the likelihood for such impacts is low.

Again, the annual VMT for passenger vehicles and trucks in the No-Build scenario are anticipated to be slightly higher than for the Build Alternatives likely resulting in higher motor vehicle emissions for these modes in the No-Build Alternative. For similar reasons discussed in the energy analysis section, the Build Alternatives, in coordination with other regional public transportation improvements, would help to reduce dependency on single-occupant vehicles. This would in turn reduce motor vehicle emissions and improve roadway congestion.

Conclusion

A qualitative energy and air quality analysis has been conducted for the various alternatives being evaluated as part of Tier 2 of the alternatives analysis. A more detailed energy and air quality analysis will be completed as part of the NEPA environmental documentation once a locally preferred alternative(s) is identified..

In general, the annual VMT for automobiles and trucks in the No-Build scenario are anticipated to be slightly higher than for the Build Alternatives likely resulting in higher energy usage and motor vehicle emissions for these modes in the No-Build Alternative. This will be confirmed in the studies to be conducted for the alternatives considered in the NEPA document.

Note that any of the high capacity transit alternatives, in coordination with other regional public transportation improvements, would help to reduce dependency on single-occupant vehicles. Buses, light rail vehicles, and modern streetcars can all carry many more people per vehicle than automobiles with the rail modes having the highest capacities per vehicle. All of the high capacity transit alternatives serve major activity centers within the study area, and because all can connect with the LRT starter line, they also serve major activity centers within the region. This high level of connectivity has the potential to make any of the transit alternatives a desirable alternative to traveling by auto. All of these factors, in turn, point to anticipated reductions in motor vehicle emissions, fossil fuel energy consumption as well as improvements to roadway congestion associated with the high capacity transit alternatives.

[1] *Central Phoenix/East Valley Light Rail Transit Project, Final Environmental Impact Statement and Section 4(f) Evaluation*, Valley Metro/Regional Public Transportation Authority, November 2002.

Appendix F
Tier 2 Cultural Resources Evaluation

DRAFT

MEMO

To: Kammy Horne

From: Robert Forrest

Date: May 5, 2009

Re: **I-10 West ALTERNATIVES ANALYSIS**
Tier 2 Analysis of Downtown Phoenix Alternative Alignments — Cultural Resources Rating Justification

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INTRODUCTION

The purpose of this memorandum is to compare the Tier 2 downtown north-south and east-west alignment alternatives (Table 1) with respect to potentially adverse effects on significant archaeological, historical, and traditional cultural resources. The analysis used information compiled during prior records and literature review conducted for the *Draft I-10 West High-Capacity Transit Corridor Study: Tier 1 Cultural Resources Evaluation* (METRO 2008).

Table 1. Tier 2 Downtown Alignment Alternatives

East-West Alignments	North-South Alignments
Van Buren Street	I-17 Corridor
Adams Street	19th Avenue
Washington/Jefferson Couplet	Grand Avenue/15th Avenue
Jefferson Street	

This analysis evaluated potential impacts to historic districts, buildings (including single-family houses), and structures using preliminary conceptual light rail design plans for each alignment alternative. The I-17 Corridor alignment alternative (northbound frontage road) and 19th Avenue alignment alternative were evaluated from I-10 to Jefferson Street. The Grand Avenue/15th Avenue alignment alternative was evaluated from just north of I-10 to Jefferson Street. The Van Buren Street alignment was evaluated from the I-17 Corridor to 7th Avenue. The Adams, Washington/Jefferson Couplet, and Jefferson Street alignments were evaluated from the I-17 Corridor east to the CP/EV starter line.

The preliminary design plans were reviewed to identify potential curb set backs, new right-of-way requirements, and potential property acquisitions that could directly affect historic districts, buildings, and structures identified in the *Tier 1 Cultural Resources Evaluation* as listed in or previously determined eligible for listing in the National Register of Historic Places (NRHP) or Phoenix Historic Property Register. This analysis also examined previously unrecorded historic-age buildings and structures preliminarily evaluated by the Tier 1 analysis as potentially eligible. The State Historic Preservation Office (SHPO) has also identified historically significant streetscapes along Washington Street and Jefferson Street that are also considered in this memorandum.

Historic Districts and Properties

The Tier 2 analysis identified 2 National Register and Phoenix Register listed districts, 11 National Register and Phoenix Register individually listed properties, 3 National Register individually listed properties, 4 Phoenix Register individually listed properties, and 12 National Register eligible properties located within the area of potential effects (defined as the existing rights-of-way of alignment alternatives and adjacent parcels) of the north-south and east-west alignment alternatives. In addition, 78 historic-age buildings and 1 historic district that the Tier 1 analysis preliminarily evaluated as eligible are also located within the area of potential effects (Table 2). Completion of formal evaluations might conclude that some of those historic-age resources are not eligible.

Table 2. Number of Historic Resources within the Area of Potential Effect

Alignment Alternative	Number of Adjacent Historic Resources	Number of Potentially Affected Historic Resources
North-South Alignments		
Grand Ave./15th Ave.	2 National Register and Phoenix Listed Districts 1 National Register and Phoenix Listed Property 1 National Register Eligible Properties 2 Contributing Properties within Listed Districts 5 Potential National Register Eligible Properties	2 National Register and Phoenix Listed Districts 1 National Register and Phoenix Listed Property 4 Potential National Register Eligible Properties
19th Ave.	1 National Register and Phoenix Listed District 1 National Register Eligible Property 1 Potential National Register Eligible Properties	1 National Register and Phoenix Listed District
I-17 Corridor	1 National Register and Phoenix Listed Property 1 National Register Eligible Property 1 Phoenix Listed Property 7 Potential National Register Eligible Properties	1 Phoenix Listed Property
East-West Alignments		
Van Buren St. (to 7th Ave.)	2 National Register and Phoenix Listed Districts 1 National Register Listed Property 1 Phoenix Listed Property 4 National Register Eligible Properties 10 Potential National Register Eligible Properties	1 National Register Listed Property 3 National Register Eligible Properties 5 Potential National Register Eligible Properties
Adams St.	4 National Register and Phoenix Listed Properties 2 National Register Listed Properties 2 Phoenix Register Listed Properties 3 National Register Eligible Properties 17 Potential National Register Eligible Properties	4 National Register and Phoenix Listed Properties 2 National Register Listed Properties 2 Phoenix Register Listed Properties 3 National Register Eligible Properties 17 Potential National Register Eligible Properties
Washington /Jefferson St.	6 National Register and Phoenix Listed Properties 1 National Register Listed Property 1 Phoenix Register Listed Property 3 National Register Eligible Properties 38 Potential National Register Eligible Properties	2 National Register and Phoenix Listed Properties 1 National Register Listed Property 1 Phoenix Register Listed Property 3 National Register Eligible Properties 38 Potential National Register Eligible Properties
Jefferson St.	3 National Register and Phoenix Listed Properties 1 National Register Listed Property 1 Phoenix Register Listed Property 3 National Register Eligible Properties 38 Potential National Register Eligible Properties	1 National Register and Phoenix Listed Properties 1 National Register Listed Property 1 Phoenix Register Listed Property 3 National Register Eligible Properties 38 Potential National Register Eligible Properties

Source (URS 2008)

The performance of each Tier 2 alternative was rated as high, moderate, or low based on the types and extent of potential impacts on (1) historic districts, buildings, and structures listed in or determined to be eligible for the National Register, (2) historic districts, buildings, and structures preliminarily evaluated as eligible for the National Register, and (3) archaeological resources.

Each of the alignment alternatives was rated as follows:
+ = High performance: alignment alternative has little or no potential for adverse effects.

O = Moderate performance: alignment alternative has some potential for adverse effects from visual impacts due to grade separation structure over the BSNF and 19th Avenue, but there also is potential to avoid or satisfactorily mitigate those impacts through sensitive design, and they may not be considered Section 4(f) constructive uses.

-- = Low performance: alternative is likely to result in a total property acquisition that almost certainly would result in adverse effects and Section 4(f) uses.

Potential "adverse effect" would occur on listed or previously determined eligible properties if either of the following occurs:

- Acquisition and alteration or demolition of property; and/or
- Changes to the setting resulting from acquisition of right-of-way and resulting street modifications and construction of facilities

Curb setbacks that would occur within existing rights-of-way, adjacent to historic houses, were evaluated as **unlikely** to result in adverse effects.

Listed and/or Eligible Historic Properties

The Adams Street, Washington/Jefferson Street and Jefferson Street alignment alternatives all received a **moderate** performance rating because a grade separation overpass necessary to accommodate the Burlington Northern Santa Fe (BNSF) railroad tracks has the potential to have adverse visual effects to two Phoenix Register listed, one National Register listed, and two National Register Eligible properties (Table 3). However, if the grade separation is an underpass to accommodate the BNSF it is likely that there would no visual effects to these listed or eligible properties. The GrandAvenue/15th Avenue, 19th Avenue, I-17 Corridor, and Van Buren Street alignment alternatives received a **low** performance rating because of the potential adverse affects to Section 4(f) properties stemming from right-of-way acquisitions of listed historic districts and eligible properties. No alignment alternative received a **high** performance rating

Potentially Eligible Historic Properties

The performance of each of the alignment alternatives also were rated with respect to potential adverse effects on potentially eligible historic properties. Detailed evaluation/assessment of these properties, to be conducted during the next phase of the Alternatives Analysis process, may conclude that some of these properties are ineligible for the NRHP.

The Grand Avenue/15th Avenue, I-17 Corridor, and 19th Avenue alignment alternative received a **high** performance rating because there is no potential for adverse affects on potentially eligible properties. The Washington/Jefferson and Jefferson Street alignment alternatives received a **moderate** performance rating because a grade separation overpass necessary to accommodate the BNSF railroad tracks has the potential to have adverse visual effects to three potentially eligible properties. However, if the grade separation is an underpass to accommodate the BNSF it is likely that there would no visual effects to the three potentially

eligible properties. The Van Buren Street, and Adams Street alignment alternatives received a **low** performance rating because they could result in adverse effects that would be considered Section 4(f) uses stemming from the acquisition of new right-of-way and potentially eligible properties. A detailed evaluation will need to be conducted to confirm if these properties are eligible historic properties.

Archaeological Resources

This criterion does not substantially differentiate one alignment alternative from another. Rating the performance of the alternatives with respect to archaeological resources is hampered by the unknown condition of the buried archaeological resources. Because of the ambiguity of the information, all are rated as having a moderate performance. Note that there is potential to mitigate adverse impacts on any archaeological resources through data recovery studies. Because the archaeological resources would be significant for their information potential, impacts on those resources may not be Section 4(f) uses.

Downtown Streetscapes

The streetscapes of Jefferson Street and Washington Street are considered to have historic value, and construction effects outside the existing curbs are a major concern. The streetscape along Washington Street is particularly sensitive because it was Phoenix's original main street and provides a view corridor to the front of the State Capitol Building from the east. Regardless of which alternatives are retained for further consideration, impacts on streetscapes would need to be considered in more detail.

Table 3. I-10 West Tier 2 Downtown Alignment Alternative Cultural Resources Evaluation Matrix

Alignment Alternative	Rating/ Summary of Findings	Potential Impacts on Historical Properties Listed in or Eligible for the National Register or Phoenix Register[1]	Potential Impacts on Historical Properties Preliminarily Evaluated as Potentially Eligible for the National Register [1]	Potential Impacts on Archaeological Sites [2]
North-South Alignments				
Grand Avenue/15th Avenue	Rating:	-	+	0
	Summary:	Potential adverse impacts from right-of-way acquisition resulting from curb modifications on: El Zaribah Shrine Auditorium Oakland District	No potential adverse impacts are expected on potentially eligible properties.	Alignment crosses two Hohokam canal that could be disturbed by construction activity.
19th Avenue	Rating:	-	+	0
	Summary:	Potential adverse impacts from right-of-way acquisition on: Oakland District	No potential adverse impacts are expected on potentially eligible properties.	Alignment crosses two Hohokam canals that could be disturbed by construction activity
I-17 Corridor	Rating:	-	+	0
	Summary:	Potential adverse impacts from acquisition of: Norton (W. R.) House	No potential adverse impacts are expected on potentially eligible properties.	Alignment crosses the Las Colinas site and four Hohokam canals. LRT guideways would be built in the street. Excavations for the guideways and utility relocations could extend beneath prior disturbance and have potential for adverse effects.
East-West Alignments				
Van Buren Street to 7th Avenue	Rating:	-	-	0
	Summary:	Potential adverse impacts through acquisition of: Las Casitas Villas	Potential adverse impacts to one property through acquisition: Valley Feed and Seed	Alignment crosses three Hohokam canals that be could disturbed By construction activity.
Adams Street	Rating:	0	-	0
	Summary:	Potential visual impacts from grade separation at 19th Avenue to: Arizona State Capitol Pinney House Grier House Ingalls/Johnson House McCord House residence at 1919 W. Adams Street	Potential adverse impacts from acquisition of four residential properties, acquisition of new right-of-way on two properties, and potential visual impacts to three properties.	Alignment crosses three Hohokam canals that could be disturbed by construction activity.

Alignment Alternative	Rating/ Summary of Findings	Potential Impacts on Historical Properties Listed in or Eligible for the National Register or Phoenix Register[1]	Potential Impacts on Historical Properties Preliminarily Evaluated as Potentially Eligible for the National Register [1]	Potential Impacts on Archaeological Sites [2]
Washington/Jefferson Street [3]	Rating:	0	0	0
	Summary:	Potential visual impacts to the Arizona State Capitol from grade separation at 19th Avenue.	Potential visual impacts to three properties from grade separation at 19th Avenue.	Alignment might cross the margin of the La Villa site and four Hohokam canals. LRT guideways would be built in the street. Excavations for the guideways and utility relocations could extend beneath prior disturbance and have potential for adverse effects.
Jefferson Street [3]	Rating:	0	0	0
	Summary:	Potential visual impacts to Arizona State Capitol from grade separation at 19th Avenue.	Potential visual impacts to three properties from grade separation at 19th Avenue.	Alignment might cross the margin of the La Villa site and four Hohokam canals. LRT guideways would be built in the street. Excavations for the guideways and utility relocations could extend beneath prior disturbance and have potential for adverse effects.

[1] Historical Buildings and Structures Ratings
High = Alternative has little or no potential for adverse effects.
Moderate = Alignment alternative has some potential for adverse effects from visual impacts due to grade separation structure over the BSNF and 19th Avenue, but there also is potential to avoid or satisfactorily mitigate those impacts through sensitive design, and they may not be considered Section 4(f) constructive uses.
Low = Alternative is likely to result in a total property acquisition that almost certainly would result in adverse effects and Section 4(f) uses.

[2] Archaeological Ratings
High = There are no Hohokam village sites recorded on or adjacent to the alignment, or if such sites are recorded along the alignment, the project probably would not require deep excavation that would disturb those resources.
Moderate = There are Hohokam village sites recorded on or adjacent to the alignment, but the alternative probably would not involve construction disturbance within those sites or construction disturbance within the sites would be limited.
Low = There are Hohokam village sites recorded on or adjacent to the alignment, and extensive construction disturbance would to be required within those sites.

[3] The streetscapes of Washington Street and Jefferson Street also have historic values that could be adversely affected by any curb modifications, and the view corridor of the capitol building along Washington Street could be adversely affected by the light rail catenary.

Appendix G
Tier 2 Downtown: Van Buren LRT Alternative – Design and Operation Considerations Technical Memorandum

DRAFT

Technical Memorandum

To: I-10 West Project Team

From: Abhishek Dayal

Date: 28 April 2009

Re: Tier 2 Downtown: Van Buren LRT Alternative – Design and Operation Considerations

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The Van Buren Street Assessment study area extends from Central Ave to I-17. An initial screening showed that light rail transit (LRT) technology is more sensitive to the constraints along this corridor. It is the only technology addressed in this assessment.

The assessment has concluded that the Van Buren Street alignment presents many constraints for high capacity transit including access impacts to businesses and schools, right-of-way costs, tie-in to METRO Starter Line, potential decreased traffic capacity of through movements and cross street traffic impacts. Specifics of these impacts include:

A. Adding LRT tracks will reduce Van Buren to one lane each direction, which would entail significant traffic capacity impacts.

B. Existing high-rise buildings in the Phoenix Central Business District (CBD) (from 5th Street to 7th Avenue) present lateral constraints for both street widening and pedestrian movement. With an assumed 14-foot desired streetscape and 16-foot street width, 10 high-rise buildings would be affected. The minimum streetscape required to avoid impacts to adjacent high rise buildings (and maintaining the 16-foot street width) would be 11.5 feet. If the streetscape is reduced to the minimum acceptable standard (9-feet) then at most, **ONE** left turn lane can be added in one of the directions only.

C. The Van Buren Street option does not serve the State Capitol and other high employment centers compared to the other East-West alignments considered.

D. Tie-in to the existing METRO Starter Line guideway at Central and 1st Avenue will be difficult and add substantial additional cost and complexity compared to the other alignments.

E. Nearly every Van Buren intersection in the CBD is signalized. If major property impacts are to be minimized, the guideway would result in unacceptable left turn lane drops at each intersection that would adversely impact intersection operations. This would affect 10 signalized intersections within the CBD.

F. With most of the intersections on Van Buren signalized, traffic signal pre-emption may be difficult to provide for LRT and may slow down the trains.

G. The Van Buren Street option would result in the most adverse impacts to listed/eligible historical properties as well as potentially eligible historic properties compared to other East-West Alignment Alternatives.

H. Sensitive land uses including Capitol Elementary School and adjacent residential properties would be susceptible to potential adverse effects on school bus and residential traffic circulation. Direct impacts to adjacent properties would also be required.

I. Existing access to the many small businesses and minor streets along Van Buren Street west of 7th Avenue would be impacted. About 55 to 60 small business/minor street left turn movements would be impacted by the LRT guideway along Van Buren Street.

J. Capacity and signalization issues would result from five-legged intersection at Grand Avenue. None of the other East-West Alignment Alternatives experience this operational constraint.

K. The Van Buren Street Alignment Alternative would result in turning lane impacts at five signalized intersections between 7th Avenue and I-17, impacting traffic in the downtown Phoenix CBD (item E above).

PHOENIX WEST

HIGH CAPACITY TRANSIT STUDY

DRAFT
EVALUATION OF ALTERNATIVES REPORT

July 2010

METRO

EVALUATION OF ALTERNATIVES REPORT

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LIST OF ACRONYMS

AA	Alternatives Analysis
AA/EIS	Alternatives Analysis/Environmental Impact Statement
ADOT	Arizona Department of Transportation
BNSF	Burlington Northern Santa Fe Railway
BRT	Bus Rapid Transit
CBD	Central Business District
CP/EV	Central Phoenix/East Valley
CWG	Community Working Group
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GWG	Government Working Group
HCT	High Capacity Transit
HOV	high-occupancy vehicle
I-10	Interstate 10
I-17	Interstate 17
LOS	level of service
LPA	Locally Preferred Alternative
LRT	Light Rail Transit
MAG	Maricopa Association of Governments
METRO	Valley Metro Rail, Inc.
NEPA	National Environmental Policy Act
NOI	Notice of Intent
ROW	right-of-way
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient, Transportation Equity Act – A Legacy for Users
SHPO	State Historic Preservation Office
TSM	Transportation System Management
UPRR	Union Pacific Railroad

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CHAPTER 1

Introduction

1.0 INTRODUCTION

The Phoenix West Alternatives Analysis/Environmental Impact Statement (AA/EIS) Study (formerly I-10 West AA/EIS Study) is proceeding in accordance with the project development process outlined by the Federal Transit Administration (FTA) for major transit capital investments and in accordance with the rules and regulations specified under the National Environmental Policy Act (NEPA). The Phoenix West AA/EIS is currently in the process of concluding the Alternatives Analysis planning phase, which allowed Valley Metro Rail, Inc. (METRO) to evaluate several alternatives and develop a focused high capacity transit (HCT) recommendation.

The Phoenix West Study Area is defined as an 11-mile HCT extension of the METRO Central Phoenix/East Valley (CP/EV) Light Rail Transit (LRT) Starter Line operating through downtown Phoenix. Figure 1 shows the Phoenix West Study Area as extending west of downtown Phoenix to approximately State Route 101, also known as Loop 101. Thomas Road borders the Study Area to the north and Buckeye Road provides the southern boundary of the study area. The 79th Avenue Park-and-Ride provides the western extent of the Phoenix West HCT transit corridor identified in the Maricopa Association of Governments (MAG) 2007 *Regional Transportation Plan* (RTP).

As shown in Figure 1, for purposes of the AA/EIS Study, the Study Area was divided into two distinct planning areas, the Mainline Section and the Downtown Section. The Mainline Section extends west of I-17, with the Downtown Section covering the Study Area portion east of I-17. Medium- to high-density residential development generally characterizes the area north of Interstate 10 (I-10) in the Mainline Section, while industrial businesses and medium- to high-density residential areas exist south of the freeway.

The Downtown Section refers to the planning area east of Interstate 17 (I-17) and includes several key employment centers and destinations including the State Capitol, city and county government offices, entertainment venues, and historic residential neighborhoods. As Figure 1 shows, METRO evaluated separate North/South and East/West alignment options to connect to the CP/EV LRT Starter Line, listed in the Figure 2 alignment alternative progression flowchart.

During the AA phase, the first step of the overall Project Development Process, METRO evaluated several HCT alternative routes, possible transit modes, and station locations in the Mainline Section using a set of evaluation criteria based on project goals and objectives that were developed with stakeholder and public input. This report provides a summary of the build (or “action”) alternative alignments carried forward for further refinement as documented in the *I-10 West AA/EIS Draft Tier 2 Evaluation Report* (METRO 2009) and provides the recommended LRT and bus rapid transit (BRT) alternatives. METRO held a public meeting in June 2009 to present the alternatives from the *Draft Tier 2 Evaluation Report* (METRO 2009) and has held several meetings with agency and local stakeholders to obtain input on the alternatives presented herein.

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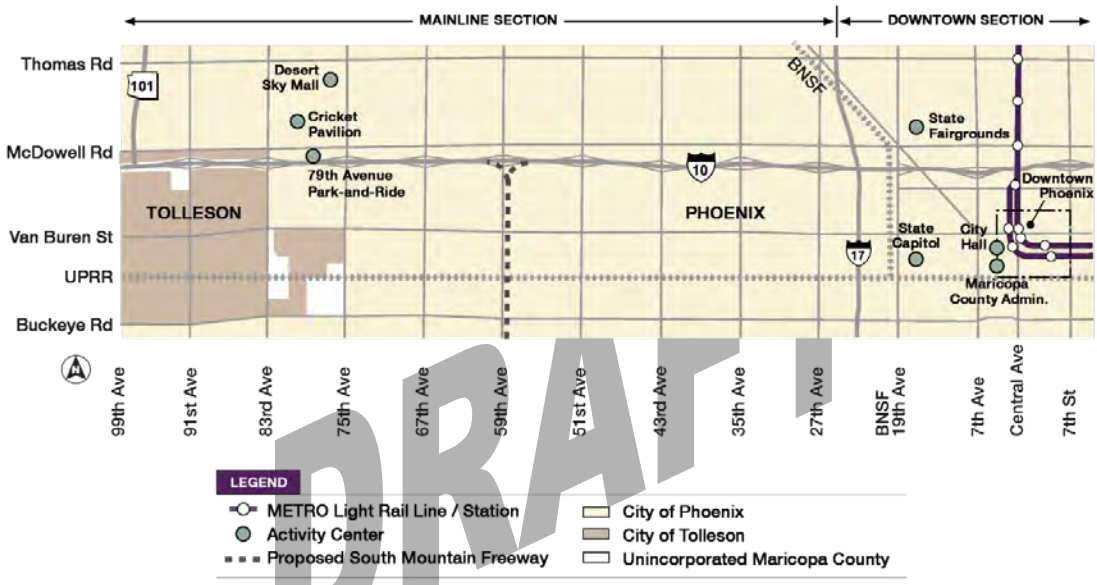
Input provided has been incorporated into the recommended alternatives presented in Section 7.0.

Figure 1 Phoenix West Study Area



Source: Phoenix West AA/EIS Study Team, 2009

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Additionally, this report summarizes the LRT and BRT mode and alignment alternatives for the Phoenix West AA/EIS in Chapters 4 and 5, respectively. An evaluation of those alternatives is included in Chapter 6. Chapter 7 describes the recommendations for the LRT and BRT alignment alternatives. Finally, Chapter 8 describes the next steps, including how the recommended alternatives will be carried forward for further evaluation during the NEPA environmental study process scheduled to begin in fall 2010. Chapter 8 also provides a summary of the thorough public involvement process completed for the Phoenix West Study.

In addition to the LRT and BRT alternatives identified in Chapters 4 and 5, other alternatives under consideration for the Phoenix West AA/EIS Study include the draft Baseline/Transportation System Management (TSM) and the No-Build Alternatives. These alternatives were defined in the *I-10 West AA/EIS Draft Tier 2 Evaluation Report* (May 2009) and will be included in the Final Definition of Alternatives planning phase per the FTA New Starts policy in accordance with the Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU). Therefore, for the purposes of this assessment, these two alternatives were not evaluated. For a complete description of the operational characteristics associated with the Baseline/TSM and No-Build Alternatives, refer to the *I-10 West AA/EIS Draft Tier 2 Evaluation Report* (METRO 2009).

CHAPTER 2

Description of Tier 2 Conceptual Alternatives

2.0 PRE-TIER 1 AND TIER 1 EVALUATION AND SCREENING

The AA process included a “Pre-Tier 1 Screening” phase, which was the planning phase used to determine the broad range of HCT modes and alignments possible within the Study Area based on minimal constraints. The “Universe of Alternatives” examined during the Pre-Tier 1 Screening phase were developed based on an examination of existing physical characteristics associated with the Study Area (e.g., potential connections to the METRO Starter Line, and rights-of-way that could accommodate HCT alignments, etc.), with input from the Phoenix West Study Team, members of the public, stakeholders, and agency representatives. During this Pre-Tier 1 Screening phase, the “problem definition” was defined for the Study Area that identified the transportation deficiencies and constraints that provided the background for developing the Phoenix West AA/EIS Study Purpose and Need.

A key decision that resulted from the Pre-Tier 1 Screening phase was the selection of the I-10 freeway right-of-way (ROW) as the recommended HCT option within the Mainline Section of the Phoenix West Corridor, since the freeway ROW clearly achieved the study goals. In July 2008 the MAG Regional Council endorsed this recommendation west of I-17 within the Phoenix West Study Area.

The full list of Alignment Alternatives considered for all modes for the Phoenix West AA/EIS Study from the Pre-Tier 1 Screening phase to the Tier 2 phase is provided in Figure 2.

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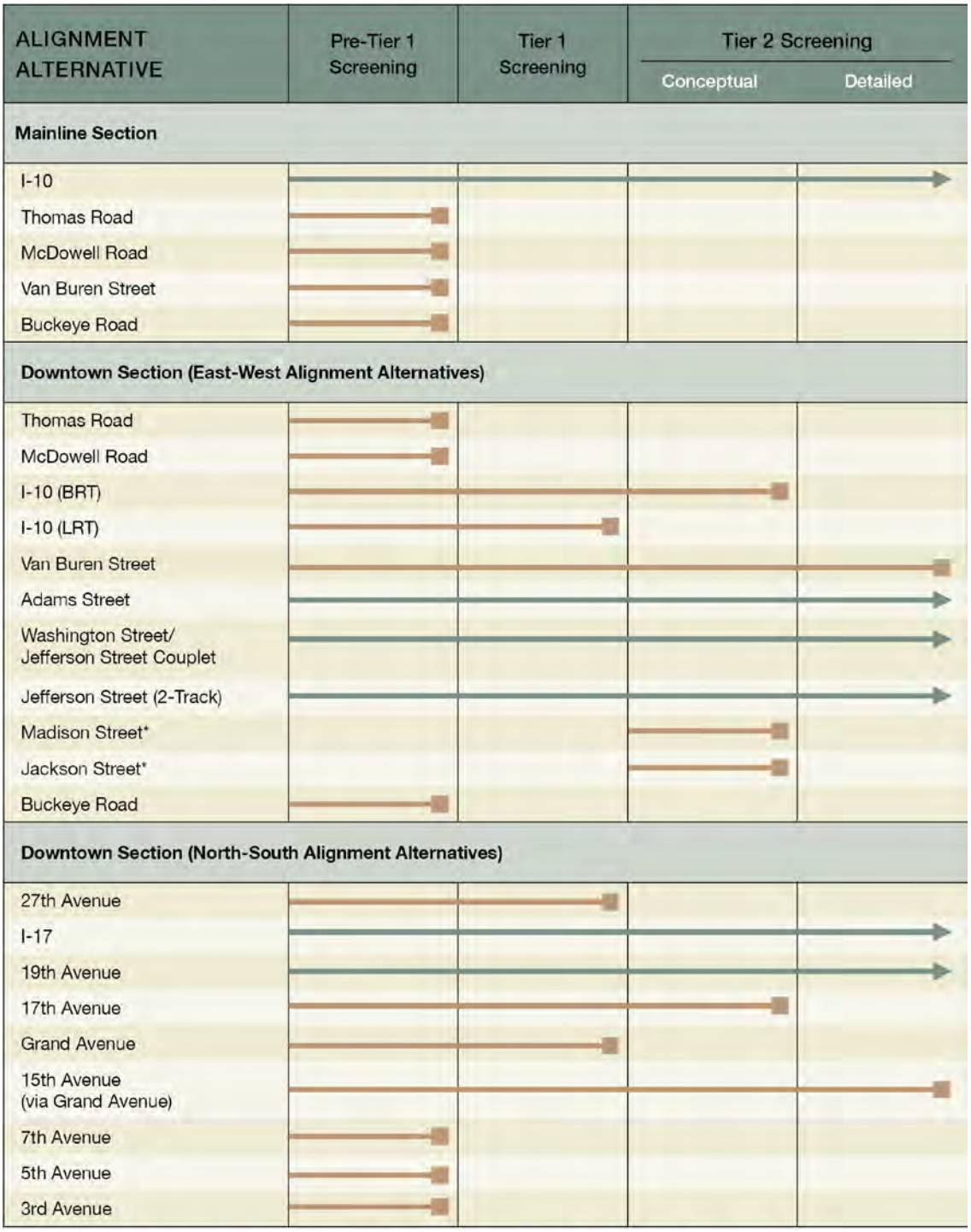
Figure 2 Phoenix West AA/EIS Alignment Alternative Progression



*Subsequent to the completion of Tier 1 Screening, community stakeholders requested that HCT options along Madison and Jackson Streets be analyzed as downtown Phoenix east-west alignments.
Source: Phoenix West AA/EIS Study Team, 2009

CHAPTER 3

Tier 2 Conceptual Alternatives Evaluation

3.0 SUMMARY OF TIER 2 EVALUATION AND SCREENING

The Tier 2 evaluation and screening process resulted in further examination of proposed Mainline Section station locations and the downtown Alignment Alternatives remaining after the Tier 1 evaluation. These Alignment Alternatives and stations identified along the Mainline Section were subject to a qualitative conceptual analysis phase, followed by a more detailed quantitative analysis during the Tier 2 Evaluation and Screening phase, as shown in Figure 2. The design of the recommended HCT alignment and station sites within the I-10 ROW will be on-going as the detailed alternatives are developed for consideration in the EIS. The Alignment Alternatives described in Section 4.0 and Section 5.0 resulted from the Tier 2 Evaluation process.

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CHAPTER 4

Definition and Evaluation of Tier 2 Detailed LRT Alternatives

4.0 DESCRIPTION OF BUILD ALIGNMENT ALTERNATIVES – LRT

4.1 PHOENIX WEST MAINLINE

In July 2008, the MAG Regional Council approved the I-10 ROW as the preferred HCT corridor west of I-17 for the Phoenix West AA/EIS Study. Therefore, the Tier 2 evaluation focused on determining appropriate locations for stations along the I-10 freeway.

As shown in Figure 3, station locations at major streets have been preliminarily identified as the preferred station locations through an extensive public and stakeholder review process and a decision will be made based on further analysis. As station planning along I-10 commenced, the Arizona Department of Transportation (ADOT) expressed some preliminary concerns in terms of safety and operation of a HCT station located at major arterial intersections recommended by the Phoenix West Study Team. METRO plans to work closely with ADOT as the station planning process progresses to account for any concerns or recommendations ADOT offers toward the design and operation of freeway stations.

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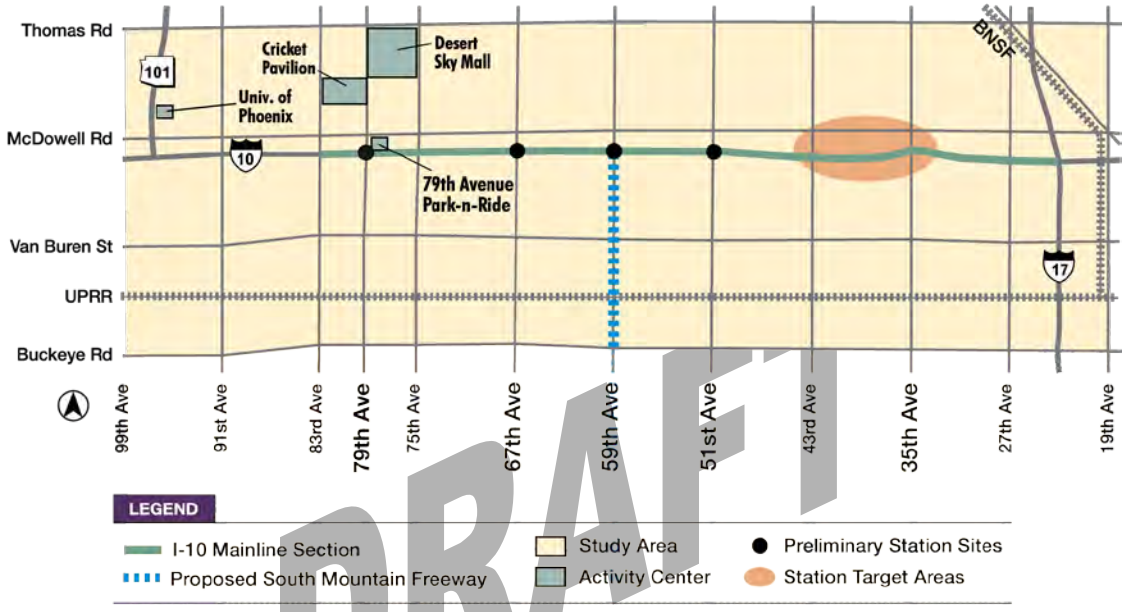
Figure 3 identifies the following potential station areas that have been recommended for further evaluation along the Mainline Section of the Phoenix West Study Area at major arterial intersections:

- Neighborhood Walk-Up Station: 35th **and/or** 43rd Avenue
- Mid-Corridor Park-and-Ride: 51st **and/or** 59th Avenue
- Mid-Corridor Station and/or Park-and-Ride: 67th Avenue
- End of Line Park-and-Ride: 79th Avenue (existing)

Pending the travel forecasting results anticipated for completion in fall 2010, METRO will determine the general locations of stations along the I-10 corridor.

METRO is in coordination with ADOT concerning the proposed construction of the South Mountain Freeway (future Loop 202), as identified in the MAG 2007 RTP. This new freeway would connect directly to I-10 from the south at 59th Avenue. METRO is determining how the proposed station near 59th Avenue should be designed to accommodate construction of the future Loop 202 proposed within the Phoenix West Study Area. METRO is also determining whether this location is suitable as a park-and-ride station site.

Figure 3 Mainline Potential Station Areas Carried Forward for Further Evaluation



Source: Phoenix West AA/EIS Study Team, 2009

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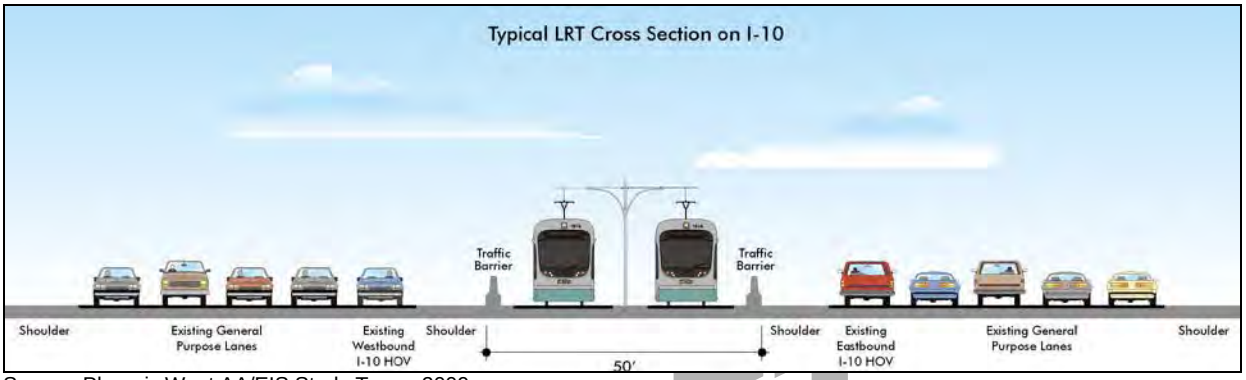
The proposed end-of-line for the Phoenix West Corridor is the existing park-and-ride at 79th Avenue. METRO is considering either building a multi-level parking garage at the existing at-grade park-and-ride site in order to expand capacity or expand the park-and-ride onto an adjacent land. The park-and-ride is currently surrounded by developed parcels including single-family homes west of 79th Avenue and apartment complexes to the north and east. If METRO chooses to expand the park-and-ride beyond the existing site limits, property acquisition would be necessary and existing residential structures would be demolished. The final decision in terms of station and park-and-ride locations will be determined during the Final Definition of Alternatives Planning phase. The recommendations developed during this phase will be incorporated into the Locally Preferred Alternative (LPA), anticipated fall 2010.

Figure 4 shows a conceptual cross-section of the I-10 median if LRT is selected as the transit mode to occupy the 50-foot freeway median.

Figure 4 Conceptual Cross-Section of LRT Operating in the I-10 Freeway Median



Source: Phoenix West AA/EIS Study Team, 2009

4.2 DOWNTOWN: NORTH-SOUTH ALIGNMENT ALTERNATIVES

The *I-10 West AA/EIS Draft Tier 2 Evaluation Report* concluded that the two downtown LRT alignment alternatives suitable for further consideration as north-south connections included I-17 and 19th Avenue. Various options for I-17 and 19th Avenue alignment alternatives were considered.

4.2.1 I-17 Options

The I-17 Alignment Alternative evaluated in the *I-10 West AA/EIS Draft Tier 2 Evaluation Report* assumed that a fixed guideway would connect the I-10 median via a direct-connect overpass to the I-17 northbound frontage road, located on the east side of I-17. The LRT guideway was assumed to travel east along either Adams Street or Jefferson Street (a description of the evaluation of the east-west alignment alternatives is described in Section 4.3).

Subsequent to the Tier 2 evaluation, further coordination with ADOT revealed a potential opportunity to use the southbound frontage road that parallels I-17 to the west as a HCT corridor from approximately the I-10 interchange to Van Buren Street. For LRT the frontage road guideway would extend to Jefferson Street. ADOT also acknowledged that should the proposed freeway lane expansion along I-17 occur within the study area, the new LRT fixed guideway would need to be shifted 300 to 500 feet east of the I-17 existing ROW if the northbound frontage road option were selected. The ADOT freeway expansion project is currently in the preliminary planning phase; therefore, the discussion relating to possible joint-project phasing or shared capital costs have not been initiated.

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The three LRT fixed guideway alternatives along the I-17 corridor evaluated during the Final Definition of Alternatives planning phase included:

- I-17 – Southbound Frontage Road
- I-17 – Northbound Frontage Road
- I-17 – ADOT Widening Option (300 feet east of I-17)

Figure 5 shows the alternatives proposed along the I-17 northbound and southbound frontage roads. Figure 6 provides a conceptual cross-section of LRT operating along the southbound frontage road, while Figure 7 depicts the LRT option along I-17 shifted east of the existing freeway ROW to accommodate the proposed ADOT I-17 widening project.

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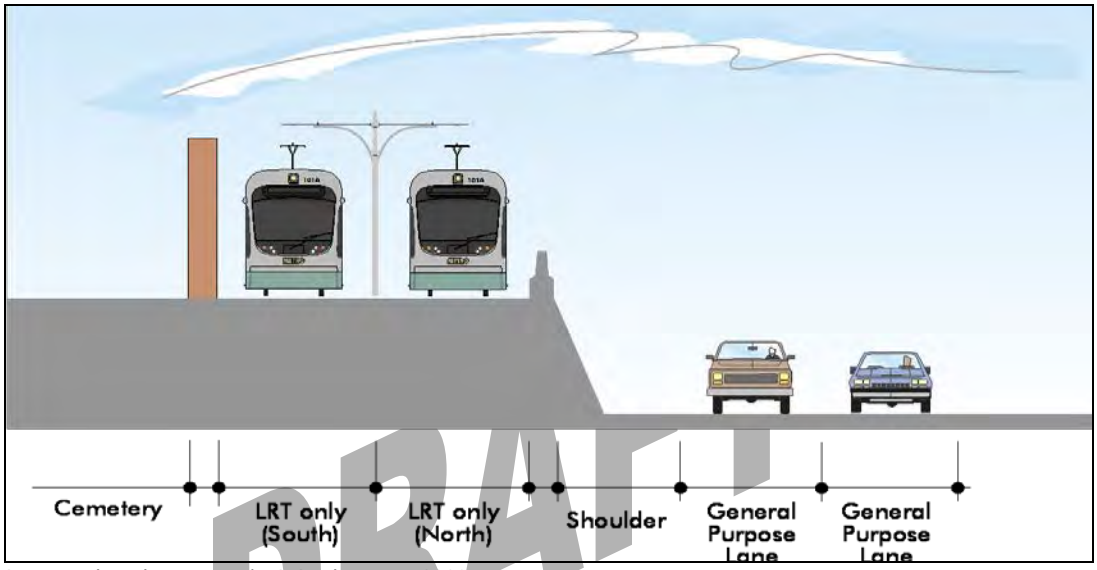
Figure 5 I-17 Northbound and Southbound Frontage Road LRT Options

Source: Phoenix West AA/EIS Study Team, 2009

Figure 6 Conceptual Cross Section of LRT along I-17 Southbound Frontage Road – facing North



Source: Phoenix West AA/EIS Study Team, 2009

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Figure 7 I-17 Modified LRT Option with ADOT Expansion Project

Source: Phoenix West AA/EIS Study Team, 2009

If an alignment along I-17 were selected as the preferred north-south LRT alignment, grade separations would be necessary at a minimum of two locations along the corridor. As depicted in Figure 5, the LRT guideway approaches downtown Phoenix from the west, descending just west of I-17 to connect with the guideway constructed along the southbound frontage road. However, if the northbound frontage road or ADOT widening option is selected, a bridge would be necessary to span the I-10/1-17 interchange before connecting with the guideway constructed east of I-17. From the onset of the Phoenix West AA/EIS Study, METRO has collaborated with ADOT. This agency interaction would continue to be instrumental regardless of which option is selected.

Regardless of the I-17 option that may be selected, another grade separation would be required as the LRT guideway approaches 19th Avenue, where the Burlington Northern Santa Fe Railway (BNSF) owns an active rail line that parallels this arterial. Some of the design and operational challenges associated with crossing LRT and freight tracks include:

- Providing enough clearance of the light rail catenary wire to accommodate freight cars;
- Making sure that the catenary wire clearance does not exceed the pantograph design limits; and
- Minimizing operational conflicts that could occur should either a freight train or LRT vehicle become inoperable on the shared track.

A further discussion of Federal regulations and conflicts of crossing freight trains and light rail vehicles is discussed in the *I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation* Memorandum, attached as Appendix A.

Due to the challenges associated with designing and operating an LRT system that would cross freight tracks at-grade, the Phoenix West Study Team is evaluating options to construct a bridge that would span the BNSF rail line or tunnel beneath to avoid operational conflicts. Regardless of the recommended option, vehicular traffic would be maintained along the east-west surface street.

Figure 8 and Figure 9 provide example, conceptual visual renderings of a bridge structure that could accommodate a light rail guideway spanning the BNSF railroad and 19th Avenue along Jefferson Street which would be similar to the grade crossing for the Adams Street Alternative. It is important to note that the lane configuration and location of the structure within the street ROW is subject to future evaluation and design. These figures are presented for demonstration purposes only.

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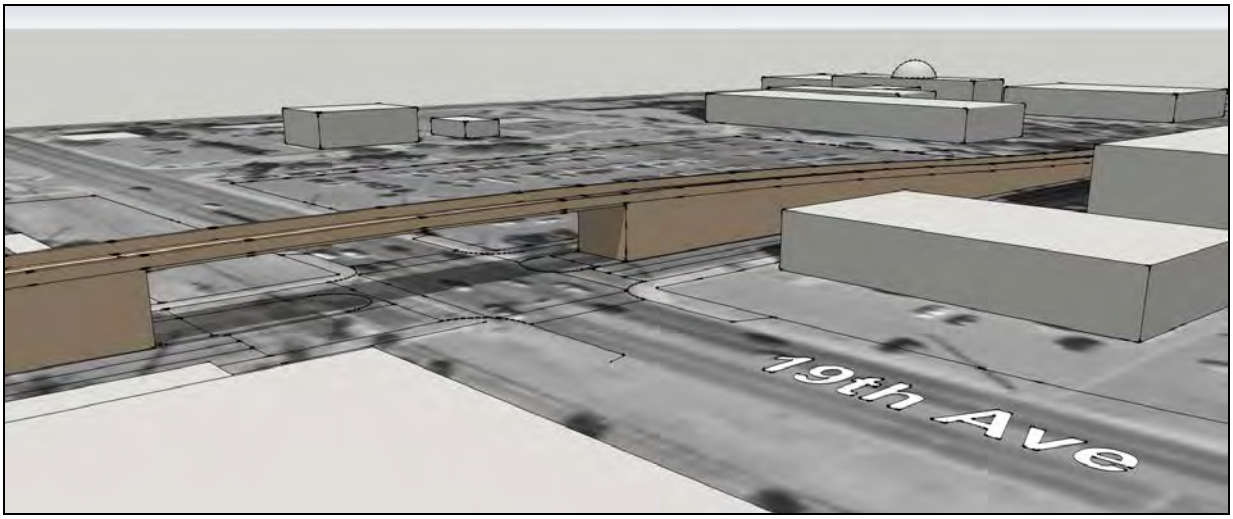
Figure 8 Birds-Eye Visual Simulation of Bridge Spanning BNSF/19th Avenue – Facing East Toward the Central Business District (CBD)

Source: Phoenix West AA/EIS Study Team, 2009

Figure 9 Birds-Eye Visual Simulation of the Bridge Structure Spanning BNSF/19th Avenue – Facing Northeast Toward the State Capitol



Source: Phoenix West AA/EIS Study Team, 2009

Figure 10 provides a visual rendering of the operation of a tunnel that would cross under the BNSF railroad and 19th Avenue with the use of Jefferson Street for the LRT guideway. Similar to Figure 8 and Figure 9, lane configuration, location of the structure

within the Jefferson Street ROW, and structure design are subject to further analysis and evaluation.

Figure 10 Birds-Eye Visual Simulation of the BNSF/19th Avenue Underpass – Facing East Toward the Phoenix CBD

Source: Phoenix West AA/EIS Study Team, 2009

Table 1 Comparison of 19th Avenue Overpass and Underpass Crossing Issues

Issues	Overpass	Underpass
Crossing of the BNSF railroad	An overpass would permit BNSF to continue with current operations before and after construction of the light rail guideway.	BNSF would likely require construction of a bypass lane for freight railroad traffic while the underpass is built. BNSF would prefer to not have suspend the railroad over a light rail guideway.
Closure of existing traffic lanes and pedestrian movement	Support columns could allow continued north-south flow of pedestrian and vehicle traffic.	Because of the depth necessary to accommodate a tunnel, the below-grade portion of the light rail right-of-way may require closure of 18th and 20th Avenues to pedestrian and vehicle traffic.

Issues	Overpass	Underpass
Visual Impacts to adjacent property owners	The overpass structure height could reach approximately 33 feet at its highest point, resulting in the introduction of a structure to the St. Matthew Neighborhood that could be considered a visual impact.	Because the underpass would be entirely below-grade, adjacent properties are not expected to experience impacts to the existing views.

Source: Phoenix West AA/EIS Study Team, 2009

BNSF prefers that the LRT tracks be elevated above the railroad ROW as depicted in Figure 8 and Figure 9 and avoid placing the BNSF tracks on a temporary structure during construction.

Additionally, the selection of the I-17 Southbound Frontage Road Option would require construction of an overpass to span I-17, thereby avoiding the removal of existing traffic lanes along either Adams Street or Jefferson Street.

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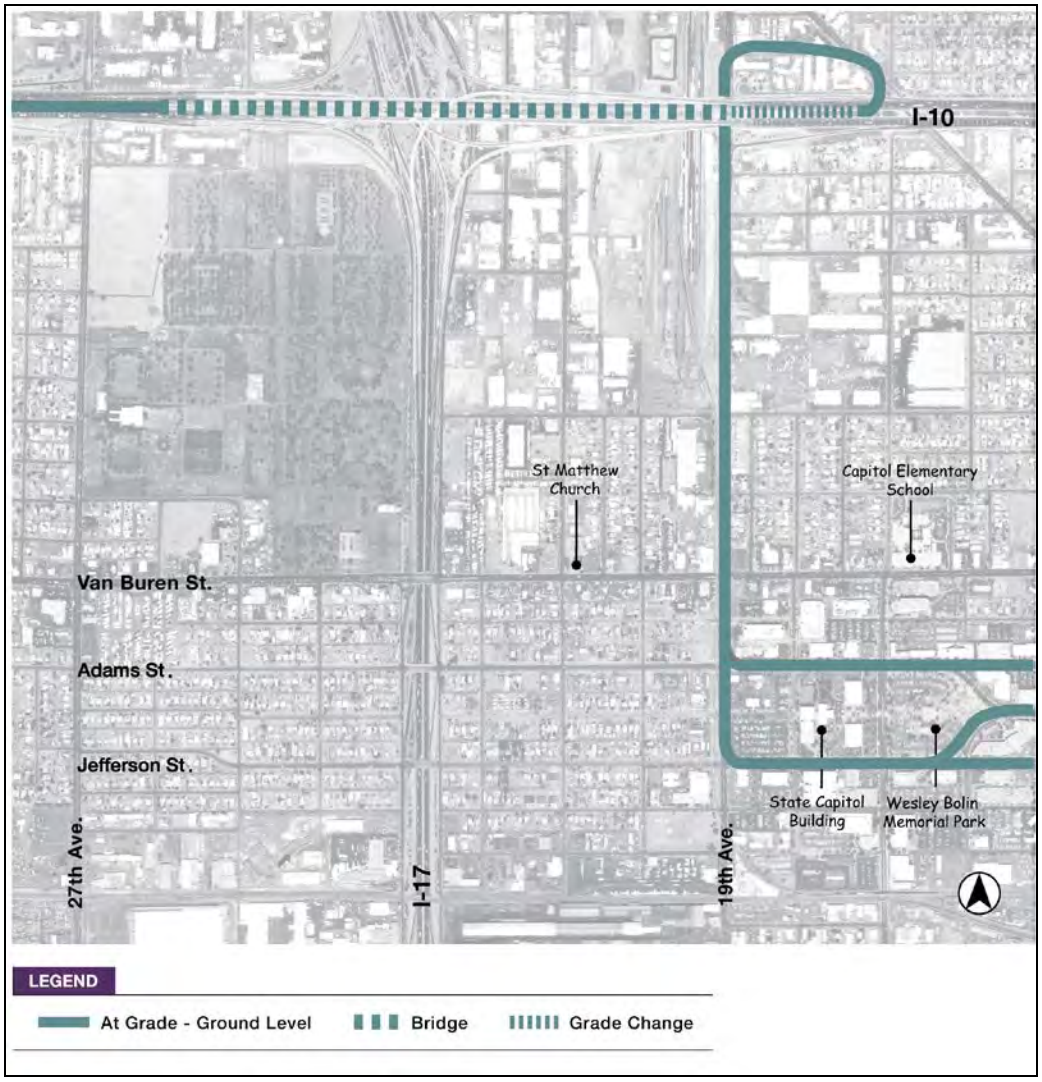
4.2.2 19th Avenue Alignment Alternative

The 19th Avenue alignment alternative carried forward for evaluation has remained consistent with the alignment evaluated in the *I-10 West AA/EIS Draft Tier 2 Evaluation Report.* As depicted in Figure 11, use of 19th Avenue would require construction of a bridge within the I-10 median from just west of the I-10/I-17 interchange to approximately 17th Avenue, a distance of approximately 1.1 miles. The LRT guideway would require construction of several support structures between the existing freeway lanes within the median. The LRT median bridge structure would descend west of 17th Avenue before turning northwest, under the I-10 westbound freeway lanes, to connect with Grand Avenue.

From Grand Avenue, the LRT guideway would then head west along Culver Street before turning south along 19th Avenue to connect with **either Adams Street or Jefferson Street**. Figure 12 provides a visual rendering that shows how the LRT vehicles would connect to downtown from I-10 via the 19th Avenue option. The current roadway configuration along 19th Avenue entails a two way, two lane road paralleling the BNSF ROW directly west of the street.

Figure 11 19th Avenue Alignment Alternative



Source: Phoenix West AA/EIS Study Team, 2009

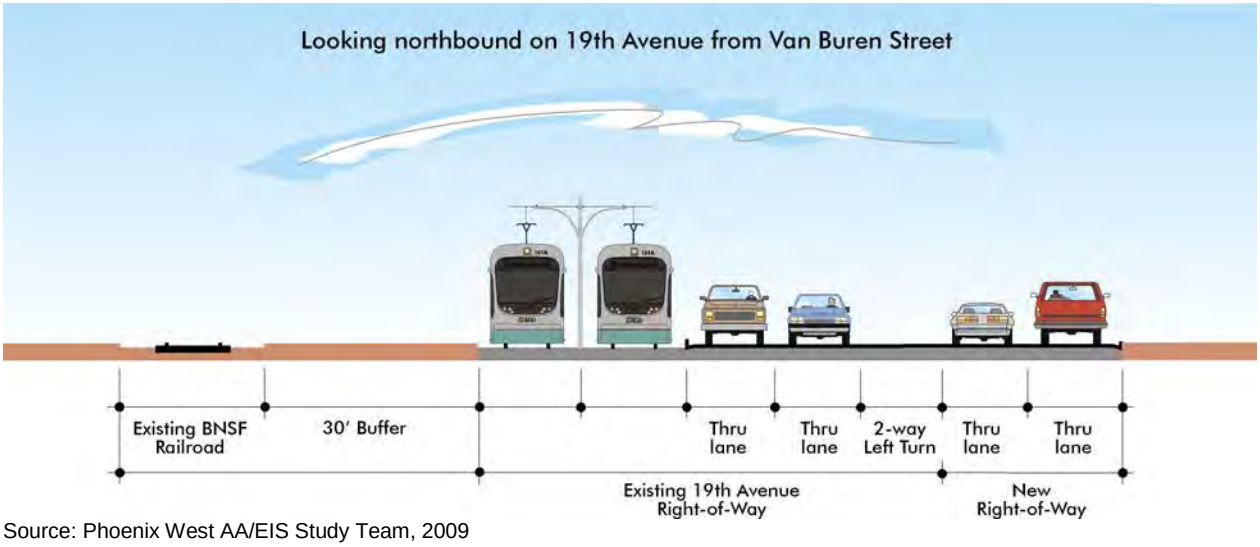
BNSF has expressed support of the grade separation option for I-17 as opposed to the 19th Avenue option, where the light rail trains would be forced to parallel the railroad and create pedestrian and passenger safety concerns due to the proximity of rail and pedestrians. As possible safety mitigation, BNSF noted that a physical barrier would be necessary to separate the railroad from the LRT tracks. BNSF added that the barrier would need to extend approximately 1 mile along 19th Avenue in downtown Phoenix if this option were selected.

Figure 12 Birds-Eye Visual Simulation Showing the LRT Downtown Connection from I-10 – Facing Northeast

Source: Phoenix West AA/EIS Study Team, 2009

Figure 13 illustrates the cross-section of maintaining existing roadway, considering BNSF provides a portion of ROW to accommodate the LRT guideway. However, as discussed in Section 4.2.1, BNSF would require installation of a physical barrier to separate the existing railroad tracks from the LRT guideway.

Figure 13 Conceptual Cross-Section of LRT Along 19th Avenue



Source: Phoenix West AA/EIS Study Team, 2009

4.3 DOWNTOWN: EAST-WEST ALIGNMENT ALTERNATIVES

Based on the evaluation results from the *I-10 West AA/EIS Draft Tier 2 Evaluation Report*, the following three arterials were determined as east-west alignment alternatives that warranted further refinement and evaluation:

- Adams Street
- Washington/Jefferson Street
- Jefferson Street (2-Track Option)

Figure 14 depicts the four east-west alignment alternatives that evolved from the three arterial corridors listed above as part of the Tier 2 Evaluation process. In addition to showing the potential east-west alternatives, Figure 14 also identifies the remaining options that were considered for a connection to the existing METRO Starter Line in downtown Phoenix.

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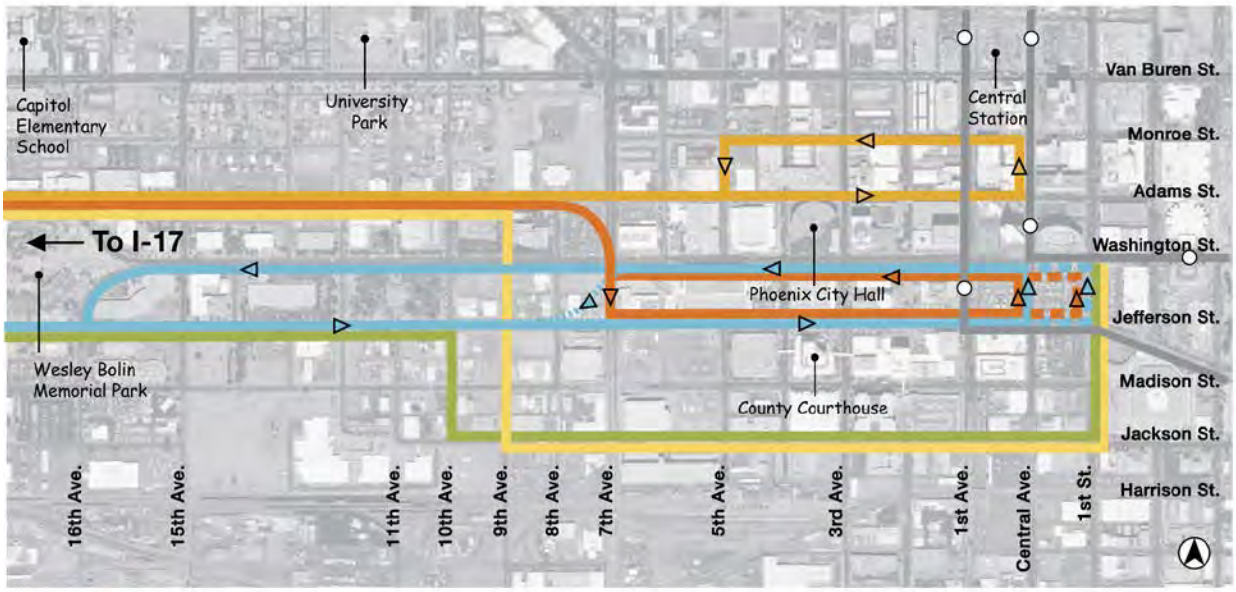
Figure 14 Downtown East-West Alignment Alternatives and METRO Starter Line Connection Options



LEGEND

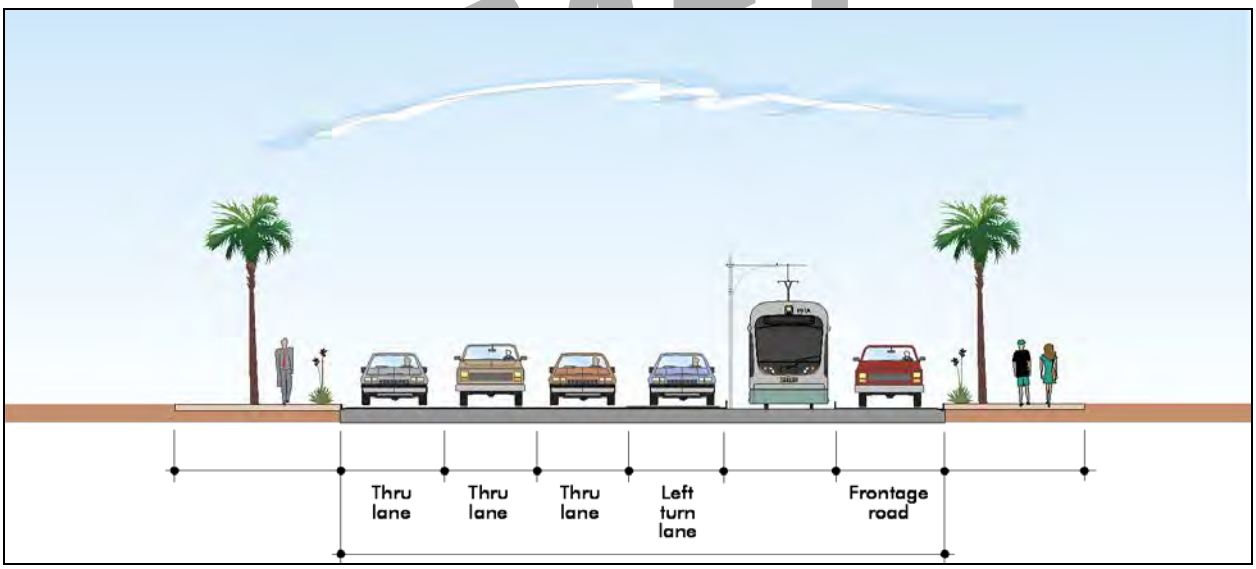
- Light Rail Line / Station
- Washington St. / Jefferson St. Couplet
- Alternate Connection Option
- 1st St. Turnaround Option
- Jefferson St. (two track)
- Adams St. (via Jackson St.)
- Adams St. / Monroe St. Couplet
- Adams St. (via Washington/Jefferson Streets)*

Note: Alignments are two-way except where indicated
*Alignment introduced for evaluation subsequent to Tier 2 evaluation
Source: Phoenix West AA/EIS Study Team, 2009

4.3.1 Washington Street/Jefferson Street Couplet Alternative

The Washington/Jefferson Couplet Alternative was designed to utilize single track service along both Washington and Jefferson streets, which was consistent with the alignment originally evaluated in the *I-10 West AA/EIS Draft Tier 2 Evaluation Report*. Construction of the LRT guideway would result in the reduction of one traffic lane along each roadway to preserve the existing curbs. Figure 15 shows a conceptual cross-section of the LRT guideway along Washington Street that would be representative of the operation west of the METRO Starter Line. As the cross-section shows, near the State Capitol Washington Street would include three through traffic lanes, a left-turn lane, a one-way LRT guideway, and a south side frontage road.

Figure 15 Conceptual Cross-Section of LRT Guideway along Washington Street – Facing East



Source: Phoenix West AA/EIS Study Team, 2009

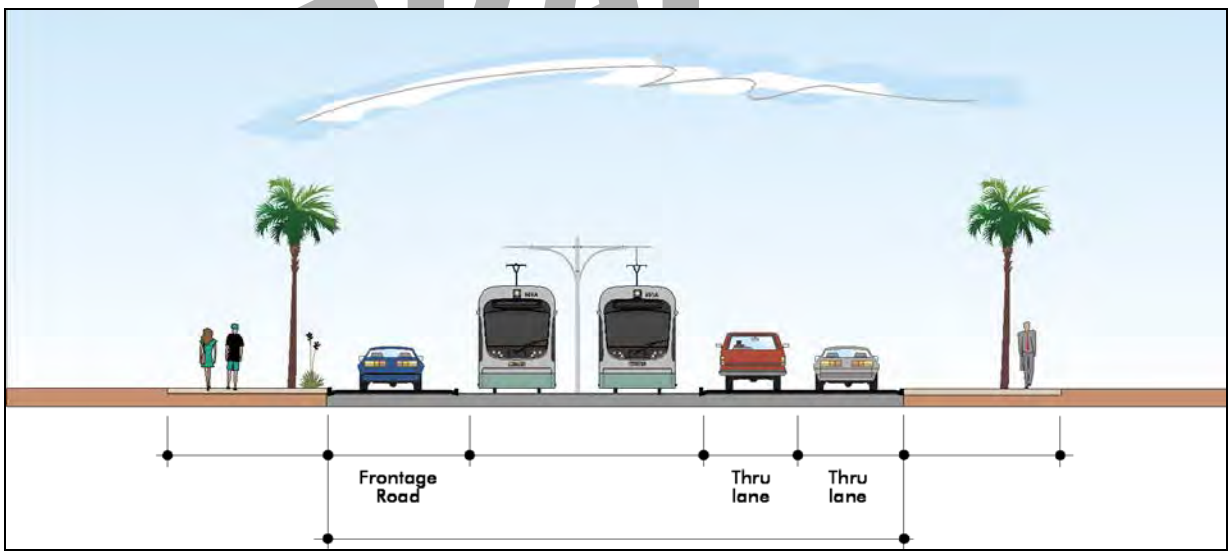
The Phoenix West Study Team elicited input from various stakeholders concerning the proposed downtown LRT connections. The Arizona State Historic Preservation Office (SHPO) expressed two separate concerns about adding a LRT guideway along Washington Street from Central Avenue to the State Capitol. First, Washington Street is considered the last remaining downtown Phoenix public "parade route" since the current METRO Starter Line was constructed along the other parade route (Central Avenue). Second, Washington Street is considered a view corridor providing an unobstructed view of the copper dome associated with the Capitol building facing west from downtown Phoenix along Washington Street. This view could be impacted by catenary wires associated with the LRT guideway.

Figure 14 shows the separate options that were considered to connect the LRT guideway from Washington Street to Jefferson Street, including a connection just west of 15th Avenue, a cross-over between 7th and 9th avenues, and a vertical cross-over

along 8th Avenue from Washington Street to Jefferson Street going west. The intent of the connection options between 7th and 9th Avenue and a connection along 8th Avenue was to preserve at least a portion of Washington Street as a view corridor to the State Capitol.

Representatives from SHPO concurred that the connection between 7th and 9th Avenues would provide the least amount of impact from a historical perspective and supported this option over the Washington Street to Jefferson Street connection option near the State Capitol. With the recommendation of this connection option, the LRT guideway would result in a double track operation along Jefferson Street west of 10th Avenue, as depicted in the cross-section shown as Figure 16. As shown, Jefferson Street would include a north side frontage road, a two-way LRT guideway, and two through traffic lanes.

Figure 16 Conceptual Cross-Section of LRT Guideway along Jefferson Street – Facing East



Source: Phoenix West AA/EIS Study Team, 2009

4.3.2 Jefferson Street Alternative

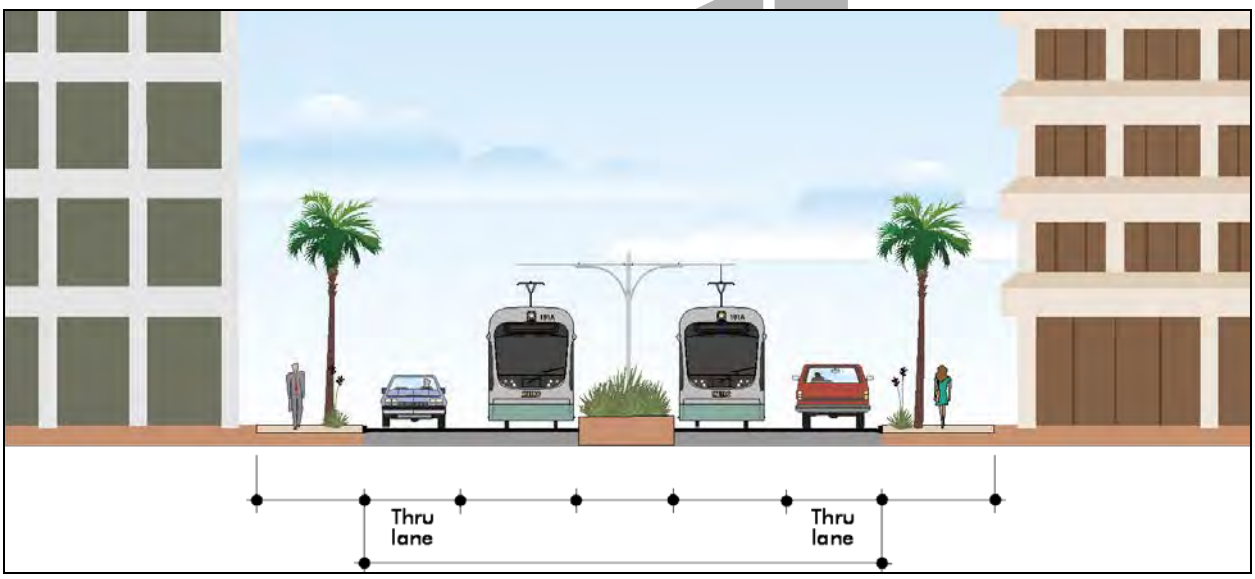
The Jefferson Street Alternative was a modification to the Jefferson Street 2-Track option identified after the Tier 2 analysis. The decision to evaluate an LRT guideway along Jackson Street was considered in case the connection along Jefferson Street at 1st Avenue resulted in design and operational complications. Additionally, various stakeholders noted the possibility of future commuter rail service along the Union Pacific Railroad (UPRR), south of Jackson Street presented a possible multi-modal connection in downtown Phoenix.

This option would involve construction of a two-track LRT guideway from the west along Jefferson Street to 10th Avenue, where the alignment would head south before heading

east along Jackson Street, which currently serves as a two-lane, two-way road with on-street parking. Finally, the guideway would head north on 1st Street to connect with the METRO Starter Line.

The cross-section shown as Figure 16 is similar to the proposed configuration along Jefferson Street for this alternative. Figure 17 shows a conceptual cross-section of the LRT corridor in the center of Jackson Street, with the two-way traffic lanes maintained by removal of on-street parking.

Figure 17 Conceptual Cross-Section of LRT Guideway along Jackson Street – Facing East



Source: Phoenix West AA/EIS Study Team, 2009

4.3.3 Adams Street (via Jackson Street) Alternative

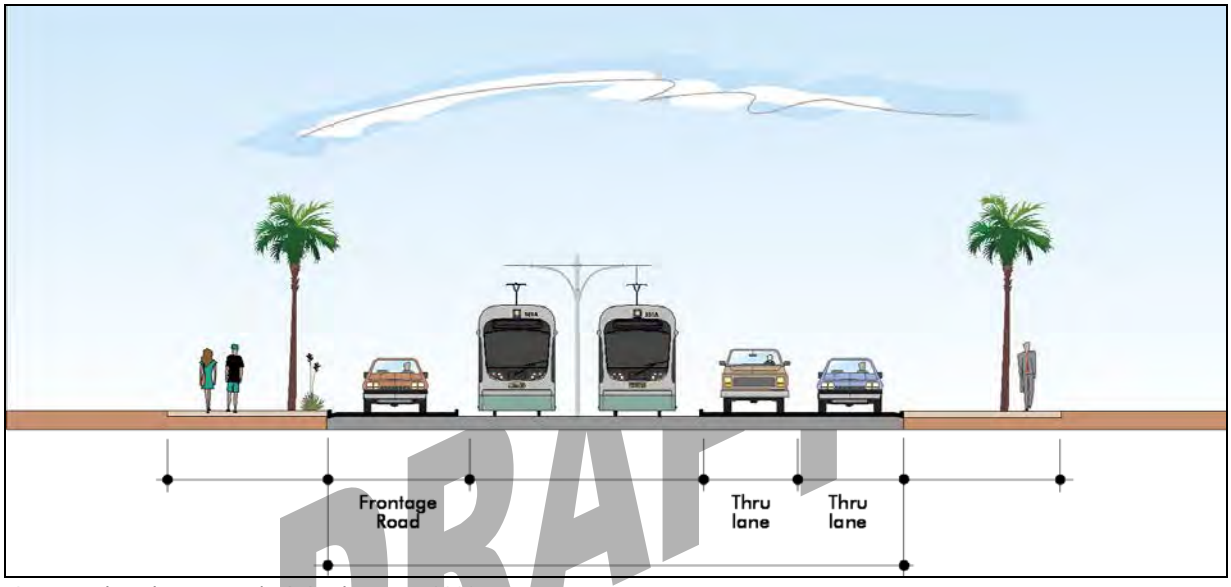
One of the modified Adams Street Alignment Alternatives included the Adams Street (via Jackson Street) Alternative. The City of Phoenix provided input subsequent to the Tier 2 evaluation indicating exclusive use of Adams Street in a two-way configuration, the LRT guideway would be problematic due to the narrow ROW associated with Adams Street west of Central Avenue. City representatives were concerned that an LRT option between 9th Avenue and Central Avenue would impact existing businesses in terms of access and possible property acquisitions, as well as impede emergency vehicle access. A potential solution resulted in a LRT alignment that deviated from Adams Street south along 9th Avenue. The rationale in using Jackson Street for this option was the same for the Jefferson-Jackson Alternative in terms of possibly serving as a multi-modal connection to a future commuter rail system.

Photo 1: Facing East of 17th Avenue – Abandoned Right-of-way along Adams Street owned by Arizona Department of Administration

The Adams Street (via Jackson Street) Alternative would result in an exclusive two-track alignment from the west along Adams Street to 9th Avenue where the alignment would head south to Jackson Street. Just east of 17th Avenue, a section of the Adams Street roadway is completely blocked to traffic due to the presence of an abandoned ROW that separates the State Department of Administration building to the south from a parking garage located north of the abandoned ROW, as shown in Photo 1. West of 17th Avenue, Adams Street is a four-lane, eastbound one-way street and a two-lane, two-way street east of 15th Avenue. Figure 18 shows a conceptual cross-section of the two-track alignment along Adams Street west of the State Capitol while Figure 19 shows a conceptual cross-section of Adams Street east of the State Capitol.

Similar to the Jefferson Street (Two-Track) Alternative, the alignment would then head east along Jackson Street and north on 1st Street providing a connection with the METRO Starter Line.

Figure 18 Conceptual Cross-Section of LRT Guideway West of State Capitol along Adams Street – Facing East



Source: Phoenix West AA/EIS Study Team, 2009

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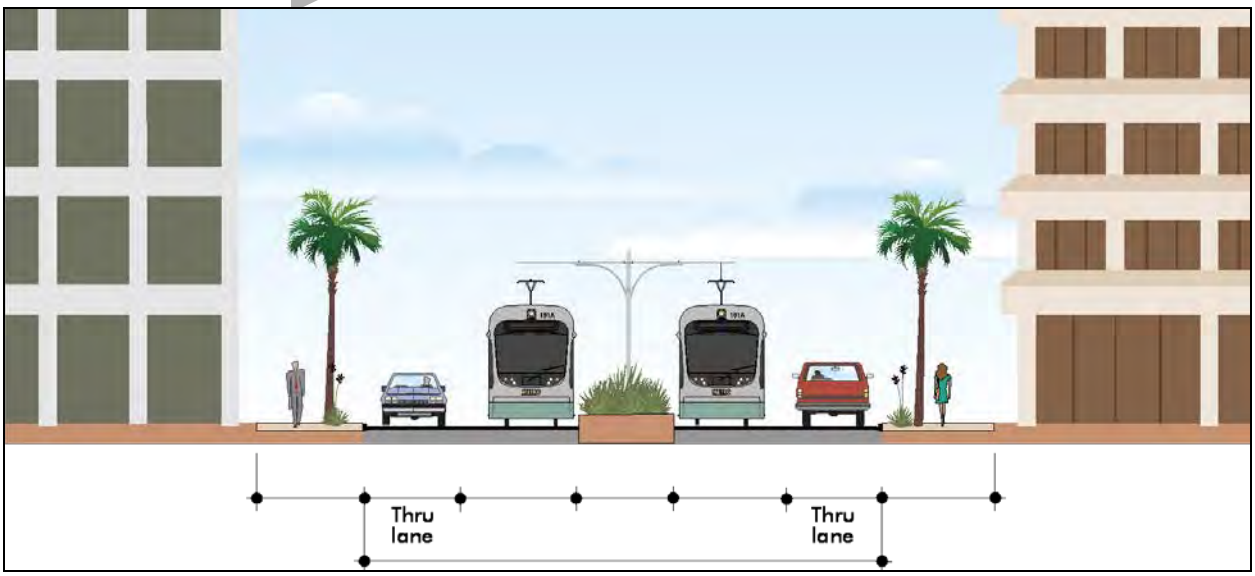
Figure 19 Conceptual Cross-Section of LRT Guideway East of the State Capitol along Adams Street – Facing East



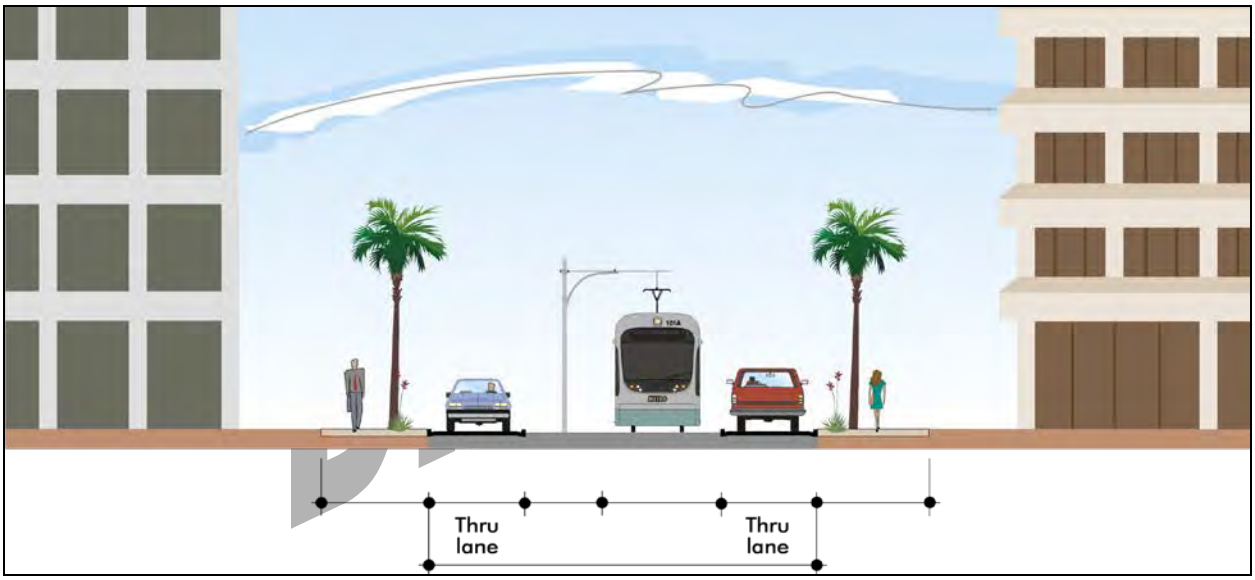
Source: Phoenix West AA/EIS Study Team, 2009

4.3.4 Monroe Street/Adams Street Couplet Alternative

Another variation of the Adams Street Alignment Alternative used a combination of a single LRT track along Monroe Street (westbound), along a single LRT track on Adams Street (eastbound) between 5th Avenue and Central Avenue. This Alignment Alternative was intended to alleviate impacts associated with the narrow Adams Street ROW east

of 5th Avenue. Figure 20 shows a conceptual cross-section of the one-way LRT guideway along Adams Street between 5th Avenue and Central Avenue. The two-lane roadway would be preserved to accommodate the LRT vehicle; however, on-street parking would be removed. This would be the similar layout for the Monroe Street portion that would accommodate the LRT guideway.

Figure 20 Conceptual Cross-Section of LRT Guideway East of the State Capitol Along Adams Street – Facing East



Source: Phoenix West AA/EIS Study Team, 2009

4.3.5 Adams Street (via Washington/Jefferson Streets) Alternative

Subsequent to the Tier 2 analysis and evaluation, the Phoenix West AA/EIS Study Team was asked to evaluate a variation of the Adams Street alignments previously addressed. The proposed alternative, similar to the Adams Street (via Jackson Street) and Adams Street/Monroe Street Couplet alignments would result in use of Adams Street from I-17 to just east of 9th Avenue for a two-way, LRT guideway.

However, in an effort to directly serve areas of high employment concentration along Washington and Jefferson Streets and support possible economic ventures along Adams Street, the LRT guideway would head southeast with a parking lot just west of 7th Avenue. From 7th Avenue, the LRT guideway would split and head east along Jefferson Street and west along Washington Street before connecting to the METRO Starter Line.

CHAPTER 5

Definition and Evaluation of Tier 2 Detailed BRT Alternatives

5.0 DESCRIPTION OF BUILD ALTERNATIVES – BRT

BRT is a limited-stop bus service designed to provide improved service and travel times over the existing transit network. Proposed BRT service would utilize existing express and RAPID bus routes and operate in an exclusive busway along the median of I-10 from 79th Avenue to I-17 and in the Southbound I-17 Frontage Road and would transition to mixed traffic in Downtown.

5.1 PHOENIX WEST MAINLINE

The BRT build alternative associated with the Mainline Section would be similar to the LRT build alternative, as described in Section 4.1. An exclusive busway would be reserved in the I-10 median from the 79th Avenue Park-and-Ride to I-17 just west of downtown Phoenix. The station options along the freeway section would be the same as those considered for the LRT build alternative along the freeway median described in Section 4.1.

Figure 21 shows a conceptual cross-section of BRT operating within the 50-foot I-10 freeway median in relation to general traffic.

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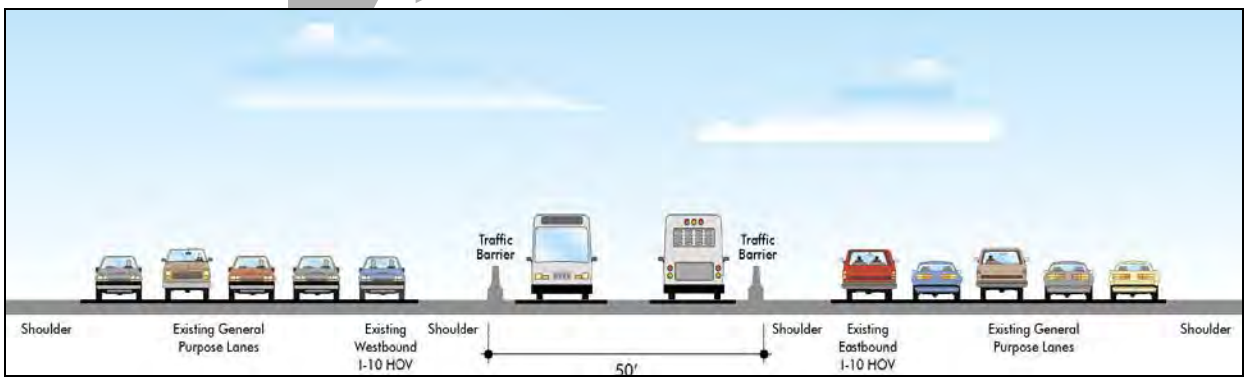
Figure 21 Conceptual Cross-Section of BRT Exclusive Guideway in the I-10 Median



Source: Phoenix West AA/EIS Study Team, 2009

5.2 DOWNTOWN BRT OPTIONS

The *I-10 West AA/EIS Draft Tier 2 Evaluation Report* evaluated the use of the existing freeway system and assumed BRT would operate on the general purpose lane of I-17 to connect to downtown Phoenix using the existing Adams and Jefferson Street on-ramp and off-ramp, respectively. However, discussions with ADOT and MAG revealed that an exclusive busway option could be examined for BRT, similar to the guideway evaluated for LRT. Therefore, METRO evaluated the following three BRT options during the Final Definition of Alternatives planning phase as described in this section:

- I-17 Exclusive Busway
- I-17 Mixed Traffic
- 19th Avenue Mixed Traffic

The Phoenix West Study Team recognized that a majority of the commuters are destined to downtown Phoenix as compared to the State Capitol. For all three alternatives, it was assumed that buses would enter downtown from two directions:

- The buses would use either I-17 or 19th Avenue via an exclusive busway to transition from I-10 into Downtown Phoenix for all day service.
- During peak hours some BRT routes would continue to use 5th Avenue/3rd Avenue direct access HOV ramps to transition to and from downtown Phoenix.

This 2-part service during peak hours would provide improved direct service to the State Capitol. The peak only service would deliver transit riders directly to downtown Phoenix, before terminating at the State Capitol. The Washington/Jefferson Street couplet was considered as the selected east-west alignment to take advantage of roadways and bus facilities that currently support bus transit operations in downtown Phoenix.

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5.2.1 I-17 Exclusive Busway

The I-17 Exclusive Busway BRT option originally examined during the Tier 2 Evaluation included use of an exclusive busway that would directly connect all day bus travel from the I-10 median to the southbound I-17 frontage road. Additionally, the existing 5th Avenue/3rd Avenue direct access HOV ramps would remain in operation to accommodate AM and PM peak hour downtown bus service.

However, as previously discussed in the I-17 LRT option description (Section 4.2.1), METRO is also examining the possibility of using a section of the I-17 Southbound Frontage Road as an exclusive busway. Connection to the I-17 Southbound Frontage Road from the I-10 median would be made via a direct access ramp southwest of the I-10/I-17 freeway interchange. BRT would operate in the exclusive busway from the I-17/I-10 stack interchange to Van Buren Street.

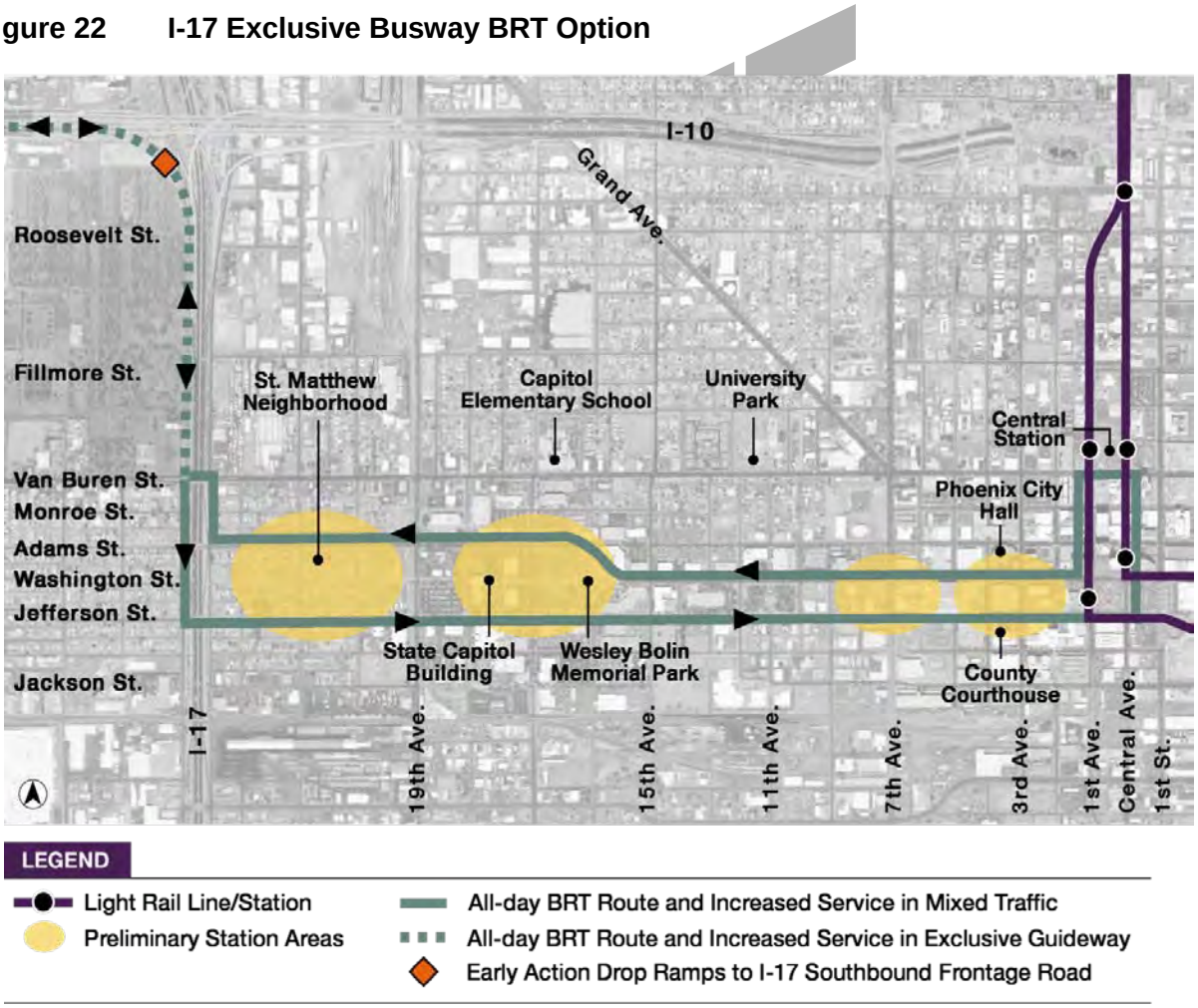
Eastbound buses would continue along the I-17 Southbound Frontage Road to Jefferson Street, where they would turn east to access the State Capitol, city/government offices, the METRO Starter Line, and Central Station. Westbound buses would travel from Central Station along Washington Street/Adams Street before connecting to the I-17 Southbound Frontage Road busway at Van Buren Street, before entering the exclusive busway to access the West Valley. Figure 22 shows how the I-17 Exclusive Busway Option would operate in downtown Phoenix with this alternative.

As part of an “Early Action Program” METRO, in joint partnership with the City of Phoenix, ADOT, and Federal Highway Administration (FHWA), is examining the

possibility of constructing the direct access ramp portion of the downtown connection. The ramp would connect the I-10 median with the I-17 Southbound Frontage Road and with initial use restricted to express and RAPID bus service.

In addition to identifying the BRT alignments, Figure 22 shows the preliminary station areas METRO recommends to serve specific locations in downtown Phoenix. The Phoenix West Study Team will continue to design and evaluate station configuration and location as the planning process continues.

Figure 22 I-17 Exclusive Busway BRT Option



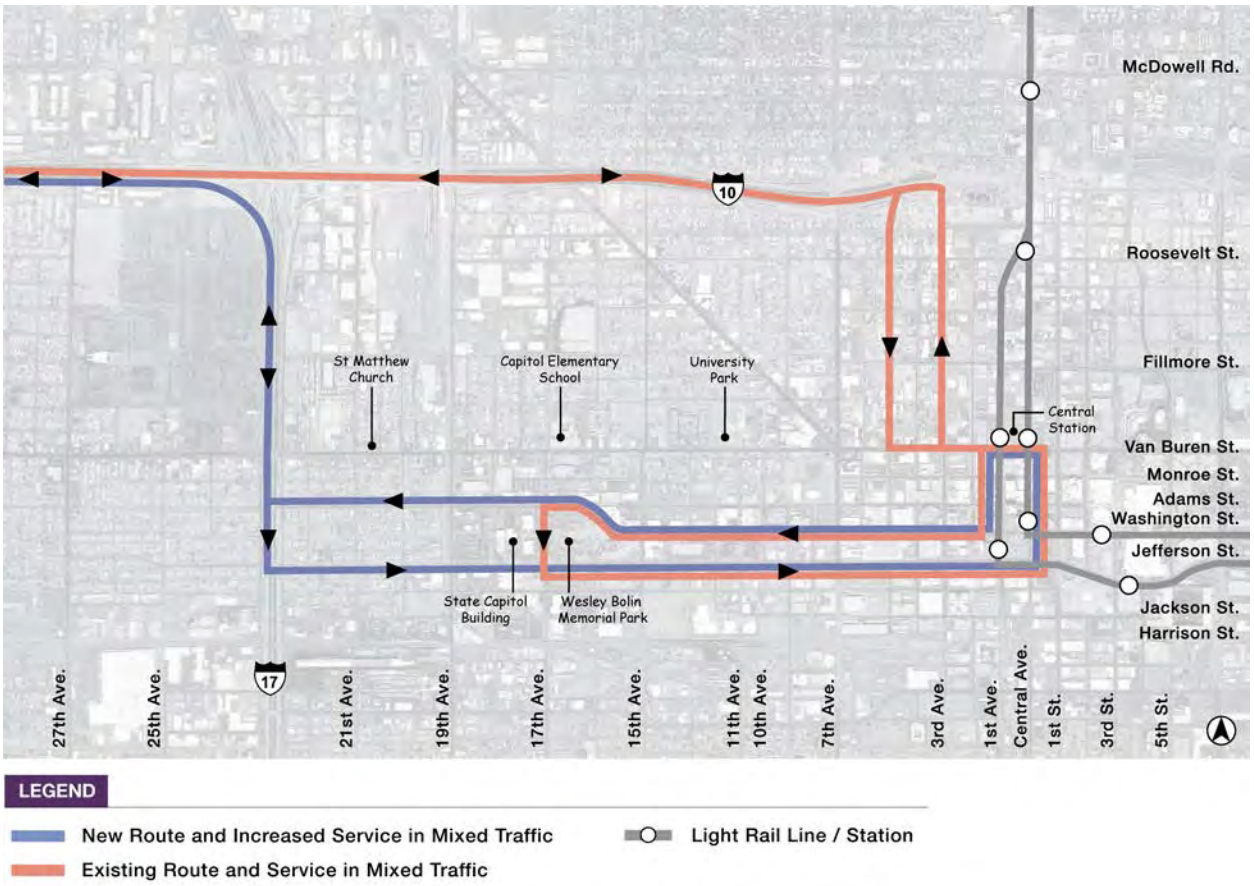
Source: Phoenix West AA/EIS Study Team, 2010

5.2.2 I-17 Mixed Traffic

The BRT I-17 Mixed Traffic Option assumes that buses would operate in new bus-only lanes built in the I-10 median west of 35th Avenue, merging into general traffic lanes near 35th Avenue traveling eastbound. Buses would have to cross the high-occupancy vehicle (HOV) lanes and general traffic lanes to access the I-17 southbound ramp,

using existing roadways to operate in mixed traffic. Figure 23 shows how BRT would operate in downtown Phoenix with this option.

Figure 23 I-17 Mixed Traffic BRT Option



Source: Phoenix West AA/EIS Study Team, 2009

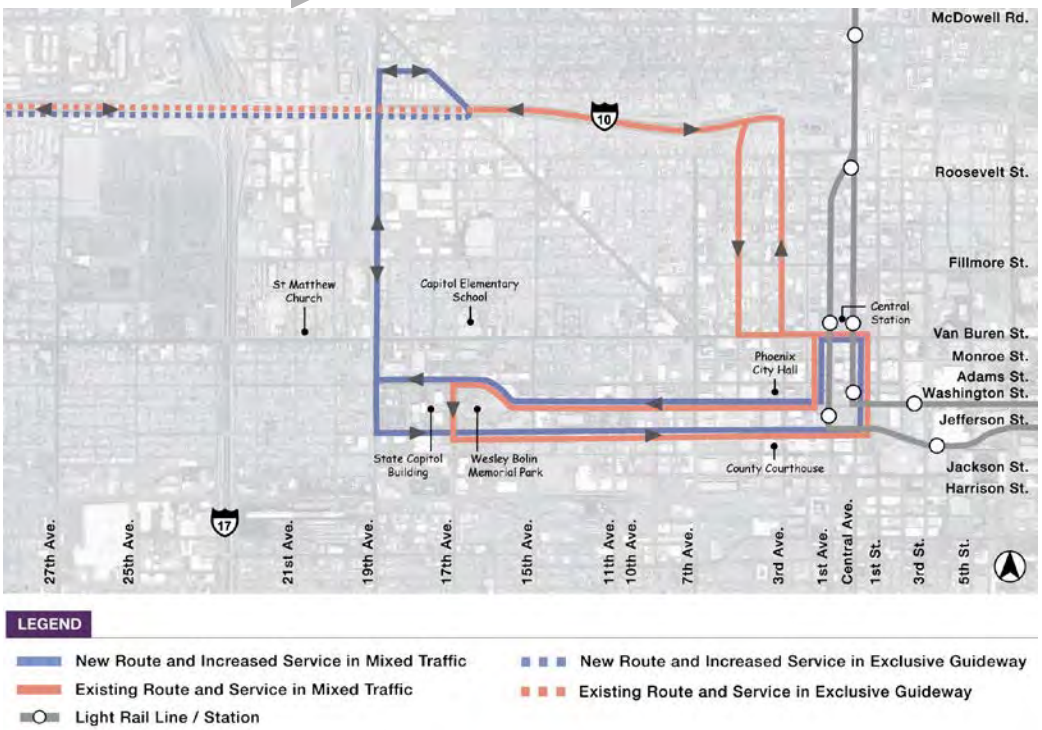
5.2.3 19th Avenue Mixed Traffic

The 19th Avenue BRT option would operate along 19th Avenue, requiring an exclusive busway east of the I-17/I-10 stack interchange before connecting to Grand Avenue with a bus-only entrance/exit ramp, as shown in Figure 24. Buses would then operate in mixed traffic along Grand Avenue and Culver Street before heading south along 19th Avenue. The conceptual simulation depicted as Figure 24 shows that the busway would descend just east of 19th Avenue before coming to grade at Grand Avenue. Figure 25 shows how BRT would operate in downtown Phoenix with the selection of the 19th Avenue option.

Figure 24 Birds-Eye Visual Simulation Showing the BRT Downtown Connection from I-10 – Facing Northeast

Source: Phoenix West AA/EIS Study Team, 2009

Figure 25 19th Avenue Mixed Traffic BRT Option



Source: Phoenix West AA/EIS Study Team, 2009

CHAPTER 6

Alternatives Remaining After Tier 2 Detailed Evaluation

6.0 DOWNTOWN BUILD ALTERNATIVES EVALUATION AND REFINEMENT

The following section summarizes the evaluation of the remaining downtown LRT and BRT alternatives. These alternatives will be further refined as the planning process moves forward.

6.1 LRT EVALUATION

6.1.1 North-South Alternatives Comparison

The *I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation* (March 2010) attached as Appendix A evaluated the I-17 and 19th Avenue Alignment Alternatives for the proposed LRT options. A qualitative assessment of the three I-17 alternative options and the 19th Avenue alternative examined several issues including travel times, necessary agency coordination, grade separation requirements, and cost. Each of the alternatives performed equally in terms of potential issues, with no fatal flaws identified through the qualitative analysis.

Separate criteria were evaluated for each of the four north-south alignment alternatives and given values to determine how each would compare. Similar to the quantitative analysis performed for the alternatives, certain alternatives fared better in different categories. However, as the *I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation* describes, the I-17 Southbound Frontage Road Alternative rated higher compared to other alternatives in terms of travel time, property acquisition, environmental impacts, and necessary coordination with ADOT and other agencies, notably BNSF to connect to the east-west alignment alternative. The I-17 Northbound Frontage Road Alternative also scored highly in the same categories; however, the I-17 (ADOT Road Widening Option) and 19th Avenue Alternatives both had a lower score due to necessary property acquisition, environmental impacts, property access/traffic impacts, and overall cost.

Subsequent to the completion of the *I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation*, the Phoenix West Study Team pursued further evaluation of the Southbound Frontage Road Option based on its relatively higher score compared to the other connections. The FHWA requested that METRO complete a report to document the change in access to the federal interstate highway system. This work included a comparison of traffic counts along the I-17 Southbound Frontage Road, assessment of future impacts to nearby intersection levels of service (LOS), potential operational conflicts caused by closing the roadway to vehicle traffic, and impacts to adjacent properties.

Initial findings of the report indicated existing and forecasted traffic counts along the section of the I-17 Southbound Frontage Road were relatively low and the LOS at nearby intersections would be unaffected as a result of closing the I-17 Southbound

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Frontage Road to vehicle traffic. METRO is considering the termination of the current access to the I-17 Southbound Frontage road from gated access points from the Beth El Greenwood and Memory Lawn cemeteries, located directly west of the section of the I-17 Frontage Road that would be used for the LRT guideway. METRO will continue working with representatives from the cemeteries to further explore property impacts.

An additional issue with use of the I-17 Southbound Frontage Road is the potential access impact to an industrial area southwest of the intersection of McDowell Road and the I-17 Southbound Frontage Road. Use of the Frontage Road as an LRT guideway south of I-10 would require the portion of the roadway north of I-10 (to McDowell Road) to become a southbound freeway access ramp to I-17 only. This concept would require that access to the industrial area is terminated along the current I-17 Southbound Frontage Road including the current access to 24th Avenue, thereby diverting all traffic to 25th Avenue to access this property. METRO is working with the City of Phoenix Streets Transportation Department and Fire Department to make sure that proposed diversion of traffic along the I-17 Southbound Frontage Road is acceptable.

Through the public outreach program, METRO met with various stakeholders, neighborhood groups and community organizations. A general theme emerged in the feedback from the community. It centered on a few main points:

- Promote economic development opportunities by connecting residents and employees to the Downtown area and the State Capitol.
- Provide transit amenity to enhance redevelopment opportunity for the St. Matthew's neighborhood.

The following comments were submitted by various community members:

- (Regarding the 19th Ave turnaround)The surrounding land uses (near Grand Ave and I-10) are uninviting and not pedestrian friendly. – Downtown Community Working Group (DCWG)
- (Regarding the I-17 alignment) I support the opportunity to have a station in the St. Matthew's neighborhood. – Bill Russell (Resident/Property Owner St. Matthews)
- Historical integrity of Oakland district & neighborhood south of University Park (Woodland) could be threatened (with 19th Avenue alignment). -- DCWG
- This alignment (19th Avenue) would eliminate Horace Steele Commons (northwest of Grand Avenue and I-10) which has been a successful place. They have just expanded their facilities. -- DCWG
- I-17 looks faster and more cost effective – DCWG

6.1.2 East – West Alternatives Comparison

As the Phoenix West AA/EIS Study Tier 2 Evaluation progressed, the Washington Street/Jefferson Street Couplet option was seen as the favorable option for LRT for several reasons:

- The direct connection to the METRO Starter Line would result in fewer ROW impacts and would reduce travel time compared to options requiring out of direction travel.
- The wide rights-of-way associated with Washington and Jefferson streets would result in fewer impacts to curbs, landscaping, and adjacent properties, compared to narrow rights-of-way associated with Monroe, Adams and Jackson streets.
- The Washington Street/Jefferson Street Couplet option serves several downtown Phoenix destinations and employment centers including Phoenix City Hall, which would not be served by the Jefferson Street (two-track) or Adams Street (via Jackson Street) options.
- Stakeholders, the local community, and decision makers view this option as the favorable alternative based on the direct connection to key activity centers and minimal impacts to adjacent properties compared to other alternatives.

Table 2 summarizes weaknesses associated with the three alignment alternatives removed from further consideration.

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Table 2 East-West Alignment Alternative Weaknesses

Alternative	Weaknesses
Jefferson Street (two-track)	• Adverse impacts to potential expansion of U.S. Airways Center along 1st Street • Adverse impacts to truck and bus circulation along Jackson Street • On-street parking removed from Jackson Street • Narrow right-of-way along Jackson Street
Adams Street (via Jackson Street)	• ADOA does not approve use of the abandoned right-of-way between 17th Avenue and 15th Avenue as this space is currently used as public open space • Adverse impacts to potential expansion of U.S. Airways Center along 1st Street, south of Jefferson Street • Adverse impacts to delivery truck circulation along Jackson Street • On-street parking removed from Adams and Jackson Streets • Narrow right-of-way along Jackson Street • Access impacts to state buildings' parking garages along Adams Street
Monroe Street/Adams Street Couplet	• Arizona Department of Administration does not approve use of the abandoned right-of-way between 17th Avenue and 15th Avenue as this space is currently used as public open space • Adversely impacts City Hall and Dodge Theater loading docks • Adversely impacts Orpheum Lofts on-street parking • Requires acquisition of commercial business to accommodate a connection with Central Avenue • Narrow right-of-way along Adams and Monroe streets • On-street parking removed from Adams and Monroe streets • A LRT westbound connection to Monroe Street from 1st Avenue would have impacted a high-density, residential condominium complex • To accommodate a westbound connection with Monroe Street, the LRT guideway would need transition from the south side of Monroe Street to the east side of Central Avenue. The radius necessary to make this turn would result in partial removal of the current station located along Central Avenue, between Adams and Washington streets. • Access impacts to state buildings' parking garages along Adams Street

Source: Phoenix West AA/EIS Study Team, 2009

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In fall 2009, METRO presented the Washington Street/Jefferson Street Couplet as the proposed east-west alternative to local stakeholders, agencies, and members of the Phoenix City Council. This alternative has obtained general support as the preferred east-west LRT alternative, with the next step in the planning process expected to lead to the recommendation of station locations in early 2010.

The following general locations in downtown Phoenix are identified as preliminary potential station areas and shown in Section 7.0:

- St. Matthew Neighborhood
- State Capitol
- 7th Avenue Vicinity
- City Government Offices

Additionally, although BNSF has expressed their preference for an overpass crossing of the railroad by an LRT guideway, METRO will conduct further evaluation and solicit further public input before deciding which grade separation option to select.

As stated Section 6.1.1, general themes started to emerge in the feedback from the community. The following comments were made during the public process:

- Existing right-of-way (on Jefferson) sufficient to not impact adjacent properties
- DES is between 17th and 19th Avenues and has about 3,000 employees with offices (that can be served by an alignment) along Jefferson. – Government Working Group (GWG)
- The ADOA has no concerns with the proposed Jefferson Street route. -- Arizona Department of Administration (ADOA)
- (On Jefferson alignment) The Maricopa County Court Complex will have over two-thousand jurors per day that are provided with a free Metro pass. This does not include the eight-thousand employees in downtown. – GWG
- (Alignment on) Adams requires lanes reduction and curbside parking removal. - GWG

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6.1.3 Central Phoenix/East Valley (CP/EV) LRT Starter Line Connection Options

In addition to evaluating the north-south and east-west alternative alignments for LRT, METRO examined separate options to connect the Phoenix West LRT extension to the CP/EV LRT Starter Line in downtown Phoenix. As shown in Figure 26, three separate options were presented to connect to the eastbound CP/EV LRT Starter Line along Washington Street: Central Avenue, 1st Street, and 5th Street.

These three options were presented to local stakeholders that could be directly impacted including representatives from the CityScape mixed-use development currently under construction bordered by 1st Avenue, Washington Street, 1st Street and Jefferson Street; U.S. Airways Center; and the Phoenix Convention Center. METRO conducted a quantitative analysis of the three options examining potential utility conflicts, traffic impacts, necessary ROW acquisition, travel time advantages, and connectivity benefits.

Representatives from the Phoenix Convention Center expressed concern about the use of 5th Street between Washington and Jefferson Streets as an exclusive LRT guideway. Although implementation of this alternative would have allowed the same number of travel lanes to remain, 5th Street is heavily used by large delivery trucks and vehicle

traffic during events. The Phoenix West Study Team also noted the use of 5th Street would result in added travel time as passenger traveling from the west to the north would be required to backtrack from 5th Street to Central Avenue. Therefore, METRO decided to carry forward the Central Avenue and 1st Street connection options, and 5th Street as a turnaround facility only for further evaluation.

The draft *Washington/Jefferson LRT Alignment Alternative Connections – Final Definition of Alternatives Technical Evaluation Memorandum* (June 2009), attached as Appendix B, provides an evaluation of the Central Avenue and 1st Street CP/EV LRT Starter Line connection options. Based on the evaluation of these two connection options, it was determined that Central Avenue was the preferred options, for several reasons:

- Central Avenue provided a direct north/south connection to the CP/EV LRT Starter Line, thereby avoiding out of direction travel.
- As a result of the CityScape development, most of the belowground utilities were relocated from Central Avenue to 1st Street. Therefore, use of 1st Street would likely require further relocation of utilities recently moved. CityScape structural engineers indicated reinforcement of Central Avenue was necessary to support the weight of the LRT guideway above a new parking garage that extends below the Central Avenue ROW. METRO is currently working with CityScape engineers to implement an early action to reinforce Central Avenue concurrent with construction of the CityScape development.
- Use of Central Avenue would not require property acquisition, whereas use of 1st Street would require encroachment onto a private property ROW located on the east side of 1st Street, between Washington and Jefferson streets.
- Central Avenue would provide a direct connection with any future South Central southbound light rail alternative, whereas 1st Street would result in out of direction travel to connect with the existing system.

Therefore, METRO has decided to pursue Central Avenue as the CP/EV LRT Connection for the Phoenix West Extension.

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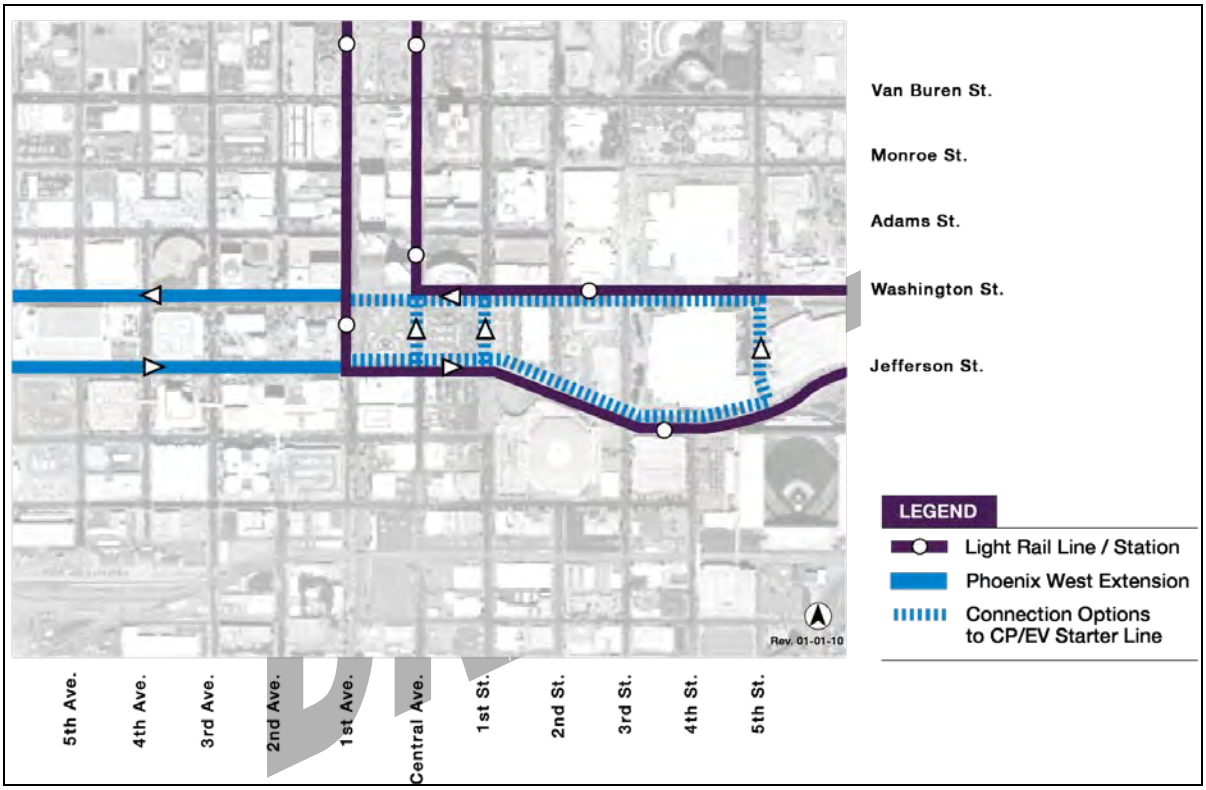
Figure 26 LRT Alternative Downtown Connection Options



Source: Phoenix West AA/EIS Study Team, 2009

6.2 BRT EVALUATION

In addition to providing a comparison of the north-south LRT alignment alternative, the *I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation* (Appendix A) also compares use of either I-17 or 19th Avenue as a BRT route. The same evaluation criteria listed in the previous section for the LRT comparison were used to compare the three downtown BRT alternatives.

Although the 19th Avenue BRT option resulted in a higher number of favorable ratings compared to the I-17 options, since both I-17 options fared well in every category, METRO determined that further evaluation of the options was warranted. Consistent with the stakeholder input provided by ADOT, FHWA, and the City of Phoenix, METRO decided to recommend the I-17 Southbound Frontage Road as an exclusive busway connection to downtown Phoenix. METRO has identified several “early action” activities proposed in advance support of implementing HCT in the Phoenix West Corridor. These activities are described in Section 7.0 and would support METRO’s commitment to bring a HCT solution to the study area.

The following feedback was received from the community and provided guidance to METRO's staff in its recommendation:

- (BRT I-17 option) Would it be possible to site a bus station along I-17 just south of cemetery?
- (Regarding BRT along 19th Avenue) In terms of redevelopment, there are many larges industrial areas along Grand Avenue and I-10. A lot of these industrial properties are flourishing and these properties may not want to just move. The surrounding land uses are uninviting and not pedestrian friendly.
- BRT seems nice because the route can change to serve the demand (DCWG).
- The potential to eliminate the BRT / Express Bus Routes from the 3rd Ave. and 5th Ave. alignments (cutting through our neighborhood)…was something that we are appreciative of…& certain light rail alignments don't overshadow the relief that our neighborhood will feel from the relocation of those bus routes (Roosevelt Action Association).

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7.0 PREFERRED LRT AND BRT ALTERNATIVES

As previously addressed in Section 2.0, in July 2008 the MAG Regional Council endorsed METRO's recommendation to select the I-10 freeway ROW for HCT improvements within the Mainline Section of the Phoenix West Study Area. Therefore, the recommended LRT and BRT alternatives described in this section relate to the Downtown Section of the Study Area.

7.1 LRT

Use of the I-17 **Southbound Frontage Road** is METRO's preferred option that is supported by the City of Phoenix, ADOT, MAG and FHWA for the LRT guideway as a north-south connection with the I-10 freeway median. The benefits associated with section of the I-17 Southbound Frontage Road include:

- This option would result in minimal impacts compared to other alternatives in terms of property acquisition.
- Relatively low traffic volumes currently exist along the southbound frontage road and existing traffic is easily diverted to nearby parallel streets.
- The availability of existing ROW along the frontage road results in reduced costs in terms of property acquisition, structure demolition, utility relocation, and addition of new traffic lanes.
- Providing a HCT option for residents of the St. Matthew Neighborhood and a direct connection to the State Capitol.

The east-west alternative recommended by METRO is the Washington/Jefferson Couplet with a cross-over connection between 8th and 7th avenues due to the following:

- This option is preferred by METRO and stakeholders since both roadways have greater existing traffic lane capacity compared to the other proposed options including Monroe, Adams, and Jackson streets and can accommodate construction of an LRT guideway.
- The four-lane rights-of-way associated with the Washington/Jefferson Couplet would be able to accommodate a LRT guideway with minimal direct (property acquisition) and indirect (property access) impacts compared to the Adams Street alignment.
- The Arizona SHPO supports METRO's recommendation to construct a LRT guideway along Washington Street between 8th Avenue and 1st Avenue. This would allow Washington Street between the State Capitol (at 17th Avenue) and 8th Avenue to retain its current traffic configuration.
- Use of Jefferson Street provides direct access to the State Capitol for a connection from the West Valley and METRO Starter Line.

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- LRT along Jefferson Street provides an opportunity to serve the St. Matthew Neighborhood with a HCT option.
- Use of Adams Street as an LRT guideway would present conflicts near the State of Arizona Department of Administration in terms of employee access, loss of a heavily used courtyard, and possible vibration impacts to the State Data Center.

Figure 27 illustrates the complete downtown LRT preferred alignment with a north-south connection along the I-17 Southbound Frontage Road connecting to Jefferson Street with a connection to the CP/EV LRT Starter Line at 1st Avenue (westbound) and Central Avenue (eastbound).

In anticipation of a HCT commitment from the City of Phoenix and partnering agencies in downtown Phoenix, METRO is recommending that some “early actions” are undertaken to alleviate issues that could potentially delay future planning efforts. As indicated in Figure 27, one of the early action items is construction of HCT drop-ramps onto the I-17 Southbound Frontage Road that would connect to the median of I-10. These drop-ramps could accommodate an exclusive busway and/or LRT guideway. METRO is pursuing this action with joint cooperation from FHWA, ADOT, and the City of Phoenix.

The second early action is associated with the proposed LRT connection at Central Avenue from the Phoenix West corridor to the CP/EV LRT Starter Line. In direct association with the new CityScape project currently under construction and overseen by Red Development, LLC, an underground parking garage was recently constructed on Central Avenue ROW between Washington and Jefferson streets. Red Development, LLC, representatives noted that ancillary structures associated with the parking garage may not be able to support the weight of LRT track and vehicle. CityScape conducted a separate study and concluded that reinforcement of Central Avenue in this location was necessary to support the weight of the LRT track and vehicle. If LRT is selected as the preferred mode for the Phoenix West corridor, it would be in METRO’s best interest to reinforce this area before the entire high-density, mixed-use CityScape complex is complete.

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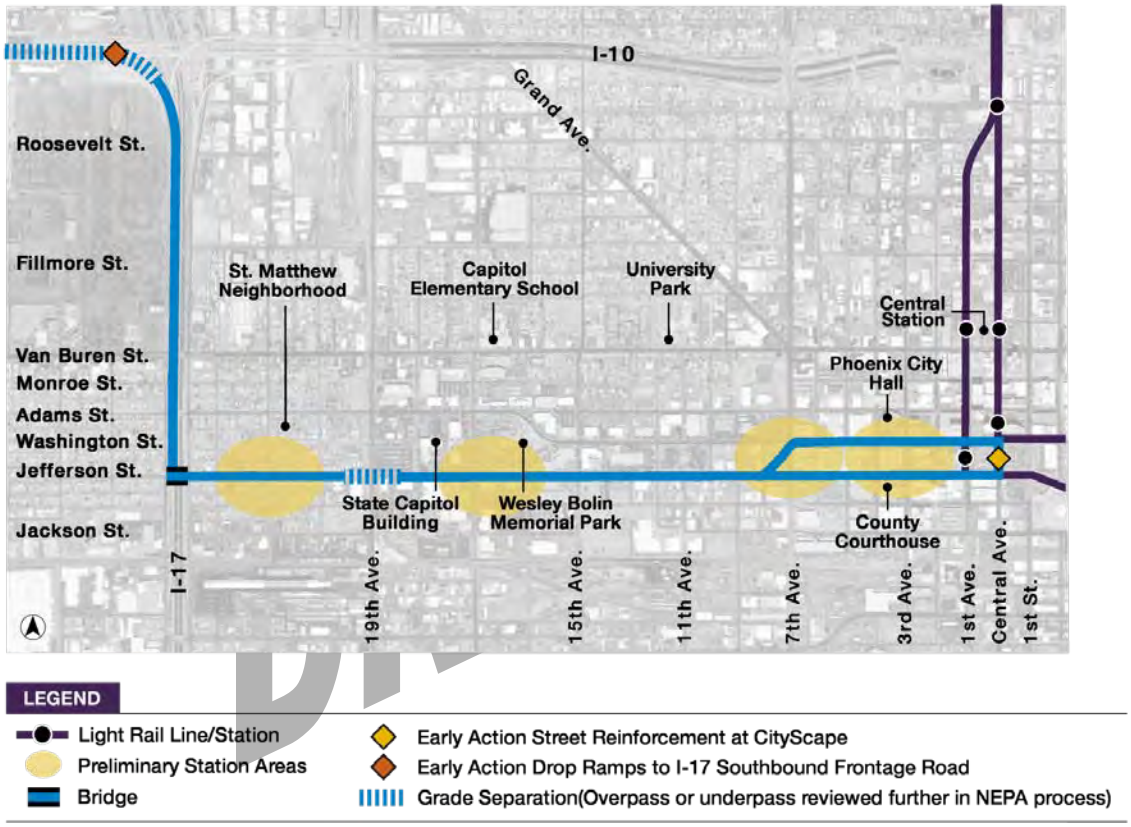
Figure 27 Preferred Phoenix West Downtown LRT Alternative



Source: Phoenix West AA/EIS Study Team, 2009

7.2 BRT

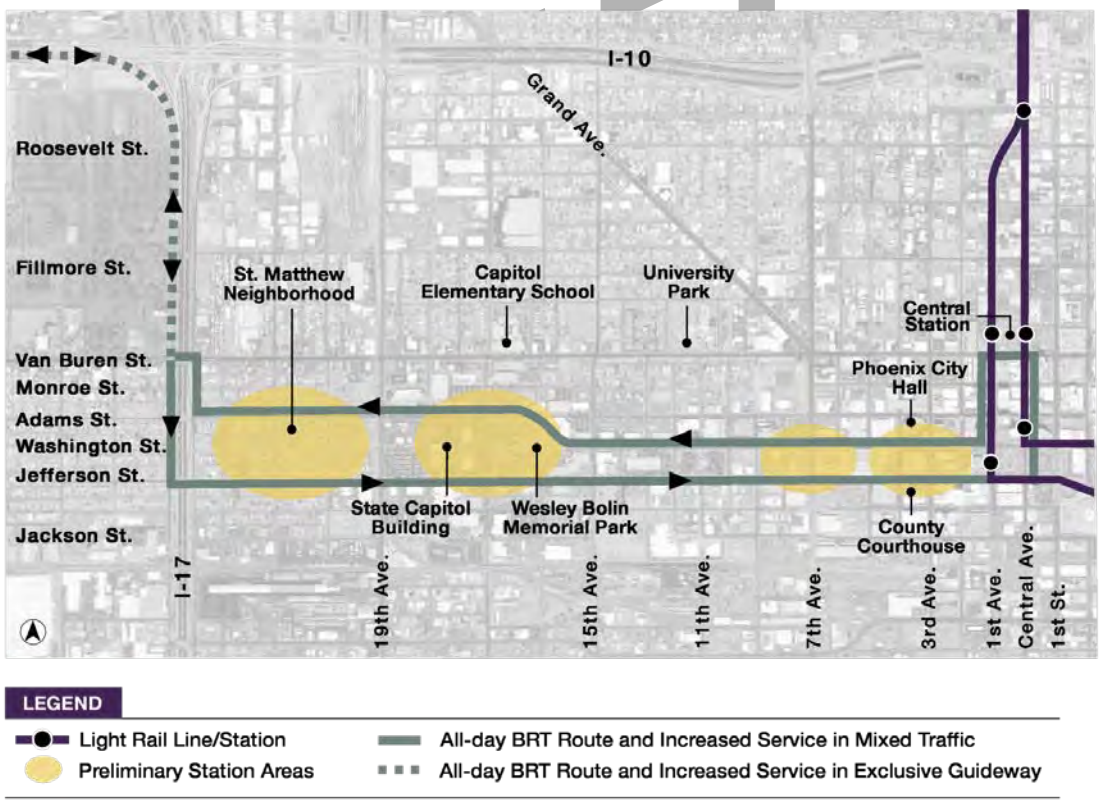
The preferred Phoenix West BRT alternative would use an exclusive busway providing direct travel connectivity from the 79th Avenue Park-and-Ride east within an exclusive busway along the I-10 median. The busway would then continue downtown along the current I-17 Southbound Frontage Road via a direct access ramp connection to the I-10 median. BRT would operate in the exclusive Frontage Road busway to Van Buren Street after which in-bound routes would continue on the Frontage Road in mixed traffic and turn east on Jefferson Street to connect to the State Capitol. Out-bound buses would also operate in the two-way busway, traveling northward along the I-17 Southbound Frontage Road from Jefferson Street before entering I-10 via a direct access ramp.

All existing Express and RAPID routes operating along I-10 west of downtown would be diverted to use the same Phoenix West BRT route. Therefore, these Express and RAPID routes would discontinue use of the direct access HOV ramp that connects to 5th and 3rd Avenues from I-10. Discontinued use of the 5th/3rd Avenue direct access HOV ramp would benefit the Phoenix West project for the following reasons:

- The I-17 Southbound Frontage Road would promote enhanced connectivity to the State Capitol.
- Use of the I-17 Southbound Frontage Road would remove bus traffic from I-10 between I-17 and the 5th/3rd Avenue direct access HOV ramp, expediting travel times to and from downtown Phoenix and reducing the impact on the rest of freeway travel.

Preliminary station area locations are the same as those described for the recommended LRT alternative. Figure 28 shows the preferred downtown BRT alternative.

Figure 28 Preferred Phoenix West Downtown BRT Alternative



Source: Source: Phoenix West AA/EIS Study Team, 2009

CHAPTER 7

Next Steps

8.0 NEXT STEPS

8.1 REFINEMENT OF REMAINING ALTERNATIVES

Although preferred alternative alignments have been identified for both future LRT and BRT service, further refinements are necessary to complete the connection with the METRO Starter Line and operation details will need to be determined (e.g., bus service modifications, station and park-and-ride locations, costs, etc.). The Phoenix West Study Team will engage in station planning during the NEPA process, which is further described in Section 8.4.

The Phoenix West Study Team is currently evaluating the best connection for the recommended Washington/Jefferson Street LRT alternative. Several conflicts in terms of potential impacts to current development (CityScape mixed-use development project) and possible operational challenges such as headway (frequency) conflicts exist at interline options currently under consideration.

Additionally, the Phoenix West Study Team will continue to work with the local downtown community, the City of Phoenix, and representatives from BNSF to determine what type of grade separation structure (LRT only) should be constructed to avoid impacts to the railroad along 19th Avenue. A grade separation structure would not be necessary for the BRT option at 19th Avenue currently under consideration.

8.2 RECOMMEND TRANSIT MODE

The Phoenix West Study Team is currently coordinating with FTA to focus the travel forecasting efforts in accordance with the FTA required New Starts evaluation criteria. Modeling is expected to continue through early 2010, with a recommended transit mode anticipated in fall 2010.

8.3 RECOMMEND LPA

Once the final alignment and mode are selected through downtown Phoenix, a Locally Preferred Alternative will be presented to stakeholders in fall 2010. The LPA will then be presented to decision-making entities including the following for approval: Village Planning Committees, the Phoenix Planning Commission, the Citizens' Transit Commission, the METRO Board, and finally the MAG Regional Council.

8.4 ENGAGE IN NEPA

The purpose of the NEPA process is to explore, in a public setting, the effects of the proposed project and its alternatives on the physical, human, and natural environment. The FTA and METRO will evaluate all significant environmental, social, and economic impacts of the construction and operation of the proposed action or locally preferred alternative. Impact areas to be addressed include: land use; development potential; secondary development; land acquisition; displacements and relocations; cultural

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resources (including impacts on historical and archaeological resources); parklands and recreational areas (Section 4(f)); visual and aesthetic qualities; air quality; noise and vibration; ecosystems (including threatened and endangered species); energy use; business and neighborhood disruptions; environmental justice; changes in traffic and pedestrian circulation and congestion; and changes in transit service and patronage. Measures to avoid, minimize, or mitigate any significant adverse impacts will be identified and evaluated.

8.5 NOTICE OF INTENT

The FTA issued a Notice of Intent (NOI) on October 2, 2007 stating that the FTA and METRO intended to prepare an AA/EIS on proposed high capacity transit improvements in the Phoenix West Corridor. FTA and METRO will decide whether a new NOI is necessary to initiate the EIS process.

8.6 PUBLIC INVOLVEMENT AND SCOPING

As this evaluation is part of the overall process under the FTA Alternatives Analysis requirements and NEPA, METRO has followed both the federal process and agency procedures to comply with public outreach requirements. METRO has also made extensive efforts to involve the community and local, state, and federal agencies beyond required processes. The public involvement and scoping process for this project was initiated in October 2007 with public and agency scoping meetings. Public involvement efforts are summarized in the following paragraphs, with a detailed list of stakeholder groups met with during the planning process listed in Appendix C.

Community Working Groups: METRO established Community Working Groups (CWGs) for both the downtown and mainline portions of the Study Area to more broadly engage the public in the planning process. The CWGs were formed as an advisory group to develop and assess the alignment alternatives (Downtown CWG only), transit technology, and station locations. These groups met regularly depending on the timing and the extent of issues to be discussed. Primary issues for the mainline group included station planning, while the downtown group was focused on proving input more specifically related to alignment. The groups were initially invited to participate through an outreach effort that included neighborhood organizations, City of Phoenix Village Planning Committees, individual property owners and business organizations. Individuals were invited to participate and to also share information from the meetings with their representative groups.

Government Working Group: The Government Working Group was established to engage agencies and others involved in planning for the future of transit alternatives in the vicinity of downtown Phoenix and in close proximity to state agency buildings. This group was made up primarily of individuals identified through meetings with representatives from the Arizona Growth and Infrastructure Cabinet and met regularly throughout the planning process for discussion about downtown Phoenix alternatives.

Neighborhood Groups: Multiple Neighborhood groups were engaged through both participation by Village Planning Committees and representatives from these groups who participated in the Community Working Group Sessions. METRO presented at several meetings by request of these groups, with a full list of meetings included in Appendix C.

In addition to these groups, METRO also met with numerous individual stakeholders during the alternatives development process. A full list of these stakeholders is listed in Appendix C. METRO intends to continue working with these groups as well as project stakeholders through the development and approval of a Locally Preferred Alternative and as part of the continued NEPA process for this project.

Public Meetings: In addition to meeting with select stakeholder groups during the planning process, METRO has held several public meetings that corresponded with major milestones in the planning process. Subsequent to the 2007 Public Scoping Meeting, members of the public were invited to separate meetings for their input on recommendations made after both Tier 1 and Tier 2 analysis.

METRO and the Phoenix West Study Team have remained committed to engaging numerous stakeholders throughout the planning process and will continue stakeholder and public outreach as the study progresses. As the project moves forward into the EIS phase, public involvement will shift to the evaluation and refinement of the locally preferred alternative and potential impacts to the human environment, anticipated to commence in fall 2010.

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Appendix A

I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation Memorandum

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MEMO

To: City of Phoenix Technical Team

From: METRO Project Team

Date: March 3, 2010

Re: Phoenix West Extension AA/EIS Study
I-17 and 19th Avenue – Final Definition of Alternatives Technical Evaluation

Background

As identified in the I-10 West AA/EIS *Draft Tier 2 Evaluation Report* (March 2009), Interstate 17 (I-17) and 19th Avenue were identified as the two preferred North-South Alignment Alternatives warranting further study during the Final Definition of Alternatives planning phase. ***Note: subsequent to the completion of the Tier 2 Evaluation Report, METRO renamed the study corridor to Phoenix West Extension.*** Both light rail transit (LRT) and bus rapid transit (BRT) high capacity transit modes were considered for the two north-south street options in this memorandum. The North-South Alignment Alternatives are shown in Figures 1, 2 and 3. Each figure also depicts grade separations (described in this document), required for each option. Grade separations on Adams or Jefferson at 19th Avenue would not be needed for the BRT option as buses would operate in mixed traffic on existing streets.

Figure 1 I-17 SB Frontage Road LRT Option

Figure 2 I-17 NB Frontage Road LRT Option

Figure 3 19th Avenue LRT Option

LRT Options

This memorandum describes the evaluation of three options are currently under examination for north-south **LRT** travel along I-17:

- The first assumes use of the I-17 southbound frontage road located just west of the freeway (Figure 1).
- The second option would use the I-17 northbound frontage road as a LRT guideway by either using the existing northbound frontage road right-of-way, resulting in a shift of the frontage road just east of its current location (Figure 2).
- The other option is based on the assumption that the Arizona Department of Transportation (ADOT) would proceed with a proposed widening project along the I-17 freeway within the study area. This would shift the I-17 northbound frontage road to the east to accommodate the widening of the existing I-17 right-of-way by extending approximately 300 to 500 feet east of its current location. The LRT guideway would be placed just east of the new I-17 northbound frontage road (not pictured).

The LRT option along 19th Avenue would require a guideway structure that would extend along the I-10 median through the I-17/I-10 stack interchange to approximately 17th Avenue, where a drop ramp would provide direct access north of I-10 to operate at grade along Grand Avenue, before heading west on Culver Street and finally travel south along 19th Avenue (Figure 3).

BRT Options

The proposed BRT options vary in terms of operation to the State Capitol from the west. These would operate a two-part service, where the Part “A” service would offer transit riders in the West Valley improved direct mobility to the State Capitol. Part “B” service would deliver transit riders directly to downtown Phoenix, before terminating at the State Capitol. For part “A” service, two North-South alignments (I-17 and 19th Avenue) and one East-West alignment (Washington/Jefferson couplet) were considered. One BRT option along I-17 (BRT I-17 Mixed Traffic option) assumes that buses would operate in the I-10 median west of 35th Ave, merging into general purpose lanes near 35th Ave traveling eastbound. Buses would thus have to cross the high-occupancy vehicle (HOV) lane and general purpose lanes to access the I-17 southbound ramp, using existing roadways to operate in mixed traffic.

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A second BRT option along I-17, similar to the LRT frontage road options, allows for BRT operating along an exclusive busway that would directly connect travel from the I-10 median to the southbound I-17 frontage road. BRT would operate on the exclusive busway from the I-17/I-10 stack interchange to Van Buren Street after which in-bound routes will continue on the frontage road and turn east on Jefferson Street to connect to the State Capitol. Out-bound buses would operate in mixed traffic along the Northbound frontage road from Jefferson Street to Van Buren Street and merge on to the exclusive busway.

The 19th Avenue BRT option would operate similar to the LRT option along 19th Avenue, requiring an exclusive busway east of the I-17/I-10 stack interchange before connecting to Grand Avenue via a drop ramp. Buses would then operate in mixed traffic along Grand Ave and Culver Street before heading south along 19th Avenue.

For Part "B" service, depending on the North-South option for Part "A" service, BRT vehicles would either merge with HOV lanes and continue traveling east and use the 5th Ave HOV ramp to get to Downtown Phoenix (with I-17 North-South option) or remain in the exclusive busway within the I-10 median traveling east to 17th Ave after which, the buses will merge with the HOV lanes and use the 5th Ave HOV ramps to connect to downtown Phoenix (with 19th Ave North-South option). Figures 4 and 5 show the BRT options:

Figure 4 I-17 BRT Option

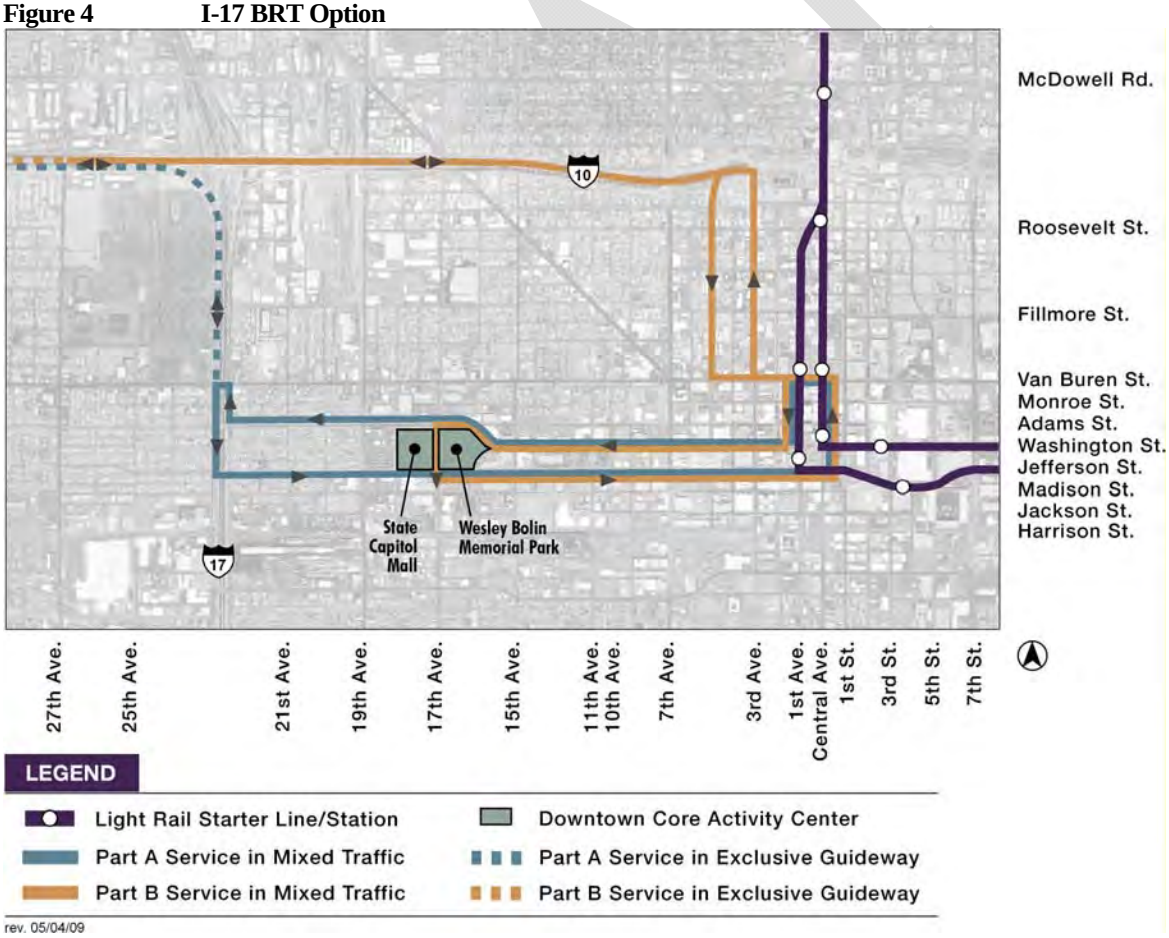
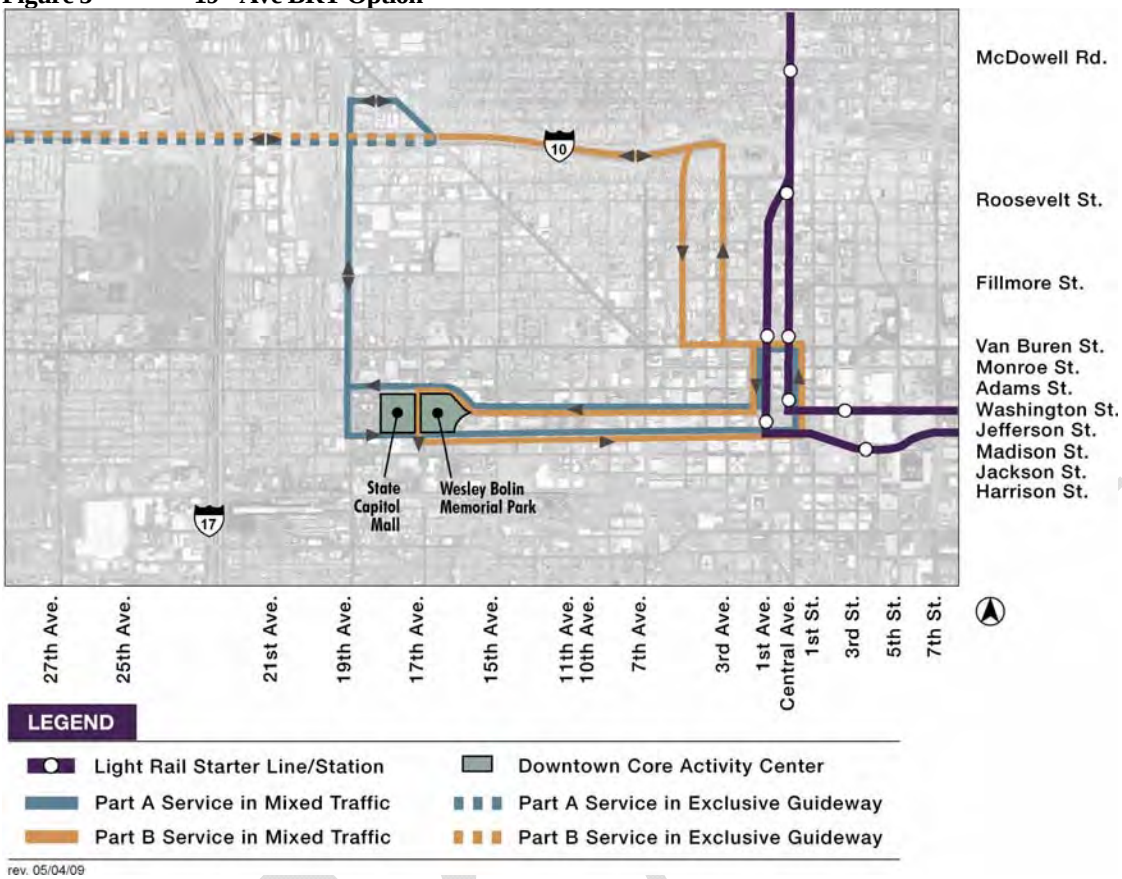


Figure 5 19th Ave BRT Option



A preliminary qualitative comparison of the separate alignments is provided in Table 1 for both LRT and BRT travel, unless otherwise noted.

Table 1 I-17 and 19th Avenue Alignment Alternative - Preliminary Considerations

Issue	Transit Mode	I-17 Southbound Frontage Road	I-17 Northbound Frontage Road (With and without ADOT widening)	19th Avenue
Travel Time	LRT and BRT	Better travel time due to being adjacent to the freeway and able to abide by higher posted speed limits.	Better travel time due to being adjacent to the freeway and able to abide by higher posted speed limits.	Slower travel time resulting from vehicles turning to connect via a clover-leaf structure at-grade to 19th Avenue via Grand Avenue. Additionally, trains would be subject to a lower posted speed limit along 19th Avenue and would require a stop at the station serving the State Fairgrounds.

Issue	Transit Mode	I-17 Southbound Frontage Road	I-17 Northbound Frontage Road (With and without ADOT widening)	19th Avenue
State Fairgrounds Area Access	LRT and BRT	Would not serve the Arizona State Fairgrounds along the I-17 portion of the alignment	Would not serve the Arizona State Fairgrounds along the I-17 portion of the alignment.	Serves the Arizona State Fairgrounds (or future development in the same locale), identified as a prominent activity center near downtown Phoenix.
Utility Conflicts	LRT	No major utility impacts have been identified within the I-17 right-of-way.	No major utility impacts have been identified within the I-17 right-of-way.	LRT could result in a potential conflict with a 75-inch underground storm drain within the 19th Avenue right-of-way.
ADOT/Other Agency Coordination	LRT and BRT	ADOT and FHWA are willing to work with METRO to abandon a portion of the I-17 southbound frontage road for use by METRO as an exclusive high capacity transit (HCT) guideway. For the LRT option, BNSF prefers use of I-17 that would result in construction of an overpass that would span the railroad adjacent to 19th Avenue.	Requires extensive coordination with ADOT on the future expansion of I-17 within the study area, which has the potential to adversely affect the Phoenix West Corridor schedule. For the LRT option, BNSF prefers use of I-17 that would result in construction a overpass that would span the railroad.	This alignment would avoid paralleling the I-17 right-of-way; therefore, the project schedule does not hinge on ADOT's plans to widen I-17. For LRT, BNSF does not support this option, citing potential safety concerns with having a LRT operate parallel to an active freight railroad.
Future ADOT Expansion	LRT and BRT	I-17 alignment would allow ADOT to potentially use the I-10 median east of the I-17 / I-10 stack interchange for future lane expansion for increased capacity through central Phoenix.	I-17 alignment would allow ADOT to potentially use the I-10 median east of the I-17 / I-10 stack interchange for future lane expansion for increased capacity through central Phoenix.	An I-10 median alignment between 27th Avenue and 17th Avenue interferes with ADOT's ability to add needed freeway lane capacity from the I-17 / I-10 stack interchange through central Phoenix.
Neighborhood Conflicts	LRT	Potential issues related to the St. Matthews Neighborhood between I-17 and 19th Avenue; however, avoids impact to the Oakland Historic District.	Potential issues related to the St. Matthews Neighborhood between I-17 and 19th Avenue; however, avoids impact to the Oakland Historic District.	Potential issues with properties within the Oakland Historic District that could be adversely affected.
Grade Separation Requirements	LRT and BRT	Requires either an overpass or underpass to avoid impacts to the BNSF railroad and a overpass to span across I-17 freeway adjacent to Jefferson Street overpass.	Requires either an overpass or underpass along a downtown arterial to avoid impacts to the BNSF railroad.	For LRT, an overpass would need to be constructed to span the BNSF railroad tracks along I-10 would avoid impacting downtown east-west arterials.

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Issue	Transit Mode	I-17 Southbound Frontage Road	I-17 Northbound Frontage Road (With and without ADOT widening)	19th Avenue
Cost	LRT and BRT	In terms of costs associated with a grade separation feature, I-17 costs would be **lower** compared to 19th Avenue; however, additional cost would be associated with construction of a bridge to span I-17.	In terms of structural costs associated with a grade separation feature, I-17 costs would be **lower** compared to 19th Avenue.	In terms of structural costs associated with a grade separation feature, 19th Avenue costs would be **higher** compared to the I-17 options.
Floodplain Concerns	LRT	Potential storm drainage issues associated with the Cave Creek 100-year floodplain if an LRT underpass is constructed to cross the BNSF railroad tracks along the selected downtown East-West alignment alternative.	Potential storm drainage issues associated with the Cave Creek 100-year floodplain if an underpass is constructed to cross the BNSF railroad tracks along the selected downtown East-West alignment alternative.	Not applicable.

Source: Phoenix West Extension AA/EIS Study Team (March 2009)

Purpose of the Memorandum

This technical memorandum identifies eight evaluation criteria that were used to provide a quantitative comparison of the I-17 and 19th Avenue Alignment Alternatives for each transit technology. The purpose of this memorandum is to compare the LRT and BRT North-South Alignment Alternatives to determine which options should be retained for further evaluation. No comparisons are being done at this stage between transit technologies.

This evaluation presents results of each criterion in an even manner. Criteria were not weighted for the purpose of this memorandum; therefore results show that each of the criteria are of equal importance.

Evaluation Criteria

Eight evaluation criteria allowed the Phoenix West AA/EIS Study Team to assess the I-17 and 19th Avenue Alignment Alternatives in a detailed manner, building off the qualitative assessment presented in Table 1. A rating of 1 through 5 was assigned to each of the evaluation criteria, with 5 representing a favorable outcome and 1 representing a less desirable result. Separate ratings have been assigned for the North-South options to each transit technology.

The methodology for the rating determination for each criterion is also described in this section.

Destinations Served – This criterion is evaluated by looking at future population and employment served. A combined overall rating was assigned for this criterion.

The Phoenix West Extension AA/EIS Study Team examined forecasted population and employment densities for the year 2030 within ½-mile of the two alignment alternatives. By examining the

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population and employment densities within proximity to the two options, it is possible to estimate which of the two options would have the potential to generate the highest amount of transit ridership.

Rating	Population Rating (# of residents)	Employment Rating (# of employees)
5	5,600 – 7,000	8,000 – 10,000
4	4,200 – 5,599	6,000 – 7,999
3	2,500 – 4,199	4,000 – 5,999
2	1,400 – 2,499	2,000 – 3,999
1	0 – 1,399	0 – 1,999

According to 2030 MAG socioeconomic data, the higher residential and employment densities within ½-mile of the North-South Alignment Alternatives are projected to reside along 19th Avenue compared to I-17. The population within a ½-mile of I-17 is projected at 3,791 residents compared to 6,530 along 19th Avenue. Similarly, for employment the higher number is anticipated along 19th Avenue (9,859) compared to I-17 (4,279). Since this criteria is independent of the transit mode as well as the type of operations (mixed traffic or exclusive guideway), both BRT and LRT North-South alternatives will be assigned the same ratings.

Travel Time – To provide an impartial estimation of travel times for BRT and LRT operations using either I-17 or 19th Avenue, the travel time was determined from a potential station location identified at 35th Avenue along I-10 to the METRO Starter Line using the Jefferson Street 2-Track Connection Option (the furthest south east-west alignment).

The evaluation assumed LRT would operate in a fixed guideway and adhere to posted speed limits the entire distance for both the I-17 and 19th Avenue options. Several assumptions were used for BRT operations. In the I-17 Alternative, BRT would operate in either mixed traffic or in a fixed guideway until Van Buren Street, where at that time, all BRT alternatives would operate in mixed traffic. In the 19th Avenue Alternative, BRT operations using 19th Avenue were assumed to be similar to LRT operations using 19th Avenue as buses would operate in a fixed guideway along I-10 until they connect to Grand Avenue at grade, where buses would then operate in mixed traffic until Central Station.

Each alternative and its associated technology were assigned a rating between 1 and 5, where the shortest travel time would be given a 5 and the longest was given a 1. The rating for travel times is identified below:

5 = less than 11 minutes, 49 seconds
4 = between 11 minutes, 50 seconds and 12 minutes, 9 seconds
3 = between 12 minutes, 10 seconds and 12 minutes, 29 seconds
2 = between 12 minutes, 30 seconds and 12 minutes, 49 seconds
1 = greater than 12 minutes, 50 seconds

Travel times were calculated based on a combination of standardized speed estimation and travel times extracted from the 2030 METRO No Build model (EMME/2). Travel times from the 2030 METRO No Build model were used to estimate for both technologies. In order to determine the optimal alternative and technology, travel times were calculated during the AM peak, in the peak direction.

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For the I-17 Alternative, two methodologies were used for calculating BRT travel times. The first methodology assumed that BRT would operate in mixed traffic once it reached the I-17 Interchange. For this operation, standardized speed estimation was used for BRT between 35th Avenue and the I-17 Interchange. Once BRT reached the I-17 Interchange, peak travel times from the 2030 METRO No Build model were used. The second methodology assumed that BRT would operate in a fixed guideway from 35th Avenue to I-17 south to Jefferson Street via the northbound or southbound I-17 Frontage Road. For this operation, standardized speed estimation was used for BRT between 35th Avenue and the Jefferson Street couplet. Once BRT reached Jefferson Street, peak travel times from the 2030 METRO No Build model were used.

For the 19th Avenue Alternative, standardized speed estimation was used for BRT between 35th Avenue and the 19th Avenue. Once BRT reached the 19th Avenue, peak travel times from the 2030 METRO No Build model were used.

For the I-17 Alternative, standardized speed estimation was used for LRT between 35th Avenue and I-17 south to Jefferson Street via the northbound or southbound I-17 Frontage Road. Once LRT reached Jefferson Street from I-17, peak travel times from the 2030 METRO No Build model were used.

For the 19th Ave Alternative, LRT used the standard speed estimation between 35th Avenue and 19th Avenue. Once LRT reached 19th Ave, peak travel times from the 2030 METRO No Build model was used.

The following table identifies the approximate travel time by alternative and technology.

Table 2 Estimated Peak Eastbound Travel Time (in minutes)

Peak Eastbound Travel Times (in min:sec)	LRT				BRT		
	LRTI-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Travel Times	12:13	11:29	11:53	12:22	12:47	11:26	12:32

Source: Phoenix West AA/EIS Study Team (March 2009)/ 2030 MAG Travel Forecasting EMME/2 Model

The overall travel time for both the I-17 and 19th Avenue Alignment Alternatives did not greatly vary through downtown Phoenix although for both BRT and LRT, the I-17 Southbound option provided the least amount of travel time.

Property Acquisition – Preliminary conceptual-level design drawings of both alignment alternatives for LRT and BRT transit modes showed properties that would be impacted or require acquisition to accommodate both transit modes.

The number of partial property takes as well as full property takes were estimated for each north-south option. Every full property take was assigned a weight of 2, while a partial property take was assigned a unit weight. An overall score was calculated based on the number of partial and full takes along each alignment alternative. The I-17 Northbound Frontage Road alignment option assuming

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ADOT widening will result in 21 partial takes and 5 full takes, while the north bound frontage road option without ADOT widening will require 14 partial takes and no full takes. It is important to note that the property acquisition estimates described for the ADOT widening option only account for the properties that would be impacted from implementation of an LRT guideway east of the new freeway location, and does not account for the properties that fall between the existing Northbound Frontage Road and the LRT alignment.

The highest number of property acquisitions would likely occur with the implementation of LRT along the 19th Avenue Alignment Alternative. The majority of the property impacts are expected along 19th Avenue where a fixed guideway would require property acquisitions along the east side of 19th Avenue. BRT operations along 19th Avenue would also result in property acquisitions, which would be limited to properties along Grand Avenue and West Culver Street to accommodate the drop-ramp from I-10. The results of this evaluation are presented in Table 3.

Table 3 Estimated Number of Property Takes by North-South Alignment Alternative

	LRT				BRT		
	LRT I-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Number of Full Property Takes	0	6	5	16	0	0	0
Number of Partial Property Takes	14	9	21	35	0	0	0
Total Number of Properties Impacted	14	15	26	51	0	0	0
Average Score of Properties Impacted	14	21	31	67	0	0	0

Average Score = (Number of Full Property Takes * 2) + (Number of Partial Property Takes * 1)
Source: Phoenix West AA/EIS Study Team (March 2009)

Ratings were assigned as follows:

<u>Average Score of Partial and Full Takes</u>

5 = 0 – 14
4 = 15 – 29
3 = 30 – 44
2 = 45 – 59
1 = 60 – 74

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Adjacent Land with Potential for Redevelopment – Economic development potential was used as a proxy to evaluate the extent of community impact by examining the adjacent vacant parcels within ¼-mile along each alignment option to determine whether existing zoning encourages development conducive to attracting high numbers of residents, workers, or visitors that could ultimately utilize a high capacity transit system in downtown Phoenix as well as areas with high potential for redevelopment as a proxy to destinations served.

Table 4 Acreage of Adjacent Vacant Parcels and Parcels with Potential for Redevelopment

	LRT				BRT		
	LRT I-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Acres of adjacent potential redevelopment property	35.1	19.5	45.5	114.7	0	19.5	114.7
Acres of Vacant Parcels	9.5	1.6	11.6	24.3	0	1.6	24.3

Source: 2009 City of Phoenix Existing Land Use

In addition, the I-17 and 19th Avenue alignment alternatives were examined for redevelopment potential. By examining the current land use of the parcels in the vicinity of the I-17 and 19th Avenue Alignment Alternatives, it was determined whether adjacent parcels have a potential for redevelopment. Generally, parcels with commercial, industrial and other ancillary non-residential uses such as parking were considered candidates for redevelopment. In this assessment, parcels within ¼-mile of each alignment were examined for the land uses previously listed. The total acreage of all such properties was compared to assign ratings. Even though research shows that there is likely more development attracted towards areas surrounding LRT stations as compared to BRT stations, for the purpose of this memo, both BRT and LRT North-South options have been assigned similar ratings. Ratings were assigned as follows:

Rating	Adjacent Vacant Parcels (Acres)	Redevelopment Potential (acreage of adjacent potential redevelopment property)
5	20 or more	100 – 125
4	15 – 19	75 – 100
3	10 – 14	50 – 75
2	5 – 9	25 – 50
1	0 – 4	0 – 25

A preliminary assessment of vacant parcels within a quarter mile along 19th Ave and I-17 alignment alternatives revealed that 19th Ave alignment had approximately 24.3 acres of vacant land available while the I-17 alignment option had approximately 11.6 acres of vacant land available for redevelopment.

The 19th Ave alignment secured a higher rating for redevelopment potential as compared to I-17 alignment primarily because the I-17 alignment is adjacent to the widened I-17 freeway which only allows redevelopment to occur on the east side of the alignment. 19th Ave alignment option had 114.7 acres of area available for redevelopment whereas I-17 alignment option had 45.5 acres of area available.

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Environmental Impacts – This evaluation examined potential impacts using a qualitative analysis for both the I-17 and 19th Avenue Alignment Alternatives on environmental criteria including impacts to Environmental Justice (EJ) populations as well as impacts to historic properties. An overall rating was assigned based on ratings assigned for individual sub-criterion.

Environmental Justice Population: Title VI of the Civil Rights Act of 1964 and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, require consideration of minority and low-income populations in major transportation investments. Executive Order 12898 requires that federal agencies consider and address disproportionately high adverse environmental effects of proposed federal projects on the health and environment of minority and low-income populations to the greatest extent practicable by law.

For this evaluation, definitions of minority and low-income areas were established based on guidance provided by the Council on Environmental Quality (CEQ). CEQ's *Environmental Justice Guidance Under the National Environmental Policy Act*, December 10, 1997, states, "Minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." The CEQ further states that "The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, a census tract, or other similar unit that is chosen so as to not artificially dilute or inflate the affected minority population."

For this analysis, the regional transit service area has been selected as the unit of geographic analysis for comparison. In conformance with the City of Phoenix policy (Phoenix is the transit federal grant recipient for the Maricopa Association of Governments (MAG) region), locations within the study area with higher percentages of low-income and minority populations than the regional transit service area's will be considered low-income areas or areas with high concentrations of minority populations. Currently, the regional transit service area percentage for minority populations is 37.6% and for low-income population is 13.1 percent. Information to evaluate low-income and minority populations is based on the 2000 US Census.

Each of the alternatives was rated to indicate the extent of impacts to such populations. More specifically, the alternatives were rated as follows:

5 = No businesses or residences within a low income and/or minority area to be relocated

4 = 1 – 2 businesses or residences within a low income and/or minority area to be relocated

3 = 3 – 4 businesses or residences within a low income and/or minority area to be relocated

2 = 5 – 6 businesses or residences within a low income and/or minority area to be relocated

1 = More than 6 businesses or residences within a low income and/or minority area to be relocated

Note that the ratings assigned are preliminary at this stage of conceptual design. As the study advances, mitigation strategies for adverse impacts would be developed.

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Table 5 Estimated Number of Relocations by North-South Alignment Alternative Within EJ Areas

	LRT				BRT		
	LRTI-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Number of Full Property Takes	0	6[1]	5	16	0	0	0
Number of Businesses	0	0	5	16	0	0	0
Businesses in Minority Areas	0	0	5	1	0	0	0
Businesses in Low Income Areas	0	0	5	1	0	0	0
Number of Residences	0	4	0	0	0	0	0
Residences in Minority Areas	0	4	0	0	0	0	0
Residences in Low Income Areas	0	4	0	0	0	0	0

[1] Two properties are vacant

Source: Phoenix West AA/EIS Study Team (March 2009)/2000 US Census

The estimated number of businesses and residences to be relocated by alternative is shown in Table 5. Some of the alternatives require relocations within minority as well as low income areas. Within a low-income and minority area, the I-17 SB Frontage Road LRT Alternative requires relocation of 4 residences.

Impacts to Historic Resources: This analysis evaluated potential impacts to historic districts, buildings (including single-family houses), and structures using preliminary conceptual-level design drawings for both alignment alternatives. The preliminary design drawings were reviewed to identify potential curb set backs, new right-of-way requirements, and potential property acquisitions that could directly affect historic districts, buildings, and structures identified in the *Tier 1 Cultural Resources Evaluation* as listed in or previously determined eligible for listing in the National Register of Historic Places (NRHP) or Phoenix Historic Property Register. This analysis also examined previously unrecorded historic-age buildings and structures preliminarily evaluated by the Tier 1 analysis as potentially eligible.

The LRT 19th Avenue alignment would impact six properties within the Oakland Historic District located along the east side of 19th Avenue. The LRT I-17 northbound frontage road alignment would impact one Phoenix Register Listed property and the southbound frontage road alignment would impact one Potentially National Register Eligible property. The LRT I-17 ADOT widening alignment would impact one National Register Eligible property and seven Potentially National Register Eligible properties.

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Table 6 Number of Potentially Affected Historic Resources

	LRT				BRT		
	LRTI-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Number of Properties within a Historic District	0	0	0	6	0	0	0
Number of Phoenix Register Listed Properties Impacted	1	0	0	0	0	0	0
Number of National Register Eligible Properties Impacted	0	0	1	0	0	0	0
Number of Potentially National Register Eligible Properties Impacted	0	1	7	0	0	0	0
Total Number of Historic Resources Impacted	1	1	8	6	0	0	0

Source: URS 2008

Each alternative and its associated technology were assigned a rating between 1 and 5, where the no impacts to historic properties would be given a 5 and the greatest number of properties impacted was given a 1. The rating for historic resources is identified below:

5 = Likely no impact to historic resources
4 = Likely impact to 1 historic resource
3 = Likely impact to 2-3 historic resources
2 = Likely impact to 4-5 historic resources
1 = Likely to impact to 6 or more historic resources

Other environmental issues such as noise, visual resources etc. will be evaluated in more detail in the EIS phase. A general assessment of the alignments with respect to those issues is provided below. Mitigation and costs associated with minimizing impacts to environmental resources are not included in this evaluation.

Noise: In general, all of the I-17 and 19th Avenue Alignment Alternatives fall within highly developed areas, with both options adjacent to a few residential homes south of Van Buren Street. Although construction and operation of either LRT or BRT would not likely affect property owners adjacent to I-17 since ambient noise levels are currently influenced by freeway traffic, the I-17 alignment alternative has the potential to result in greater noise impacts compared to I9th Avenue. The reasoning behind this conclusion is that the remaining connecting East-West Alignment Alternatives (Adams and Jefferson Streets) fall within the St. Matthews residential neighborhood. Residents in this neighborhood could experience an increase in noise during construction of an LRT system guideway; however, BRT would not result in noise impacts due to operation of buses with general traffic. The remainder of each alignment alternative east of 19th Avenue is surrounded by industrial and

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commercial properties, generally not considered sensitive land uses that would be susceptible to noise impacts.

Operation of BRT or LRT is not expected to result in noise impacts that would violate Federal or local standards.

Visual Impacts: This criterion, typically associated with operational impacts on visual resources related to new structures associated with a new HCT system, would generally be influenced by a grade separation feature or overhead catenary system (OCS) lines associated with LRT. Similar to noise impacts, visual impacts are intensified if they result in an impact to sensitive land uses (e.g. residential properties or public service buildings such as schools and parks).

The alignment alternative expected to have **no visual impact** is the BRT option that would operate in mixed traffic along I-17. This option would not require construction of a new structure as buses would operate in general purpose travel lanes along I-17 until operating in mixed traffic on the selected East-West Alignment Alternative.

The BRT options that would use the 19th Avenue or I-17 southbound frontage road would result in minimal visual impacts. A new grade separated structure would be required near the I-10/I-17 stack interchange for the 19th Avenue option; however, this structure would be located in an area of existing overhead freeway structures and likely be of little notice to adjacent properties.

Conversely, each of the LRT Alignment Alternatives is expected to result in visual impacts since a grade separation structure and OCS lines associated with light rail would be necessary to connect I-10 to downtown Phoenix. The grade separated structure required for either of the frontage road options would likely be of little notice in the vicinity of the I-10/I-17 stack interchange due to existing overhead structures. The OCS lines would be noticeable to residents south of Van Buren along each frontage road.

With the selection of the I-17 LRT Alignment Alternative, the remaining connecting East-West Alignment Alternatives (Adams and Jefferson Streets) would result in visual impacts to residents of the St. Matthews neighborhood. The 19th Avenue LRT Alignment Alternative has the potential create a visual impact to residents who live in the Oakland Historic District.

<u>Property Access and Traffic Impacts</u>

This criterion is evaluated by three sub-criteria and an overall rating is assigned based on the ratings received for each individual sub-criterion:

Impacts to Driveways: Establishment of a fixed guideway along an arterial roadway has the potential to adversely affect existing access to adjacent properties. Potentially affected driveways were examined based on an aerial analysis of the study area. Driveways on vacant land were not considered during this evaluation. Similar to the discussion concerning property acquisition, the impacts that relate to the I-17 option that considers the ADOT freeway widening considers impacts to properties just east of the new I-17 freeway footprint.

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Additional Traffic Signals: Location of the fixed guideway or busway within the ROW of an arterial street would require a safe interface between the transit vehicles and vehicular and pedestrian traffic. Each crossing of the HCT at locations without existing signalization would require the installation of a traffic signal. Additionally, traffic signals/access points would be needed to handle the anticipated increased demand for U-turns and left turns and provide additional accessibility to the corridor.

Since all grade crossings of fixed guideway segments must be signalized or provided with crossing gates, the number of new traffic signals along each alignment was estimated and results are listed in Table 7. For BRT, no additional traffic signals are required.

Diminished Roadway Access: Some of the options associated with I-17 and 19th Avenue would result in diminished roadway access that would include either closure of an existing roadway, abandonment of current access, or traffic diversion to change the existing traffic flow. Table 7 lists roadways that would require traffic modifications based on preliminary design of each of the I-17 and 19th Avenue Alignment Alternatives.

Table 7 Summary of Property Access and Traffic Impacts

Alignment Alternative	Number of Driveways Affected	# of Additional Traffic Signals Required	Diminished Roadway Access	Overall Access and Traffic Impacts Rating
LRT I-17 (NB Frontage Road Option)	None	None	None	5
LRT I-17 (SB Frontage Road Option)	3	1	Washington Street	3
LRT I-17 (ADOT widening option)	2	1	Washington Street Monroe Street 22nd Avenue	2
LRT 19th Avenue	5	1	Washington Street Monroe Street	1
BRT I-17 (Mixed Traffic)	None	None	None	5
BRT I-17 (SB Frontage Road Option)	1	None	None	4
BRT 19th Avenue	None	None	None	5

Source: MAG 2008 Aerials

Ratings were assigned as follows:

5 = Likely no impact to access and/or traffic resulting from construction and/or operation of a new HCT system
4 = Likely impact to property access but little to no traffic impacts anticipated
3 = Likely impact to property access with minimal traffic impacts
2 = Likely impact to property access with several traffic impacts
1 = Likely impact to property access, roadway access and additional traffic signals required

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Cost

For the capital cost criterion, the cost of building additional structure needed for grade separation, the cost of acquiring right-of-way, and the cost of utility relocation were compared in base year dollars. Additional costs such as trackwork, catenary cables, OCS poles etc. as well as professional services such as design services, project management etc. were not included for this comparison. Also, the cost differentials between alignment alternatives will likely increase when capital costs are estimated by year of expenditure. For the LRT mode, depending on the North-South alignment considered, a grade separated structure will be needed to travel from the I-10 right-of-way and to cross the Burlington Northern Santa Fe (BNSF) railroad near Downtown Phoenix. Figures 1, 2 and 3 show the locations of the bridge structures needed for I-17 Northbound Frontage Road, Southbound Frontage Road and 19th Avenue LRT alignment options respectively. For BRT, exclusive busway is needed as shown in Figures 4 and 5.

Right-of-way as well as utility relocation costs were estimated for the I-17 Alignment Alternative assuming ADOT's I-17 widening project would occur. In addition, I-17 estimates were paired with the estimated costs of crossing the BNSF railroad tracks assuming an overpass structure is constructed.

Table 8 Estimated Capital Cost by Alignment Alternative

	LRT				BRT		
	LRTI-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Approximate Cost of Right-of-Way, Grade Separation, and Utility Relocation ($ millions)	$64.1	$48.8	$66.4	$110.4	$22.6	$20.7	$22.6

Source: I-10 West AA/EIS Study Team (March 2009)

Capital Cost Estimates (grade separated structures, right-of-way, utility relocation) were rated as follows:

5 = Less than $25 million

4 = $25 – $40 million

3 = $40 – $55 million

2 = $55 – $70 million

1 = More than $70 million

19th Ave LRT alignment received the lowest rating since it would incur the highest (approximately $110.4 million) capital cost as compared to the I-17 LRT alignment alternatives. The 19th Ave alignment option is likely to incur approximately $54 million for grade separated structures whereas I-17 option is likely to incur approximately $42.7 million for grade separation. BRT option along I-17 using Southbound Frontage Road is likely to incur approximately $20.7 million for grade separation, right-of-way and utility relocation costs whereas that along 19th Ave is expected to cost

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approximately $22.6 million. BRT in mixed traffic option along I-17 costs the same as BRT on 19th Ave due to an exclusive busway along I-10 for its Part "B" service.

ADOT/Other Agency Coordination

The final evaluation criteria, ADOT/Other agency coordination, compared the potential issues of building additional structure needed for grade separation with ADOT's freeway expansion projects. Discussions with ADOT suggested that there may fewer issues to deal with if an alignment gets out of the I-10 freeway sooner. At the same time ADOT's I-17 widening project may also conflict with the transit operations depending on the location of the exclusive guideway (or busway for BRT options). Other agency coordination may include working with Federal Railroad Administration (FRA) and BNSF for Railroad crossings for I-17 LRT options as well as safety considerations for LRT operation along 19th Ave.

The alignments were thus rated based on the level of coordination needed and/or potential conflicts with ADOT projects/other agencies. The ratings were assigned as follows:

LRT I-17 (NB Frontage Road Option) – 2

- + Allows the alignment to come out of the I-10 freeway sooner as compared to 19th Avenue alternative.
- + Preferred by BNSF since this option alleviates concerns with use of 19th Avenue where LRT would parallel freight trains.
- – Conflicts with ADOT's I-17 widening project. Leaves no room for I-17 widening on the east side.
- – Requires grade separation in a residential neighborhood, requiring coordination with BNSF and FRA for railroad crossing near 19th Avenue.

LRT I-17 (SB Frontage Road Option) – 5

- + Allows the alignment to come out of the I-10 freeway sooner as compared to 19th Avenue alternative, allowing a direct connection with the State Capitol.
- + Does not conflict with ADOT's I-17 widening project. Leaves room for I-17 widening on the east side.
- + Preferred by BNSF since this option alleviates concerns with use of 19th Avenue where LRT would parallel freight trains.
- – Requires grade separation in a residential neighborhood, requiring coordination with BNSF and FRA for railroad crossing near 19th Avenue.

LRT I-17 (ADOT Widening Option) – 4

- + Allows the alignment to come out of the I-10 freeway sooner as compared to 19th Avenue alternative.
- + Does not conflict with ADOT's I-17 widening project. Leaves room for I-17 widening on the east side.
- – Will require schedule coordination with ADOT for property acquisition.

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- Requires grade separation in a residential neighborhood, requiring coordination with BNSF and FRA for railroad crossing near 19th Avenue.

LRT 19th Avenue – 3

+ Does not conflict with ADOT's I-17 widening project. Leaves room for I-17 widening on the east side.
- Stays on the I-10 freeway ROW longer compared to I-17 options and potentially conflict with ADOT's I-10 widening project and would incur a greater cost compared to the I-17 options.
- Requires coordination with BNSF and FRA for railroad/rail yard crossing on I-10 near 19th Avenue.
- Requires coordination with BNSF to maintain a safe distance between LRT and Railroad for safe operations along 19th Avenue.

BRT I-17 (SB Frontage Road Option) – 5

+ Allows the alignment to come out of the I-10 freeway sooner as compared to 19th Ave alternative
+ Does not conflict with ADOT's I-17 widening project. Leaves room for I-17 widening on the east side.
+ The Southbound Frontage Road presents an opportunity for an HCT guideway due to minimal existing traffic, no property impacts, no utility conflicts, and a direct route to and from the State Capitol for West Valley residents.
+ Does not require coordination with BNSF and FRA for railroad crossing near 19th Ave.

BRT 19th Avenue – 4

+ Does not conflict with ADOT's I-17 widening project. Leaves room for I-17 widening on the east side.
+ Does not require coordination with BNSF along 19th Ave since it operates in mixed traffic.
- Stays on the I-10 freeway ROW longer compared to I-17 options and potentially conflict with ADOT's I-10 widening project.
- Requires coordination with BNSF and FRA for railroad/rail yard crossing on I-10 near 19th Avenue.

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Evaluation of I-17 and 19th Avenue Alignment Alternatives

Table 9 summarizes the results of the detailed evaluation of LRT transit mode along the I-17 and 19th Avenue Alignment Alternatives.

Table 9 Evaluation Ratings of the I-17 and 19th Avenue LRT Alignment Alternatives

Evaluation Criteria	LRT Rating			
	LRTI-17 (NB Frontage Road Option)	LRT I-17 (SB Frontage Road Option)	LRT I-17 (ADOT Widening Option)	LRT 19th Avenue
Destinations Served*	3	3	3	5
Travel Time	3	5	4	3
Property Acquisition	5	4	3	1
Community Impact/ Benefit	3	1	3	5
Environmental Impacts	5	4	2	3
Property Access and Traffic Impacts	5	3	2	1
Cost	2	3	2	1
ADOT/Other Agency Coordination	2	5	4	3

*This rating reflects the average scoring of population and employment.
Source: I-10 West AA/EIS Study Team (March 2009)

Table 10 summarizes the results of the detailed evaluation of BRT transit mode along the I-17 and 19th Avenue Alignment Alternatives.

Table 10 Evaluation Ratings of the I-17 and 19th Avenue BRT Alignment Alternatives

Evaluation Criteria	BRT Rating		
	BRT I-17 (Mixed Traffic)	BRT I-17 (SB Frontage Road Option)	BRT 19th Avenue
Destinations Served*	3	3	5
Travel Time	2	5	2
Property Acquisition	5	5	5
Community Impact/ Benefit	1	1	5
Environmental Impacts	5	5	5
Property Access and Traffic Impacts	5	4	5
Cost	5	5	5
ADOT/Other Agency Coordination	5	5	4

*This rating reflects the average scoring of population and employment.
Source: I-10 West AA/EIS Study Team (March 2009)

Additional Considerations

In addition to the evaluation criteria previously discussed, several considerations relating to the crossing of the BNSF railroad would need to be considered for both alignment alternatives. Both the I-17 and 19th Avenue LRT options would require crossing the existing tracks, but the manner in which this occurs will need to consider the following:

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Federal Railroad Administration Requirements

The Federal Railroad Administration (FRA) regulations concerning light rail vehicles crossing railroad tracks is addressed in the U.S. Code of Federal Regulations [(CFR) in 49 CFR Part 209 (Appendix A)] and [49 CFR Part 211 (Appendix A)].

49 CFR Part 209 (Appendix A) states that a tourist line (light rail is not explicitly mentioned, but previous experience with FRA personnel indicate FRA would use this as a guideline) would be considered insular (separate from the general railroad system), if, among other considerations, the 'tourist line" tracks are at least 30 feet from the railroad. Although, it should be noted BNSF has the ultimate authority to determine an appropriate separation, which could require 50- to 100-feet of separation from freight operations, or other separation means. For example, in Denver the LRT system was required to install a safety barrier between the Union Pacific Railroad (UPRR) where separation was less than 50 feet.

49 CFR Part 211 (Appendix A) addresses crossings at grade of light rail, conventional railroad equipment, and waivers for temporal separation of light rail and freight operations. Essentially, FRT could require that light rail and conventional operations be separated in time if the two crossed at grade. The standard height requirement for the light rail vehicle overhead catenary system (OCS) for at grade crossings is 24- or 25-feet above the rail; however, this distance could strain operations of the light rail vehicle pantograph.

As to grade separations, BNSF currently requires that any bridge over their tracks have 24- to 25-feet in clearance from the top of rail to the bottom of the bridge structure. A light rail underpass would require at least 15 feet from the top of the rail to the OCS wire for the pantograph to operate properly.

BNSF requirements for crossing tracks

As previously stated, although the FRA establishes regulations concerning separation between freight railroad operations and light rail guideways, the ultimate authority lies with BNSF.

Liability of Valley Metro Rail and BNSF

An issue that would need to be resolved early in the shared use agreement is delegation of liability for both Valley Metro Rail and BNSF. In instances where freight railroads and transit agencies share track, liability is assigned in one of three ways: 1) by fault, 2) based on financial limits, and 3) by incident circumstances. These measures may be used alone or can be used in combination.[1]

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[1] *Federal Transit Administration Final Report – Sharing of Track by Transit and Freight Railroads: Liability and Insurance Issues.* September 21, 2005. p. 9-10.

Conclusion

The qualitative analysis provided in this memorandum demonstrated that all LRT options along I-17 scored higher than the LRT alignment along 19th Avenue. Of the I-17 options, the alternative using Southbound Frontage Road received the highest score.

Overall, BRT options along 19th Ave and I-17 (Southbound Frontage Road option) were relatively comparable and performed better compared to the I-17 option in mixed traffic.

Regardless of selection of I-17 or the 19th Avenue Alignment Alternative (except for BRT in mixed traffic along I-17), coordination with the BNSF railroad will be necessary as crossing the rail line is unavoidable to connect the I-10 West extension with the METRO Starter Line. It should be noted that it would be beneficial in terms of cost savings if METRO is able to coordinate with BNSF early in the planning process to create a shared use agreement to enable at-grade crossing on 19th Ave.

It should be noted that the results presented in this memorandum have not been weighted so each of the criteria have been evaluated equally. We recommend that further discussion and analysis should be conducted to determine whether criteria should be weighted based on importance of each issue or if a subsequent analysis should be carried forward by using select criteria examined in this memorandum or additional criteria if necessary.

The City of Phoenix should also be aware that this memorandum does not take community input into account at this time. The I-10 West AA/EIS Study Team will meet with the community and neighborhood groups in the upcoming weeks to present results of the technical analysis and receive feedback from residents and the public.

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Appendix B

Washington/Jefferson LRT Alignment Alternative Connections – Final Definition of Alternatives Technical Evaluation

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MEMO

To: City of Phoenix Technical Team

From: METRO Project Team

Date: January 27, 2010

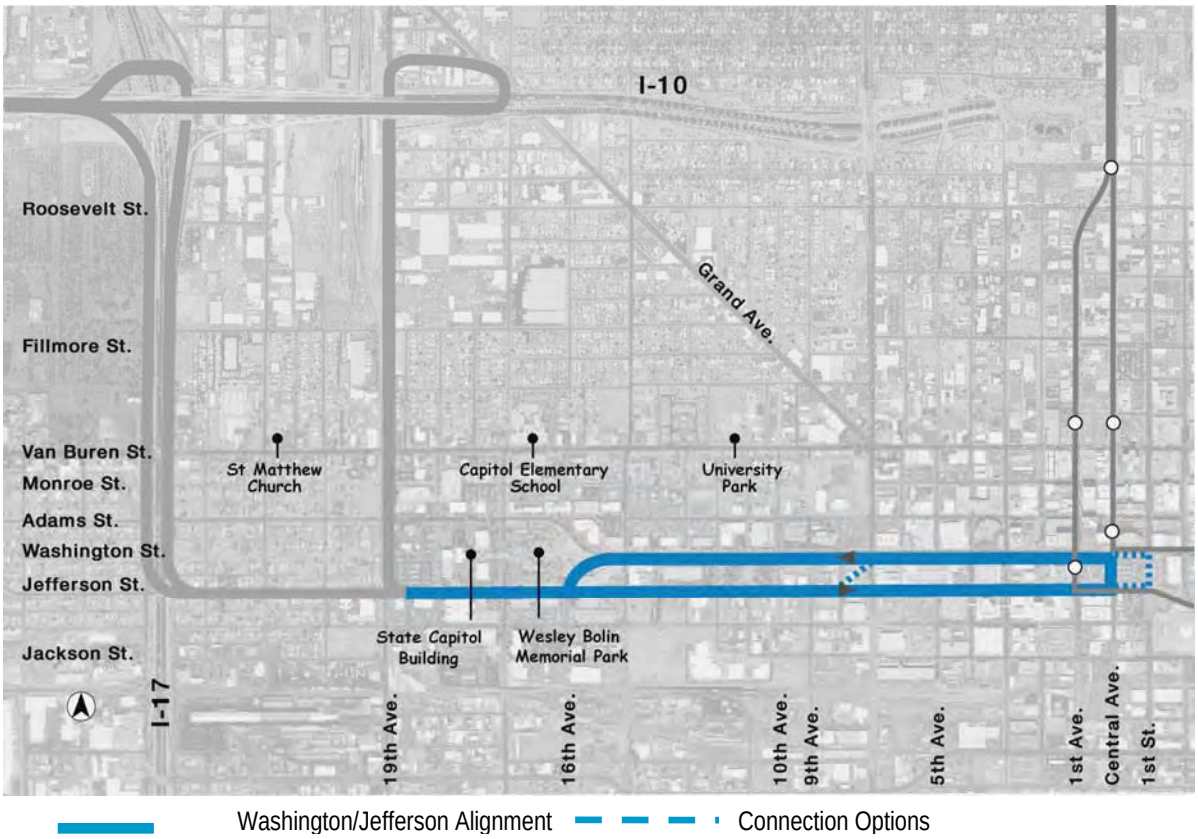
Re: Phoenix West AA/EIS Study
Washington/Jefferson LRT Alignment Alternative Connections – Final Definition of Alternatives Technical Evaluation

Background

The Phoenix West Study Team is currently in the process of evaluating various high-capacity transit alternatives in downtown Phoenix for both bus rapid transit (BRT) and light rail transit (LRT) transit modes. One of the goals identified for the Phoenix West Alternatives Analysis/Environmental Impact Statement (AA/EIS) (formerly entitled I-10 West AA/EIS) was to provide a high-capacity transit option that connects to the METRO Starter Line currently in operation through downtown Phoenix.

The purpose of this memorandum is to provide a detailed evaluation of light rail connection options associated with the Washington/Jefferson Alignment Alternative, shown in Figure 1.

Figure 1 Washington/Jefferson Downtown LRT Alignment Alternative



The two Washington/Jefferson Street Connection Options evaluated in this memorandum include:

- **1st Avenue/Central Avenue – cross-over at 7th Ave.:** (Washington/Jefferson Street One Way Couplet with a single track from Central Avenue to 7th Avenue). A double track would extend along Jefferson Street from 8th Avenue to 19th Avenue or I-17. The crossover from single track to double track along Jefferson would occur between 8th Avenue and 7th Avenue. The connection with the METRO Starter Line is shown on Figure 2.
- **1st Avenue/1st Street – cross-over at 7th Ave.:** (Washington/Jefferson Street One Way Couplet with a single track from Central Avenue to 7th Avenue). A double track would extend along Jefferson Street from 8th Avenue to 19th Avenue or I-17. The crossover from single track to double track would occur from Jefferson Street between 8th Avenue and 7th Avenue. The connection with the METRO Starter Line is shown on Figure 3.

Connection Options Evaluation Criteria

The evaluation for the two Starter Line connection options assessed of the following issues:

- Conflicts with existing and planned utilities
- Consistency with stakeholder input
- Traffic Impacts (traffic capacity and operations)
- Impacts to current and future development
    - Conflicts with CityScape
    - Conflicts with U.S. Airways Center
- Property impacts
    - Direct impact to right-of-way (e.g., property acquisition or structures)
    - Access complications
- Difficulty of construction
- LRT Travel time
- Costs
- Conducive with light-rail expansion south along Central Avenue

Ratings of "+," "0," and "—" were provided for each issue to the two connection options to provide a direct comparison based on the evaluation results, as shown in Table 1. Alternatives that received similar ratings by certain issues indicated that there was no difference in terms of impact between the two Washington/Jefferson Couplet Connection Options.

Figure 2 1st Avenue/Central Avenue – cross-over at 7th Avenue Option

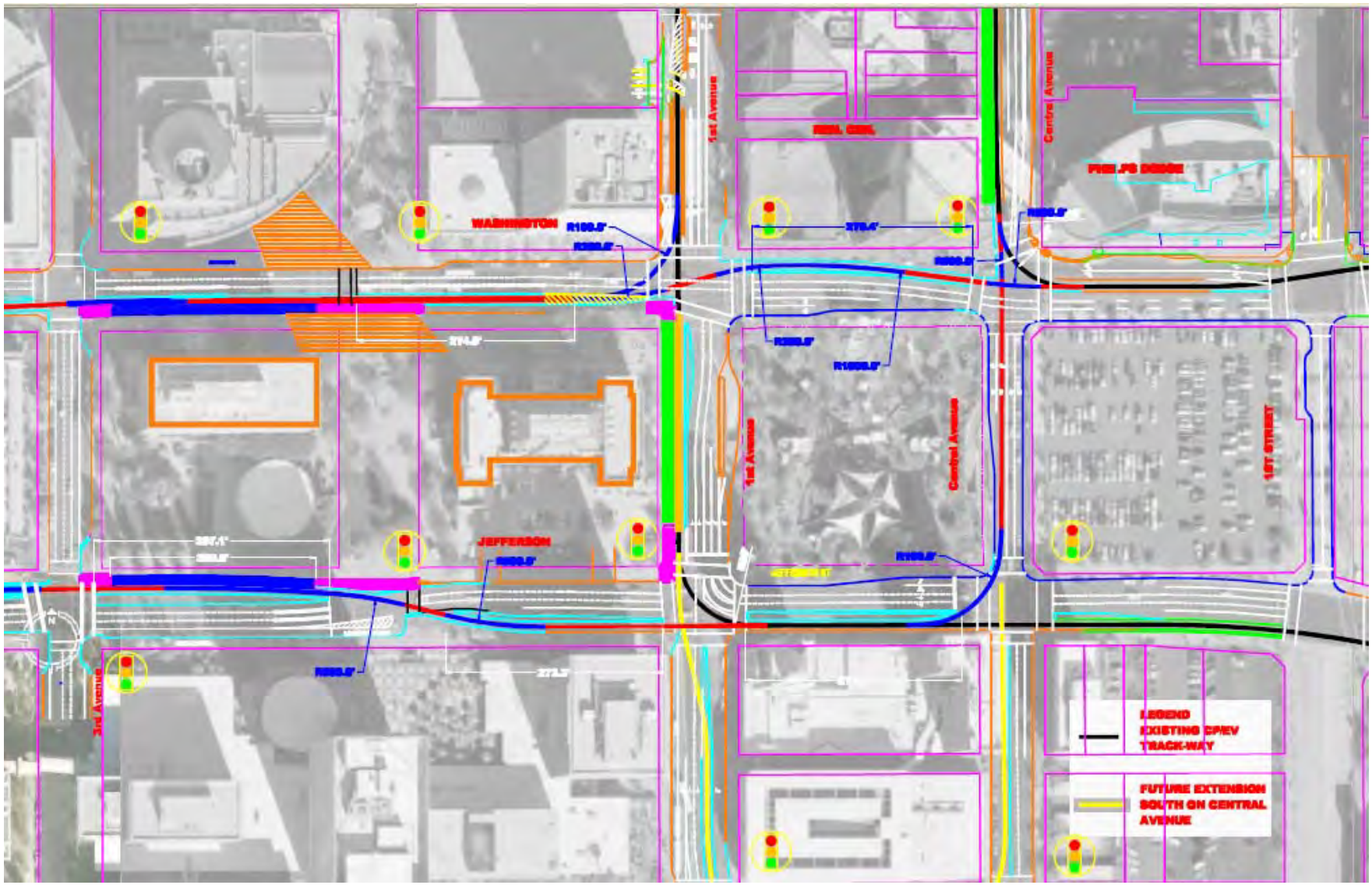


Figure 3 1st Avenue/1st Street – cross-over at 7th Avenue Option

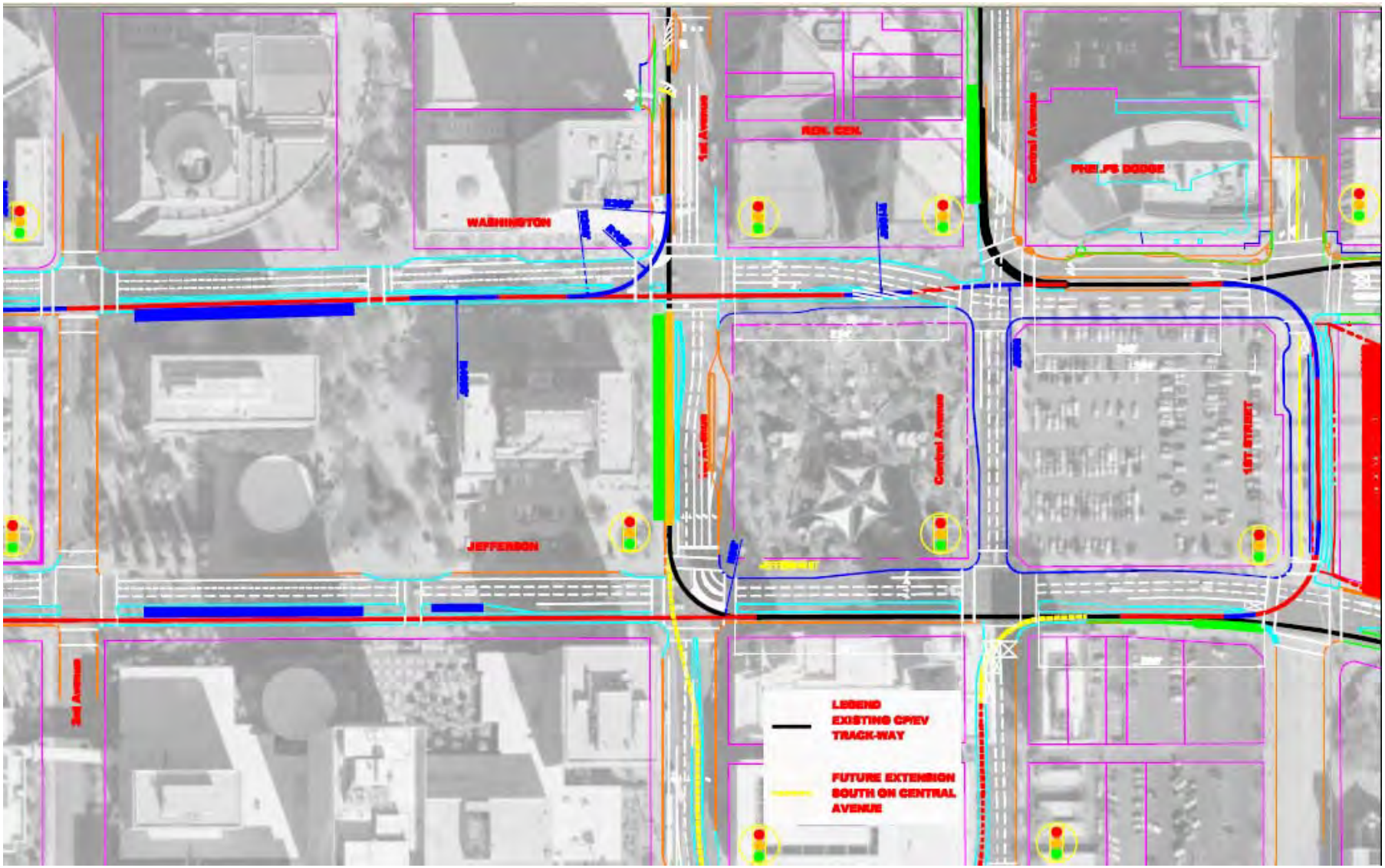


Table 1 Comparison of Washington/Jefferson LRT Alignment Alternative METRO Starter Line Connection Options

Issue	1st Ave./Central Ave. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets	1st Ave./1st St. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets
Utility Conflicts	Central Ave. does not present any utility conflicts. However, utilities within the 1st Ave. right-of-way include an average size storm drain (39-inches), a fiber optic line, and several other utility lines. **Rating: 0**	Utilities within the 1st Ave. right-of-way include an average size storm drain (39-inches), a fiber optic line, and several other utility lines. Utilities within the 1st St. right-of-way include an average size storm drain (21-inches), 24-inch sanitary sewer, major water line (12-inches), and gas, power, and communication lines. **Rating: —**
Consistent with Red Development Input	This connection option does not respond to Red Development's concerns about locating light rail along Central Avenue **Rating: —**	This option responds to concerns from Red Development regarding potential conflicts with their 5 story underground garage under Central Avenue. **Rating: +**
Traffic Impacts	• A shared traffic lane for LRT and traffic would be necessary along Central Avenue between Washington and Jefferson Streets. • Two adjacent intersections would be subject to all-red signals along Jefferson Street (at 1st and Central Avenues). • As westbound trains travel through the Washington/1st Ave. intersection, only the two left turn lanes onto 1st Ave. would be allowed to proceed; all other traffic would be required to stop. • Four 90-degree, low speed turns would be required of trains, all surrounding the block bounded by Washington/Jefferson Streets and 1st/Central Avenue. **Rating: Pending further analysis**	• No shared traffic lanes would be necessary with this option. • Three all-red signalized intersections would be necessary within close proximity: o 1st Avenue/Jefferson Street o 1st Street/Jefferson Street o 1st Street/Washington Street • General traffic could proceed as westbound trains travel through the Washington/1st Ave. intersection. • Five 90-degree, low speed turns would be required of trains surrounding the two blocks bounded by Washington/Jefferson Streets and 1st Avenue/1st Street. **Rating: Pending further analysis**

Issue	1st Ave./Central Ave. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets	1st Ave./1st St. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets
Current and Future Development Conflicts	The light rail catenary lines along Central Ave. may conflict with the proposed CityScape pedestrian bridge. **Further coordination with CityScape is warranted to determine pedestrian bridge clearance.** **Rating: —**	As the proposed conceptual design connection is currently shown, six 90-degree turns would be required for this option for a northbound connection from a possible future south LRT connection. The other option would be to connect along 1st Street south of Jefferson Street, which would conflict with U.S. Airways potential expansion to the west. **Rating: 0**
Right-of-way Impacts	This option would not impact existing right-of-way. **Rating: +**	Requires negotiation with the Colliers to acquire right-of-way on the east side of 1st St. between Washington and Jefferson Streets. **Rating: —**
Property Access Conflicts	This option would not result in any property access constraints. **Rating: +**	This option could adversely affect access from the valet parking associated with CityScape on 1st Ave. **Rating: —**
Difficulty of Construction	The Red Parking Garage under Central Avenue may not be able to support a light rail system. Furthermore, the pedestrian bridge proposed with the CityScape development along Central Avenue may not provide enough clearance for the catenary lines. Another consideration is the catenary lines may need to be secured to the adjacent CityScape buildings. **Rating: —**	No major construction design issues are associated with this proposed alternative. **Rating: +**
LRT Travel Time	This option provides the best direct connection for all direction of travel. The Single Track Couplet would allow LRT vehicles to travel with traffic within the traffic signal progressive band, which is conducive to light rail vehicle signal priority on the one-way streets. **Rating: +**	The connection along 1st St. would result in two additional turns; thereby affecting the travel time of the light rail vehicles. **Rating: —**

Issue	1st Ave./Central Ave. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets	1st Ave./1st St. – Single Track Couplet between Central/7th Avenues on Washington and Jefferson Streets
Cost	**To be determined**	**To be determined**
	Rating: Pending further analysis	**Rating: Pending further analysis**
Conducive with Future LRT Expansion South along Central Avenue	This alternative would provide a direct connection with a future light rail system extending south along 1st Ave with northbound trains. **Rating: +**	Although a South Central southbound light rail connection would be possible with this option, northbound trains would be subject to six 90-degree turns over four city blocks, resulting in travel delay. **Rating: —**

Appendix C

Summary of Public Involvement Interaction

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METRO met with various stakeholders throughout the evaluation process with the goal of informing residents, stakeholders and interested groups and involve agencies about the project and to present the alternatives and issues for public and agency review. During the course of the study, the public involvement team conducted the following meetings:

Community Working Groups/Government Working Groups (# of meetings held)

- Community Working Groups (25 total)
    - Downtown (13)
    - Mainline (10)
    - Combined (2)
- Government Working Group (4)

Public Meetings

- Scoping (2)
- Tier 1 Input/Results (2)
- Tier 2 Input/Results (2)

Other Stakeholders

- Alhambra Village Planning Committee (2)
- Arizona Centennial Commission (2)
- Arizona Department of Administration (3)
- Arizona Growth & Infrastructure Cabinet (7)
- Arizona State University
- Capital Mall Association
- Central City Village Planning Committee (3)
- Citizen's Transit Commission (5)
- City of Phoenix Planning Commission
- Council Study Session
- District 7 Council Office
- Downtown Phoenix Partnership (Staff) (4)
- Downtown Phoenix Partnership (Executive Board)
- Downtown Voices Coalition
- Encanto Village Planning Committee (3)
- Estrella Village Planning Committee (3)
- Grand Avenue Merchant's Association
- General Services Administration – Federal Court
- Greater Phoenix Chamber of Commerce
- Greenwood Memory Lawn Cemetery (2)
- Historic Neighborhood Coalition (2)
- Isaac Neighborhood Initiative Area Community
- Maricopa Facilities Review Committee (2)
- Maryvale Block Watch Alliance

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- Maryvale Core Economic Development Planning (2)
- Maryvale United Neighborhood Block Watch
- Maryvale Village Planning Committee (2)
- Murphy Elementary School District
- Murphy Elementary School District Board
- New Life Fight Back
- Phoenix City Council (3)
- Phoenix Community Alliance (Staff) (4)
- Phoenix Community Alliance Transportation & Infrastructure Committee (3)
- Phoenix Convention Center
- Phoenix Planning Commission
- Roosevelt Action Association (2)
- Roosevelt Preservation Association
- St. Matthews Neighborhood (2)
- US Airways Arena
- US Federal Court
- Weed and Seed Coalition (2)
- West Phoenix Revitalization Citizen's Advisory Board (2)
- WESTMARC Transportation Committee
- Wells Fargo

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Special Events

- It's Our Community Special Event
- New Life Fight Back G.A.I.N. Special Event

PHOENIX WEST

HIGH CAPACITY TRANSIT STUDY

DRAFT

FINAL DEFINITION OF ALTERNATIVES REPORT

June 2011

METRO

Phoenix West AA/EIS

Draft

Final Definition of Alternatives Report

Prepared for:

Valley Metro Rail, Inc.

June 2011

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Appendix A METRO/ADOT/MAG/City of Phoenix Working Agreement
Appendix B Economic Impact Assessment

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1.0 INTRODUCTION

This report describes the proposed No-Build, Build Light Rail Transit (LRT) and Build Bus Rapid Transit (BRT) alternatives for the Phoenix West Extension (formerly I 10 West) Alternatives Analysis/Environmental Impact Statement (AA/EIS) Study. METRO is concurrently developing a Baseline Alternative, which will document an incremental expansion of transit services over the existing service levels within the Phoenix West Study Area. A detailed description of the Baseline Alternative will be submitted as a memorandum separate to this document.

METRO initiated the Phoenix West AA in summer 2007 with the identification of transportation deficiencies and the Purpose and Need for a high-capacity transit (HCT) investment in the study corridor. Since the initiation of the study, METRO has developed and evaluated potential alternative alignments based on the project's Purpose and Need as well as stakeholder input. A substantial public outreach effort was conducted to solicit input on METRO's decision making process as alternatives were removed from consideration. Additionally, METRO has completed extensive travel demand model forecasting for various transit modes. Modifications to the build alternative transit service frequencies, accomplished through travel forecasting efforts which resulted in optimal service levels for each Build Alternative as described in this report.

Assumed service levels for both the existing bus network, including bus route and frequency modifications for the proposed Phoenix West Extension alternatives are described in this report. Figures are included in this document to show the existing and proposed bus route modifications by the No-Build, LRT and BRT Build Alternatives.

1.1. BACKGROUND

The passage of Proposition 400 by Maricopa County voters in November of 2004 signified a substantial increase in the amount of funding for public transit. Proposition 400 also represented the public's interest to provide a transportation system that could accommodate regional growth.

Funds from the Proposition 400 half-cent transportation sales tax extension were allocated toward the 57.7-mile LRT system identified in the 2005 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP). The 20-mile Central Phoenix/East Valley (CP/EV) LRT Starter Line that serves the cities of Phoenix, Tempe, and west Mesa opened for passenger service in December of 2008. The MAG RTP identified an 11-mile extension along Interstate 10 (I-10), from the CP/EV LRT Starter Line to the vicinity of 79th Avenue, as one of six additional LRT/ HCT corridors within Maricopa County (MAG 2003). This segment of I-10, defined as the Phoenix West Corridor is scheduled to be in operation by 2021, with the remaining system to be operational by 2031.

1.2. FEDERAL PROCESS

Project justification is defined under 49 USC 5309 (e)(1) and provides the basis for Federal Transit Administration (FTA) approval to advance candidate investments through the project development process. Project justification is based on several measures as outlined and supplemented by FTA guidance on the process of applying criteria and measures as well as in defining the No Build, Baseline, and Build Alternatives. For purposes of this report, these alternatives, excluding the Baseline Alternative, are defined. Detail is provided to serve as a foundation by which the benefits of the Phoenix West project can be isolated an attributed to the project or LRT Build Alternative.

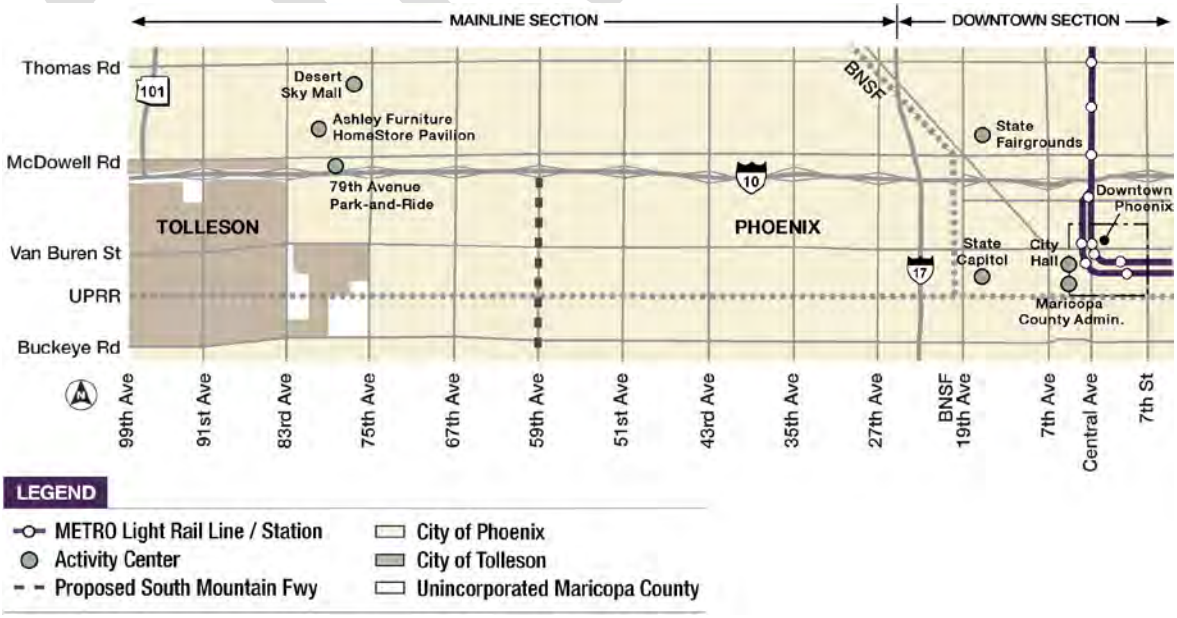
1.3. PROJECT STUDY AREA

The Phoenix West Study Area is bounded on the north by Thomas Road, on the south by Buckeye Road, on the west by State Route 101 (Loop 101), and on the east by 7th Street, as depicted in Figure 1. For the purposes of alternatives development and analysis, the corridor was divided into two sections that have different characteristics in terms of alignment opportunities, station needs, key types of impact, and transit service needs.

- The portion west of Interstate 17 (I-17) is referred to as the **Mainline Section**. This section would generally operate at a higher speed with greater station spacing that other portions of the system currently in operation.

- The portion east of I-17 is referred to as the **Downtown Section**. The Downtown Section contains most of the employment destinations in the corridor and is also where Phoenix West would connect to the existing CP/EV Starter Line.

Figure 1 Phoenix West AA/EIS Study Area



Source: METRO 2010

1.4. PURPOSE AND NEED

The first step of the Phoenix West AA was to identify the transportation deficiencies and travel characteristics associated with the Phoenix West Study Area and define project objectives to address transportation issues in the corridor. As identified in the *I-10 West AA/EIS Draft Purpose and Need* (METRO 2008), the purpose of the proposed Phoenix West AA/EIS Study is to:

- Offer a viable transportation alternative that will facilitate the safe and efficient movements of people, particularly commuters, through and within the Phoenix West Study Area;
- Provide efficient HCT service within the Phoenix West Study Area;
- Provide additional capacity as part of a "shared solution" incorporating transit, highway improvements, and existing service such as high-occupancy vehicle (HOV) lanes and bus service along I-10 in the Southwest Valley that are currently operating at level of service (LOS) E-F and are anticipated to steadily deteriorate. In support of this shared solution approach, METRO plans to enter into a Working Agreement with MAG and the Arizona Department of Transportation (ADOT) that will promote the cooperative approach to the Phoenix West HCT Project (a draft of the working agreement is attached as Appendix A) ;
- Enhance economic development potential within the corridor by improving access to existing and planned employment and activity centers in both the West Valley and downtown Phoenix;
- Support regional plans and policies that reinforce an efficient transit system; and
- Support regional air quality goals.

Development of an HCT option would help to satisfy the four following primary needs:

1) **A need for added peak period travel capacity and a more reliable mode as part of a balanced transportation system.** According to the *I-10 West Transportation Assessment* (METRO 2008), congestion during both the AM and PM peak periods along I-10 within the Study Area is expected to become much worse by 2030, with HOV volumes expected to more than double. Transit improvements are needed to address the future demands as part of a "shared solution" to facilitate the safe and efficient movement of people and goods within the Study Area, specifically along I-10.
2) **A need for increased transit system connectivity.** Transit service coverage in the Study Area is limited, especially for longer peak period commute trips. Improved services and connections are needed between and among the destinations within and connected to the Study Area.
3) **A need for improved access to corridor destinations.** Improved transit service should be implemented to provide safe and efficient access to numerous local and

regional destinations within and adjacent to the Phoenix West Study Area including the State Capitol, the City of Phoenix/Maricopa County Government Center, Phoenix Governmental Mall, and entertainment destinations including downtown Phoenix sports and arts venues and Ashley Furniture HomeStore Pavilion located in western Phoenix.

4) **A need to reinforce economic development opportunities.** Investments in HCT should be leveraged to encourage more intensive transit oriented development (TOD) in the Study Area consistent with prior planning studies and future development.

2.0 ASSUMPTIONS MADE FOR ALL ALTERNATIVES

In an effort to structure the Baseline and Build Alternatives in a consistent manner, METRO incorporated certain physical, operational, and policy level assumptions as guiding principles. By using the assumptions listed in Table 1, METRO developed HCT alternatives based on the guidance that meets the needs of the Phoenix West Extension Study Area.

Table 1 Assumptions Referenced for Alternative Definitions

Physical Location	• Where feasible, the HCT alternatives would utilize existing right-of-way (ROW) to minimize property impacts. • Along the I-10 ROW within the Mainline Section, stations are to be spaced no closer than 1 mile apart in an effort to provide an efficient level of service and reduce delay time. • In the Downtown Section, it is assumed that the proposed HCT investment along the Phoenix West Extension would connect to the CP/EV Starter Line in Downtown Phoenix, generally between I-10 and Buckeye Road, based on the existing and planned LRT/HCT corridors identified in the Public Transit chapter of the *MAG RTP 2010 Update*.
Operational Characteristics	• 10 minute all day headways are assumed for the HCT alternatives in an effort to provide high levels of service. • For the Build Alternatives, the HCT alternatives assume that introduced local/ circulator bus routes would connect to either a LRT or BRT system. Express routes would be truncated at the 79th Avenue Park-and-Ride to connect the LRT or BRT system. • The LRT Build Alternative should interline with the CP/EV Starter Line to reduce the transfer connection time between the Phoenix West Extension.
Supporting Policies	• All alternatives identified assume implementation of the most cost effective feeder bus service. • Where feasible, the proposed alternatives should not duplicate existing HCT service.

Source: METRO, 2010

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3.0 DESCRIPTION OF ALTERNATIVES

3.1. NO-BUILD ALTERNATIVE

The No-Build Alternative is a "no-action plan" that would rely on existing transit routes, frequencies, and facilities. The No-Build Alternative would assume implementation of transportation projects and transit improvements identified in the MAG *Regional Transportation Plan 2010 Update*. The No Build Alternative does not meet the Purpose and Need for the project but is required by FTA for evaluation as part of the AA and the National Environmental Policy Act (NEPA) process and establishes a baseline of comparison for other alternatives (including the FTA Baseline).

This section describes the transportation- and transit-related modifications planned in the Phoenix West Study Area in the No-Build Alternative. These modifications also provide a benchmark for measuring improvements proposed in the Baseline/Transportation System Management (TSM) Alternative and Build Alternatives.

The following elements of the No-Build Alternative are described below:

- Highway Network
- Passenger Facilities/Stations
- Light Rail Transit
- Background Bus Network
- Express Bus Routes
- Local Bus Routes

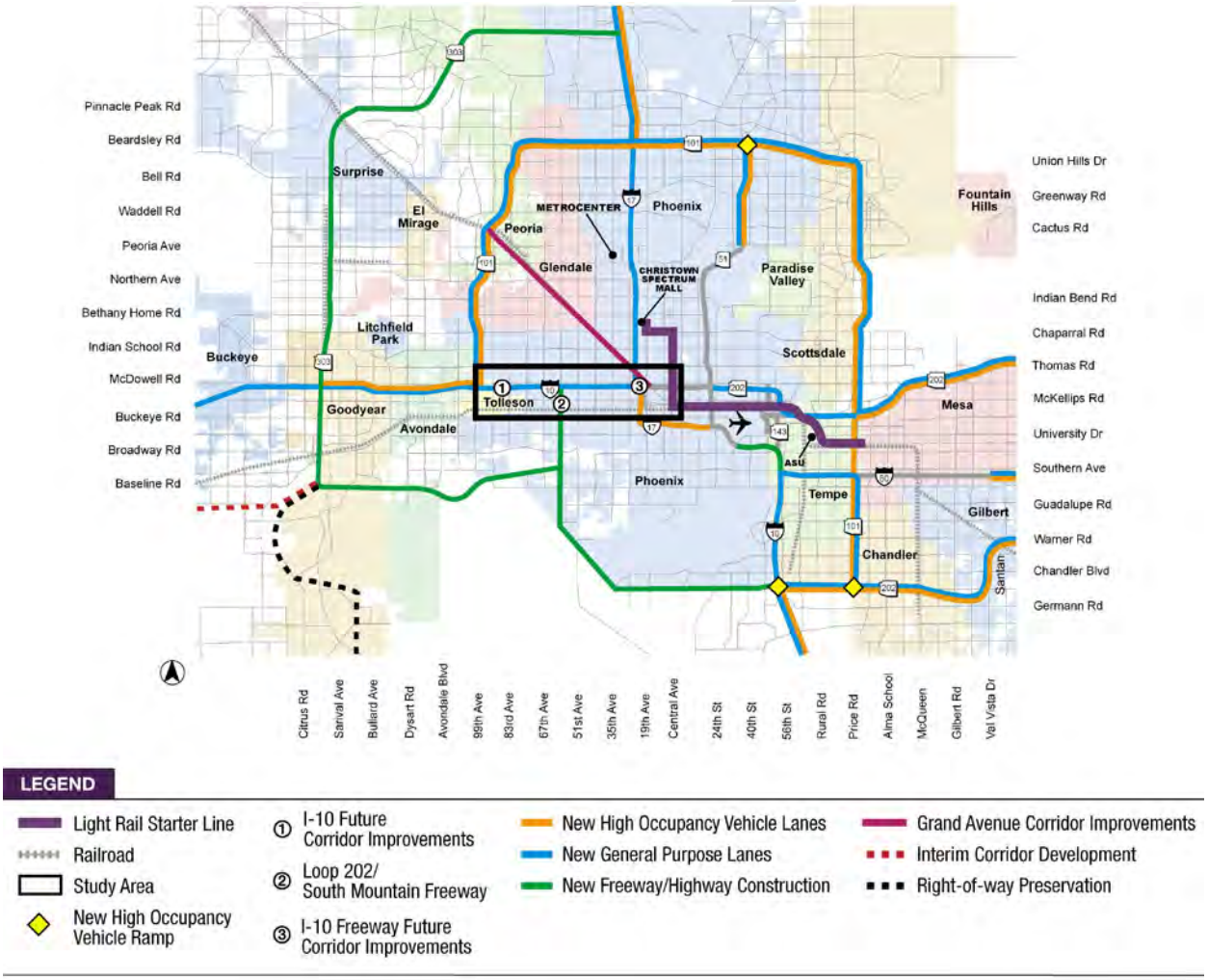
Highway Network

The No-Build Alternative would include all highway improvements proposed by ADOT within the Phoenix West Study Area. An example of one proposed improvement that could have implications on travel patterns in the Phoenix West Study Area includes the proposed construction of high occupancy vehicle (HOV) lanes along I-10 from Loop 101 westward to Loop 303. Figure 2 shows the following proposed improvements identified in the MAG *RTP 2010 Update* within the Study Area.

- **Loop 202/South Mountain Freeway** – The Loop 202 - South Mountain Freeway would connect I-10 in the Southeast Valley with I-10 in the West Valley. The new state route would relieve traffic congestion in central Phoenix by diverting through trips around South Mountain rather than through downtown Phoenix. As currently designed, ADOT's Preliminary Preferred Build Alternative would link the new Loop 202 Freeway with I-10 near 59th Avenue. The project is programmed to extend through RTP Planning Phase 2 (2011 to 2015) and Phase 3 (2016 to 2020) in the MAG *RTP 2010 Update*.

- **Interstate 17 (Black Canyon Freeway) Future Corridor Improvements** – The proposed addition of one general purpose lane and one HOV lane in each direction along I-17 could have implications on the future Phoenix West Extension. The MAG Central Phoenix Transportation Framework Study, along with a Design Concept Report/Environmental Impact Statement conducted by ADOT addressing capacity improvements along I-17 targeted for completion at the end of 2012, will address the specific approach to addressing the I-17 freeway expansion.

Figure 2 Proposed ADOT Highway Improvements in the MAG Region



Source: Maricopa Association of Governments (MAG) 2010 Regional Transportation Plan (RTP) Update

Passenger Facilities/Stations

The No-Build Alternative would include all park-and-ride facilities that are currently programmed in the RTP as listed in Table 2 and shown on Figure 3.

Table 2 Planned and Operating Park-and-Ride Facilities

Park-and-Ride	Fiscal Year of Operation	Routes Served
79th Avenue Park-and-Ride	In Operation	- Route 17 - Route 17A - Route 29 - Route 560 Avondale Express - I-10 West RAPID
Glendale Park-and-Ride	In Operation	- Route 70 - Route 573 Northwest Valley/Downtown Express - Route 577 Peoria Express
Goodyear Park-and-Ride	In Operation	- Route 562 Goodyear/Downtown Express
Surprise Park-and-Ride	In Operation	- Route 571 Surprise Express - Grand Avenue Limited (FY 2011-2015 Expansion) - Bell Road Supergrid (FY 2021-2025) - Loop 303 Express (FY 2026-2031)
Peoria Park-and-Ride	In Operation	- Route 106 - Grand Avenue Limited - Route 571 Surprise Express - 83rd/75th Avenue Supergrid (FY 2021-2025) - Peoria Express (FY 2026-2031)
East Buckeye Park-and-Ride	2011-2031	- Buckeye Express (FY 2011-2015)
Glendale Arrowhead Park-and-Ride	2011-2031	- Route 575 North Glendale Express

Source: MAG 2010

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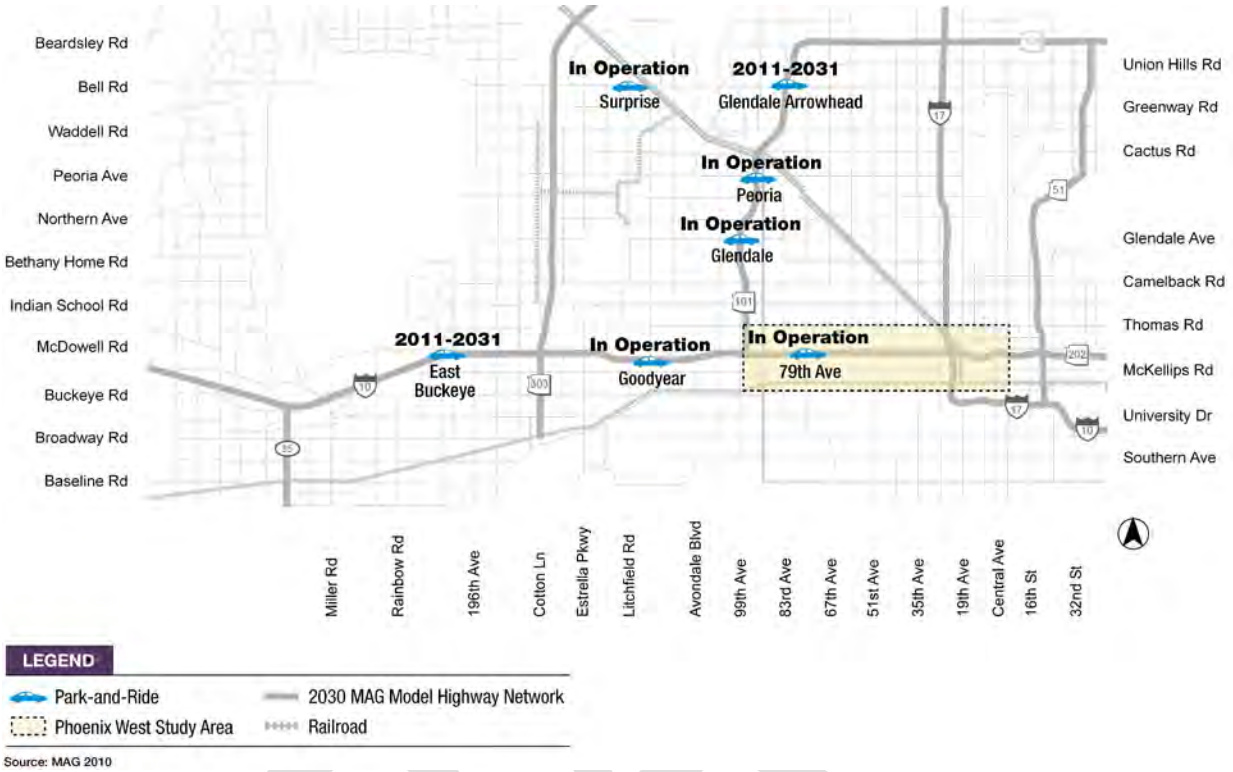
Figure 3 Planned and Operating Park-and-Ride Facilities



Source: MAG 2010

Light Rail Transit

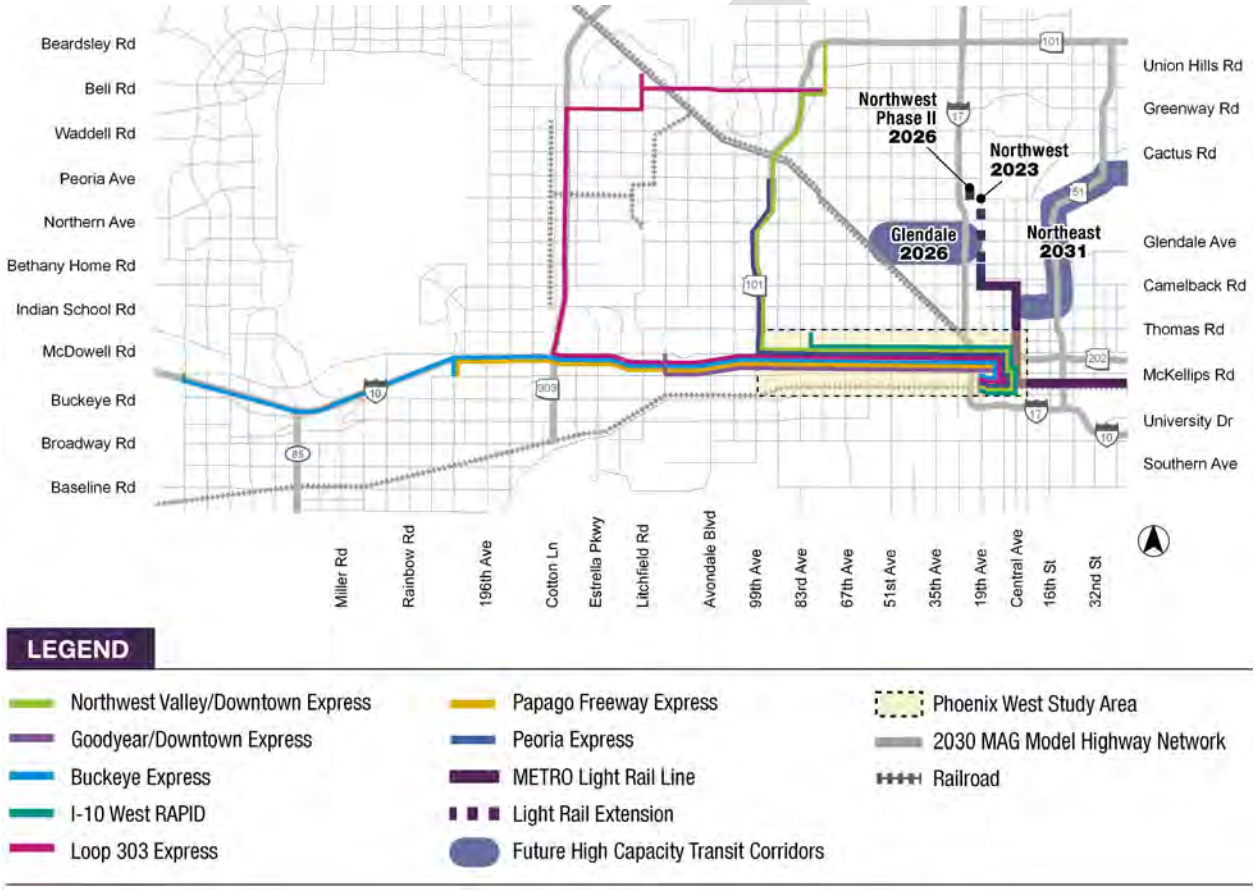
The existing CP/EV Starter Line currently operates seven days a week, with varying schedules for weekday, weekend, and holiday service. METRO operates Monday through Thursday service from 4:15 a.m. to 12:45 a.m. From approximately 7:30 a.m. to 7:00 p.m. headways are at 12 minutes, with trains operating at 20 minute frequencies outside of these times. On Fridays, headways are similar to Monday through Thursday service; however, service is extended until 3:45 a.m. Saturday light rail service operates between 4:45 a.m. to 3:49 a.m., with 15 minute headways in place until 8:00 p.m. After 8:00 p.m. trains operate at 20 minute frequency. Light rail service on Sundays and holidays operates between 4:45 a.m. and 12:45 a.m., at 20 minute headways. Figure 4 shows the proposed HCT extensions in the vicinity of the Phoenix West Study Area.

Ultimately, METRO would prefer to operate service at 10 minute frequency at all times. However, 10 minute service is pending the availability of future funding sources that could be used to pay for improved service frequency. For purposes of the Phoenix West AA/EIS Study, METRO anticipates operating at this improved 10-minute schedule in the opening year of the Phoenix West Extension, scheduled in 2021. The No-Build Alternative would not result in light rail expansion. METRO assumes that both the Northwest Extension Phase 1 and the Central Mesa Extension will be operational by 2030.

Background Bus Network

The No-Build Alternative would include all fixed route bus service (local and express) that is currently programmed in the *2010 RTP Update*. Table 3 identifies the bus routes that currently serve the Phoenix West Study Area and includes the service assumptions for both opening day of the extension and the horizon year of these routes in the No-Build Alternative. Figure 4 identifies the express and RAPID bus routes and Figure 5 shows the local bus routes serving the Phoenix West Study Area.

Figure 4 Express and RAPID Bus Routes Serving the Phoenix West Study Area



Source: MAG 2010

Figure 5 Local Bus Routes Serving the Phoenix West Study Area

Source: Valley Metro/RPTA 2011

Table 3 No-Build Headways, Horizon Year

Route No.	Description	No-Build Headways (minutes)	
		Peak	Off-peak
Express Bus			
460	I-10 West RAPID	10	N/A
561	Papago Freeway Express	30	N/A
562	Goodyear/Downtown Express	30	N/A
573	Northwest Valley/Downtown Express	30	N/A
577	Peoria Express	30	N/A
579	Loop 303 Express	30	N/A
Local Bus/Supergrid			
1	Washington St	30	30
3	Van Buren St	15	30
8	7th Ave	30	30
10	Roosevelt St	30	30
13	Buckeye Rd	30	30
15	15th Ave	30	30
17	McDowell/McKellips Rd	15	30
19	19th Ave	30	30
27	27th Ave	30	30
29	Thomas Rd	20	30
35	35th Ave	20	30
43	43rd Ave	30	30
51	51st Ave	35	35
59	59th Ave	30	30
67	67th Ave	30	30
131	START	60	60
685	Gila Bend Connector	180	180
Circulators			
DASH-G	DASH – Government Loop	12	12
MARY	Maryvale Circulator	30	30

Source: MAG 2010 – 2031 Travel Demand Model

Express Bus Routes

Route 460 – I-10 West RAPID – This service commenced operation in 2006 and provides peak period express service between Desert Sky Mall, the 79th Avenue Park-and-Ride, and downtown Phoenix.

Route 561 – Papago Freeway Express – This future route would provide peak period service between the future East Buckeye Park-and-Ride and Downtown Phoenix along I-10.

Route 562 – Goodyear/Downtown Express – Route 562 currently provides three weekday peak period inbound and outbound trips between the Goodyear Park-and-Ride in the West Valley and Downtown Phoenix..

Route 573 – Northwest Valley/Downtown Express – This service commenced in 2008, providing peak period express service to Downtown Phoenix from the following locations: 75th Avenue and Beardsley Road, Arrowhead Towne Center, and the Glendale Park-and-Ride.

Route 577 – Peoria Express – This future route would provide peak period express service between downtown Phoenix, a transit center at 43rd Avenue and I-10, and the Goodyear Park-and-Ride. .

Route 579 – Loop 303 Express – This service will begin in 2023 and will provide peak period express service between downtown Phoenix and the following locations: Arrowhead Transit Center; 99th Avenue and Bell Road; Sunrise Municipal Complex; Surprise Park-and-Ride; Loop 303 Park-and-Ride (at Northern Avenue); and the Goodyear Park-and-Ride.

Local Bus Routes

The following section describes the local bus routes that currently provide service within the Phoenix West Study Area. Unless otherwise noted, each of the local bus routes provides two-way service, seven days a week with limited weekend service.

Route 1 – This is an east-west route that provides service along Adams, Jefferson, and Washington Streets from 27th Avenue to Galvin Parkway (near the Phoenix Zoo), with access to the State Capitol, Central Station, and the CP/EV Starter Line. Within the Phoenix West Study Area, this route mimics the proposed east-west Build Alternatives between I-17 and 1st Avenue.

Route 3 – Route 3 is an east-west route that provides service along the northern extent of the Phoenix West Extension along Van Buren Street. The Route 3 service extends east of 67th Avenue through downtown Phoenix with access to Central Station, and continues east to Galvin Parkway (near the Phoenix Zoo).

Route 8 – Route 8 is a north-south route that travels along 7th Avenue and passes through the Phoenix West Extension Corridor through downtown Phoenix. Route 8 accesses Central

Station in Downtown Phoenix and extends along a portion of Jefferson Street before diverting south along 7th Avenue to southern Phoenix.

Route 10 – Route 10 provides limited access to the Phoenix West Study Area. West of the CP/EV Starter Line, Route 10 serves transit patrons south of the Phoenix West Study Area. Conversely, east of Central Avenue, Route 10 provides service to the east and north. Essentially, Route 10 passes through the easternmost boundary of the Phoenix West Study Area as it provides service along Central Avenue, also providing service to Central Station.

Route 13 – This route provides service to the southernmost portion of the Phoenix West Study Area as it travels primarily along Buckeye Road. The route extends from 75th Avenue through downtown Phoenix to Sky Harbor Airport.

Route 15 – Similar to Route 8, Route 15 essentially provides north-south local bus service through Central Phoenix. Route 15 provides service between Metrocenter Transit Center in northern Phoenix and Phoenix Sky Harbor Airport. Route 15 serves a portion of Washington/Jefferson Street within the Phoenix West Study Area.

Route 17 – This route provides east-west service along McDowell Road between 83rd Avenue and Granite Reef Road in the East Valley. Route 17 passes through downtown Phoenix and provides the closest indicator of bus transit ridership within the Phoenix West Study Area as McDowell Road parallels the I-10 freeway within 0.5 mile along its entirety.

Route 19 – Route 19 is another north-south route that provides local bus service to downtown Phoenix and crosses through the Phoenix West Study Area along 19th Avenue. This route extends between northern Phoenix and Baseline Road.

Route 27 – Route 27 serves as a north-south route that crosses through the Phoenix West Study Area along 27th Avenue. Route 27 extends from northern Phoenix to just south of the Study Area to Durango Street.

Route 29 – Similar to Route 17, Route 29 provides east-west service along a major arterial that parallels I-10 within the Phoenix West Study Area. Route 29 provides local bus service along Thomas Road, located one mile north of McDowell Road, from the Desert Sky Mall Transit Center at 75th Avenue to east Phoenix.

Route 35 – Route 35 is primarily a north-south route that crosses through the Phoenix West Study Area along 35th Avenue. This route provides transit service between Happy Valley Road in northern Phoenix and Baseline Road in southern Phoenix.

Route 43 – Route 43 crosses the Phoenix West Study Area at 43rd Avenue as a north-south bus route, providing transit service between Union Hills Road in northern Phoenix to Mohave Street (just south of Buckeye Road) in southern Phoenix.

Route 51 – Route 51 serves as a north-south bus route that crosses the Phoenix West Study Area along 51st Avenue. This service operates between Thunderbird Road in northern Phoenix to Roosevelt Street in downtown Phoenix.

Route 59 – This route crosses the Phoenix West Study Area along 59th Avenue as a north-south bus route. Route 59 provides service between Glendale Foothills Library in Glendale to southern Phoenix at Buckeye Road.

Route 67 – Serving as a north-south bus route, Route 67 provides service between Arrowhead Towne Center in Peoria and Buckeye Road in southern Phoenix. Route 67 crosses the Phoenix West Study Area along 67th Avenue.

Route 131 (START) – Route 131 primarily provides service to destinations in Avondale including Estrella Mountain Community College, Old Town Avondale, and Avondale Civic Center. This local bus route connects passengers to a park-and-ride located at Donnie Hale Park.

Route 685 – Providing regional service, the Gila Bend Regional Connector, or Route 685, provides flex-stop service between Ajo and Phoenix Monday through Saturday. Headways vary between two to three hours for this limited service, with the easternmost portion of the Study Area terminating at the Desert Sky Mall Transit Center, just north of the 79th Avenue Park-and-Ride.

3.2. BUILD ALTERNATIVES

This section describes the LRT and BRT Build Alternatives selected for evaluation through the Phoenix West AA/EIS Study process. Both alternatives are described in terms of physical location and operational characteristics.

3.2.1. LRT Build Alternative

LRT technology uses electrically powered vehicles with steel wheels on steel rails to move large numbers of people efficiently in high-demand urban corridors, such as the Phoenix West Study Area. LRT typically operates in an exclusive guideway, meaning no automobiles or other types of vehicles travel on the same trackway or occupy the same space as LRT. With the number of roadways crossing the Phoenix West Study Area, either traditional railroad gates or traffic signals may be required to control crossings of the LRT trackway.

The recommended LRT alignment for the Phoenix West AA/EIS Study would extend light rail service along an 11-mile corridor, west of 1st Avenue in Downtown Phoenix. As shown in Figure 1, the Phoenix West Study Area includes a Mainline and Downtown Section, each with their separate land use characteristics, design challenges, and transit connections. This section describes the LRT Build Alternative within the separate Downtown and Mainline Sections.

It is assumed that light rail service would operate at 10 minute frequencies upon inception of the Phoenix West Extension. METRO is currently evaluating whether the recommended Phoenix West LRT Build Alternative will interline with the CP/EV Starter Line in operation or require passengers to transfer between the separate transit lines. For travel forecasting purposes and as listed in Table 4, the LRT service for Phoenix West is assumed to interline with the CP/EV LRT Starter Line at 1st Avenue. With 10 minute headways assumed for the Phoenix West Extension and 10 minute frequency for the CP/EV LRT Starter Line, tying both systems together would result in 5 minute headways for LRT vehicles operating along Central Avenue. Because the trains operating along the Phoenix West Extension would turn north along Central Avenue, the CP/EV LRT Starter Line east of Central Avenue would maintain 10 minute headways. It should also be noted for travel forecasting purposes, the LRT Build Alternative assumes connection of the light rail to the CP/EV LRT Starter Line along Central and 19th Avenues north of the Phoenix West Study Area to Dunlap Road as well as extending east into Central Mesa. The current LRT service terminates at 19th Avenue/Montebello in Phoenix and Main Street/Sycamore on the eastern end.

The service and operational characteristics of the LRT Build Alternative were developed to meet the Purpose and Need for the project. This includes the overall alignment and station locations, service frequency, and minimization of transfer based on the travel patterns observed in the corridor. As a fixed guideway, the LRT Build Alternative also meets the need for reinforcement of economic development opportunities in the corridor and part of a shared solution to incorporate highway, bus, and transit service as a seamless system. A preliminary analysis of existing and potential future socioeconomic conditions based on the introduction of LRT within the study area is included as Appendix B.

Downtown Section

The LRT Build Alternative would operate approximately 3 miles in the Downtown Section of the Phoenix West Study Area. Directly west of the CP/EV Starter Line at 1st Avenue along Washington and Jefferson Streets, the recommended alternative would operate as a single-track along Washington Street (westbound) and Jefferson Street (eastbound) for approximately 0.5 mile to 7th Avenue. Just west of 7th Avenue, the westbound LRT trackway would divert southwest across a vacant parcel owned by the City of Phoenix and continue to operate westbound along Jefferson Street. This would effectively create a double-track, two-way operation in a single guideway for the remainder of the Phoenix West Extension. The guideway would be exclusively reserved for light rail vehicles, physically separated from automobile traffic through use of a barrier such as a trackway curb. Preliminary design efforts conclude that modification of Jefferson Street, currently a 4-lane one-way arterial road for eastbound traffic, to accommodate the LRT guideway could result in the preservation of 2 lanes for general traffic with a frontage road for local access.

One of the major issues the LRT guideway would face in the Downtown Section is crossing 19th Avenue. BNSF Railway operates freight along a railroad track that parallels 19th Avenue on the west side of the road. A grade separation structure would be required to cross the freight tracks at 19th Avenue. METRO is currently evaluating whether an overpass or underpass would be constructed to accommodate the railroad crossing.

As the LRT Build Alternative heads west of downtown Phoenix, the two-way LRT guideway would cross over I-17 along Jefferson Street by either using the existing arterial bridge crossing or constructing a new freeway overpass structure to accommodate the guideway, parallel to the existing Jefferson Street Bridge. METRO is currently coordinating with ADOT regarding the appropriate design. Just after the LRT guideway crosses the freeway, it would continue north along the I-17 Southbound Frontage Road before operating within the I-10 right-of-way (ROW).

The I-17 Southbound Frontage Road, which currently accommodates southbound automobile traffic, would be modified to accommodate the LRT guideway. Between Van Buren and Jefferson Streets, the I-17 Southbound Frontage Road would maintain at least one lane for southbound automobile traffic. However, north of Van Buren Street the Frontage Road would be converted to an exclusive LRT guideway, removing all other traffic from this section of road.

Mainline Section

From the Phoenix West Downtown Section, the Mainline Section guideway would connect directly from the I-17 Southbound Frontage Road to the I-10 median via a direct access ramp constructed west of the I-17/I-10 confluence, commonly known as the "Stack Interchange." Between I-17 and 83rd Avenue, the 50-foot freeway median is currently vacant, preserved for high capacity transit when the I-10 freeway was originally designed and constructed. The recommended LRT Build Alternative guideway would operate within the freeway median for approximately 3 miles before transitioning near 47th Avenue via grade separation over the westbound freeway traffic lanes to the north side of I-10. METRO is currently working with ADOT, the City of Phoenix, and other stakeholders to identify the specific location of the north side transition within the freeway.

The guideway would be placed adjacent to a drainage channel that parallels I-10 to the north, within the ADOT freeway ROW. From approximately 47th Avenue, the LRT guideway would parallel the drainage channel to connect with the 79th Avenue Park-and-Ride. Preliminary analysis shows that the access road adjacent to the drainage channel could accommodate the light rail guideway.

Along the Phoenix West Mainline Section, the LRT Build Alternative would require crossing of several arterials along the north side of the freeway. METRO is working with ADOT, the City of Phoenix, and other stakeholders to evaluate appropriate crossing mechanisms including elevated trackway crossings and at-grade crossings.

The following are the elements of the LRT Build Alternative including:

- Passenger Facilities/Stations
- Light Rail Transit
- Background Bus Network
- Express Bus Routes
- Local Bus/Planned Supergrid Routes
- Circulators
- Feeder Bus Service

Passenger Facilities/Stations

The LRT Build Alternative would include implementation of stations and park-and-ride facilities throughout the Phoenix West Study Area. Specific station locations will be identified in the EIS planning phase of the Phoenix West Study. Four station areas have been identified in the Downtown Section to generally serve the transit corridor along Washington and Jefferson Streets. METRO has identified strategic station target areas, located to include destinations in downtown Phoenix including:

- St. Matthew Neighborhood – between 20th Avenue and I-17
- The State Capitol Complex – near 17th Avenue
- Maricopa County/City of Phoenix government buildings – near 7th Avenue
- City of Phoenix offices – near 3rd Avenue

Because the LRT Build Alternative guideway would be located on both Washington and Jefferson Streets east of 8th Avenue, separate stations for eastbound and westbound travel would be required for the proposed 3rd Avenue station locations.

Along the Mainline Section, the LRT Build Alternative would place most new transit facilities on the north side of the I-10 ROW, with the exception of a new LRT station in the freeway median at 35th Avenue. By placing the LRT guideway and facilities along the north side of I-10, an opportunity is presented to possibly enhance economic development and serve medium to high-density residential land uses due to the close proximity of the LRT guideway.

The LRT Build Alternative Mainline transit facilities would include:

- LRT Stations – 35th Avenue (median station), 51st Avenue, and 67th Avenue
- LRT Stations and Park-and-Rides – 59th Avenue and 79th Avenue (existing)

The 79th Avenue Park-and-Ride would remain as a functional transit park-and-ride; however, the LRT Build Alternative assumes the park-and-ride would increase capacity depending on forecasted demand. For the month of June 2010, Phoenix Public Transit reported that the facility was at approximately 65 percent capacity.

Light Rail Transit

The build alternative includes the construction of an 11-mile extension of light rail line to the 79th Park-and-Ride from downtown Phoenix. This service is assumed to operate 10 minute peak and off-peak LRT headways within the Phoenix West portion of the Study Area. However, with the connection of the Phoenix West Extension to the CP/EV Starter Line, as previously described, the light rail vehicles making the transition would result in improved headways along the portion of the CP/EV Starter Line section along Central Avenue up to Dunlap Road (the proposed terminus of the Northwest Extension Phase I). The 10 minute CP/EV Starter Line service and 10 minute Phoenix West LRT service would result in trains serving stations every 5 minutes north of the confluence of the two lines.

Background Bus Network

The purpose of the background bus network is to provide connection to the light rail extension within the Phoenix West Study Area. Table 4 summarizes the service assumptions for both opening day and the horizon year of bus routes in the LRT Build Alternative, with proposed route modifications noted in bold.

Table 4 LRT Build Headways, Horizon Year

Route No.	Description	LRT Build Headways (minutes)	
		Peak	Off-peak
High Capacity Transit			
-	CP/EV Starter Line	10	10
NEW LRT	**New** 79th Avenue Park-and-Ride to State Capitol to Downtown Phoenix north to 19th Avenue and Dunlap Avenue	**10**	**10**
Express Bus**			
460	**Removed** I-10 West RAPID	**N/A**	**N/A**
561	Papago Freeway Express	**30**	**N/A**
562	Goodyear/Downtown Express	30	N/A
573	Arrowhead-Downtown Phoenix	30	N/A
577	Peoria Express	**30**	**N/A**
579	**Removed** Loop 303 Express	**N/A**	**N/A**
Local Bus/Supergrid			
1	Washington St	30	30
3	Van Buren St	15	30
8	7th Ave	30	30
10	Roosevelt St	30	30
13	Buckeye Rd	30	30
15	15th Ave	30	30
17	McDowell/McKellips Rd	15	30
19	19th Ave	30	30

Route No.	Description	LRT Build Headways (minutes)	
		Peak	Off-peak
27	27th Ave	30	30
29	Thomas Rd	20	30
35	35th Ave	20	30
43	43rd Ave	30	30
51	51st Ave	35	35
59	59th Ave	30	30
67	67th Ave	30	30
131	START	60	60
685	Gila Bend Connector	180	180
Circulators			
DASH-G	DASH – Government Loop	12	12
MARY	Maryvale Circulator	30	30
35L	**New Service**	**15**	**30**
6751L	**New Service**	**15**	**30**
79L	**New Service**	**15**	**30**
Feeder Bus Service			
91	**New Service**	**15**	**30**
107N	**New Service**	**15**	**30**
107S	**New Service**	**15**	**30**
DysN	**New Service**	**15**	**30**
DysS	**New Service**	**15**	**30**
EstN	**New Service**	**15**	**30**
EstS	**New Service**	**15**	**30**

Source: METRO 2010

* *Bold text indicates a change in headway or addition of service over the No-Build Alternative scenario; alignment changes discussed below*

** *New terminus; please see route description below for details*

Express Bus Routes

Route 460 – The proposed LRT Build Alternative would eliminate Route 460.

Route 561 – The proposed LRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 562 – The proposed LRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 573 – The proposed LRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 577 – The proposed LRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 579 – The proposed LRT Build Alternative would eliminate Route 579.

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Local Bus/Planned Supergrid Routes

The LRT Build Alternative would not result in any modifications to the local bus or planned Supergrid service in terms of routes or frequencies.

Circulators

DASH-Government Loop – The proposed LRT Build Alternative would not result in a change in service to the DASH-Government Loop circulator.

MARY – The proposed LRT Build Alternative would not result in a change in service to the MARY circulator.

The following three circulator routes are not currently programmed in the current RTP or Transit Life Cycle Program (TLCP), however METRO believes they are necessary to provide walk access trips to light rail service. Service frequencies indicated for these routes are suggestive.

Route 35L – The LRT Build Alternative would result in a new Route 35L that would operate in a loop providing a localized connection to light rail service operating within the I-10 ROW. Route 35L would operate along 35th and 43rd Avenues, with Encanto Boulevard providing the northern boundary and Lower Buckeye Road the southern boundary. Peak period frequency would be 15 minutes, with off peak service provided every 30 minutes.

Route 6751L – Route 6751L would be introduced as a circulator route that would provide localized service that would connect the light rail service at the 67th and 59th Avenue bus stops. Route 6751L would operate along the portions of 51st and 67th Avenues generally bordered by Encanto Boulevard to the north and Lower Buckeye Road to the south. Peak period frequency would be 15 minutes, with off peak service provided every 30 minutes.

Route 79L – The Route 79L circulator would be a new service intended to connect the southwestern Phoenix area and City of Tolleson with the new LRT extension via direct connection to the 79th Avenue Park-and-Ride and Desert Sky Transit Center. Route 79L would essentially provide a loop service through the main section of Tolleson, extending south to Lower Buckeye Road between 75th and 99th Avenues before crossing I-10 to connect passengers at the 79th Avenue Park-and-Ride and Desert Sky Transit Center. The circulator would use 83rd Avenue to cross to the north of I-10 to access the 79th Avenue Park-and-Ride. Route 79L would operate 15 minute peak period service, with 30 minute off peak frequencies.

Feeder Bus Service

The feeder bus service described in this section includes routes that are outside the Phoenix West Study Area and not currently programmed in the current RTP or TLCP. To provide service to West Valley residents, new transit service will be required. Accordingly, the feeder routes described in this section were added to improve the overall connection from the West

Valley to the Phoenix West Study Area. Service frequencies indicated for these routes are suggestive.

Route 91 – Similar to circulator Routes 35L, 6751L, and 79L, Route 91 would connect directly with the Phoenix West LRT extension at the 79th Avenue Park-and-Ride. Route 91 would operate as a to/from linear feeder route that would connect riders from Northern Avenue to the Desert Sky Transit Center and 79th Avenue Park-and-Ride. Route 91 would generally use 91st Avenue and extend through the western areas of Glendale and Phoenix. Route 91 would operate at 15 minute peak period service, with 30 minute off peak service.

Route 107N – The LRT Build Alternative would introduce Route 107N as a feeder bus route to provide a connection to the Phoenix West LRT Extension operating from the 79th Avenue Park-and-Ride. Serving northeast Avondale, Route 107N would generally follow 107th Avenue from Camelback Road, head west along McDowell Road before entering I-10 at 115th Avenue. The route would truncate at the 79th Avenue Park-and-Ride, requiring passengers to transfer to the light rail system to connect with downtown Phoenix and the rest of the METRO system. Route 107N would operate at 15 minute peak period service, with 30 minute off peak service.

Route 107S – Whereas Route 107N would provide localized feeder bus service north of I-10, Route 107S would serve southeast Avondale along 115th Avenue north of Lower Buckeye Road. Route 107S would access the freeway at 115th Avenue and connect to the 79th Avenue Park-and-Ride, requiring a transfer to the Phoenix West light rail to access the rest of the METRO system. Route 107S would operate at 15 minute peak period service, with 30 minute off peak service.

Route DysN – Also serving as a new feeder bus service, Route DysN would provide bus service along Dysart Road north of I-10 through western Avondale and the City of Litchfield Park. Route DysN would access the freeway at Dysart Avenue and travel along I-10 to the 79th Avenue Park-and-Ride, requiring that passengers transfer to light rail at the 79th Avenue Park-and-Ride. Route DysN would operate at 15 minute peak period service, with 30 minute off peak service.

Route DysS – Providing feeder bus service to southwest Avondale, the LRT Build Alternative would introduce Route DysS as a feeder route to connect passengers to the light rail at the 79th Avenue Park-and-Ride using I-10. The DysS route would access I-10 at Dysart Road and provide 15 minute peak period service and 30 minute off peak service.

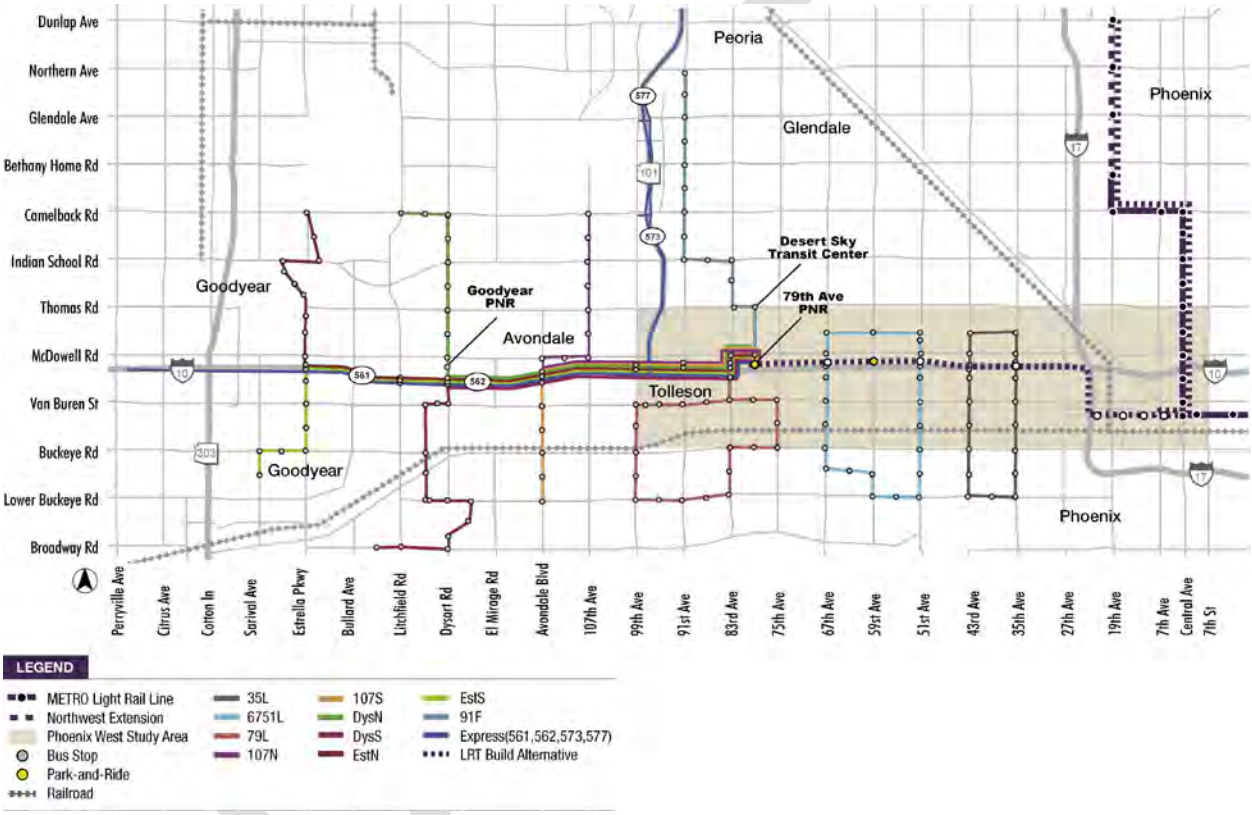
Route EstN – Serving the City of Goodyear, Route EstN would be introduced as a new feeder bus route that would generally follow Pebble Creek Parkway north of I-10 from Camelback Road to I-10. Route EstN would travel along I-10 to the 79th Avenue Park-and-Ride, requiring a transfer to light rail to access the METRO system. Route EstN would operate at 15 minute peak period service, with 30 minute off peak service.

Route EstS – Route EstS would serve as a new feeder bus route providing service to the area of Goodyear directly south of I-10 along Estrella Parkway to just north of Lower

Buckeye Road. Connecting to I-10 at Estrella Parkway, Route EstS would travel along I-10 to the 79th Avenue Park-and-Ride, where a transfer to light rail would be required to connect to downtown Phoenix and the rest of the METRO system. Route EstS would operate at 15 minute peak period service, with 30 minute off peak service.

Figure 6 shows the circulator and feeder bus service routes associated with the LRT Build Alternative.

Figure 6 Phoenix West Recommended LRT Build Alternative and Bus Routes



Source: METRO 2010

3.2.2. BRT Build Alternative

The BRT Build Alternative is designed to provide a fast, reliable transit service by providing limited stops through the use of bus-only travel lanes (similar to the LRT guideway described for the LRT Build Alternative), queue jump treatments, and/or signal priority systems.

The proposed BRT alignment for the Phoenix West AA/EIS Study would assume that the alignment would travel within a designated guideway following the same recommended LRT alignment in the Mainline Section of the Study Area. The BRT Build Alterative would operate in mixed traffic in the Downtown Section of the Study Area, as described in this section. The BRT Build Alternative would operate at headways consistent with the LRT Build Alternative.

The service and operational characteristics of the BRT Build Alternative were developed to meet the Purpose and Need for the project.

Downtown Section

The BRT Build Alternative would operate along Washington and Jefferson Streets in Downtown Phoenix. Buses operating in downtown Phoenix would operate in mixed traffic along one-way roadways, with eastbound buses traveling along Jefferson Street and Westbound buses along Washington Street. (Near 17th Avenue Washington Street diverts northwest and turns into Adams Street.) As the westbound buses approach I-17, they would divert north along the I-17 Northbound Frontage Road and cross I-17 at Van Buren Street. Eastbound buses would cross I-17 at Jefferson Street, again within mixed traffic. No separate guideway, or "busway," would be implemented east of I-17 for the BRT Build Alternative. However, measures such as queue jumpers and signal priority treatments would be implemented to promote efficient movement of buses within the mixed traffic environment.

It should also be noted for travel forecasting purposes the BRT Build Alternative assumes bus service that parallels the CP/EV LRT Starter Line along Central and 19th Avenues north of the Phoenix West Study Area to Dunlap Road.

Similar to the LRT Build Alternative, a busway to be used exclusively for bus travel would be implemented along the I-17 Southbound Frontage Road from I-10 to Van Buren Street. All other vehicle traffic south of I-10 along the Southbound Frontage Road would be discontinued until Van Buren Street. South of Van Buren Street along the I-17 Southbound Frontage Road, eastbound BRT buses would operate in mixed traffic. Implementation of the BRT Build Alternative would result in the discontinued use of the 3rd/5th Avenue direct access HOV ramp that connects to 5th and 3rd Avenues from I-10 by existing express buses.

Mainline Section

Similar to the LRT Build Alternative, the BRT Build Alternative would operate in an exclusive busway that would be assumed on the north side of I-10 west of I-17. The busway would connect to downtown via a direct access ramp that would provide direct access to the I-17 Southbound Frontage Road.

The BRT Build Alternative is assumed to follow the same alignment as the LRT Build Alternative in the Mainline Section of the Phoenix West AA/EIS Study Area. The busway would extend within the I-10 median west of I-17 until approximately 47th Avenue where it would divert to the north side of the I-10 ROW along the existing drainage channel. The BRT guideway would extend to the 79th Avenue Park-and-Ride. All express and RAPID routes that currently operate along I-10 from the West Valley would truncate at the Park-and-Ride facility, requiring passengers to transfer to the BRT service to access downtown Phoenix.

The following are the elements of the BRT Build Alternative including:

- Passenger Facilities/Stations
- Background Bus Network
- Express Bus Routes
- Local Bus/Planned Supergrid Routes
- Circulators
- Feeder Bus Service

Passenger Facilities/Stations

The transit facilities including park-and-rides and stations previously described for the LRT Build Alternative would generally be located in the same areas. In the Downtown Section, four station areas have been identified to generally serve the transit corridor along Washington and Jefferson Streets. However, as opposed to the LRT Build Alternative, because buses associated with the BRT Build Alternative would travel on separate roadways (Washington/Adams Street and Jefferson Street), additional stations are necessary. The station target areas where two stations would be placed to accommodate eastbound and westbound buses in downtown Phoenix would include:

- St. Matthew Neighborhood – between 20th Avenue and I-17 along Adams and Jefferson Streets
- The State Capitol Complex – near 17th Avenue Along Adams and Jefferson Streets
- Maricopa County/City of Phoenix government buildings – near 7th Avenue along Washington and Jefferson Streets
- City of Phoenix Offices – near 3rd Avenue along Washington and Jefferson Streets

Along the Mainline Section, the arterials identified for the LRT Build Alternative that would include park-and-rides and station would be exactly the same for the BRT Build Alternative. The BRT Build Alternative would operate within an exclusive busway within the freeway median to approximately 47th Avenue, where the busway would transition to the north side of I-10. From here the busway would extend west to the 79th Avenue Park-and-Ride. Whereas grade separations would be necessary at select arterial crossings for the LRT Build Alternative along the Mainline Section, the BRT Build Alternative would allow buses to cross the major arterials at-grade.

The BRT Build Alternative Mainline facilities would include:

- BRT Stations – 35th Avenue, 51st Avenue, and 67th Avenue
- Park-and-Rides – 59th Avenue and 79th Avenue (existing)

Background Bus Network

The purpose of the background bus network is to provide connection to the new BRT service within the Phoenix West Study Area. Table 5 summarizes the service assumptions for both opening day and the horizon year of bus routes in the BRT alternative, with proposed route modifications noted in bold.

Table 5 BRT Build Headways, Horizon Year

Route No.	Description	BRT Build Headways (minutes)	
		Peak	Off-peak
High Capacity Transit			
-	CP/EV Starter Line	10	10
NEW BRT	**New-**79th Avenue Park-and-Ride to State Capitol to Downtown Phoenix north to 19th Avenue and Dunlap Avenue	**10**	**10**
Express Bus**			
460	**Removed**-I-10 West RAPID	**N/A**	**N/A**
561	**New** Papago Freeway Express	**30**	**N/A**
562	Goodyear/Downtown Express	30	N/A
573	Arrowhead-Downtown Phoenix	30	N/A
577	**New** Peoria Express	**30**	**N/A**
579	**Removed**-Loop 303 Express	**N/A**	**N/A**
Local Bus/Supergrid			
1	Washington St	30	30
3	Van Buren St	15	30
8	7th Ave	30	30
10	Roosevelt St	30	30
13	Buckeye Rd	30	30
15	15th Ave	30	30
17	McDowell/McKellips Rd	15	30
19	19th Ave	30	30
27	27th Ave	30	30
29	Thomas Rd	20	30
35	35th Ave	20	30
43	43rd Ave	30	30
51	51st Ave	35	35
59	59th Ave	30	30
67	67th Ave	30	30
131	START	60	60
685	Gila Bend Connector	180	180
Circulators			
DASH-G	DASH – Government Loop	12	12
MARY	Maryvale Circulator	30	30
35L	**New Service**	**15**	**30**
6751L	**New Service**	**15**	**30**
79L	**New Service**	**15**	**30**

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Route No.	Description	BRT Build Headways (minutes)	
		Peak	Off-peak
Feeder Bus Service			
91	**New Service**	**15**	**30**
107N	**New Service**	**15**	**30**
107S	**New Service**	**15**	**30**
DysN	**New Service**	**15**	**30**
DysS	**New Service**	**15**	**30**
EstN	**New Service**	**15**	**30**
EstS	**New Service**	**15**	**30**

Source: METRO 2010

* *Bold text indicates a change in headway or addition of service over the No-Build Alternative scenario; alignment changes discussed below*

** *New terminus; please see route description below for details*

Express Bus Routes

Route 460 – The proposed BRT Build Alternative would eliminate Route 460.

Route 561 – The proposed BRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 562 – The proposed BRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 573 – The proposed BRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 577 – The proposed BRT Build Alternative would result in inbound service terminating at 79th Avenue.

Route 579 – The proposed BRT Build Alternative would eliminate Route 579.

Local Bus/Planned Supergrid Routes

The BRT Build Alternative would not result in any modifications to the local bus or planned Supergrid service in terms of routes or frequencies.

Circulators

DASH-Government Loop – The BRT Build Alternative would not result in a change in service to the DASH-Government Loop circulator.

MARY – The BRT Build Alternative would not result in a change in service to the MARY circulator.

The following three circulator routes are not currently programmed in the current RTP or TLCP, however METRO believes they are necessary to provide walk access trips to BRT service. Service frequencies indicated for these routes are suggestive.

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Route 35L – The BRT Build Alternative would result in a new Route 35L that would operate in a loop providing a localized connection to BRT service operating in an exclusive guideway within the I-10 ROW. Route 35L would operate along 35th and 43rd Avenues, with Encanto Boulevard providing the northern boundary and Lower Buckeye Road the southern boundary. Peak period frequency would be 15 minutes, with off peak service provided every 30 minutes.

Route 6751L – Route 6751L would be introduced as a circulator route that would provide localized service that would connect the BRT service to the 67th and 59th Avenue bus stops. Route 6751L would operate along the portions of 51st and 67th Avenues generally bordered by Encanto Boulevard to the north and Lower Buckeye Road to the south. Peak period frequency would be 15 minutes, with off peak service provided every 30 minutes.

Route 79L – The Route 79L circulator would be a new service intended to connect the southwestern Phoenix area and City of Tolleson with the new BRT service via direct connection to the 79th Avenue Park-and-Ride and Desert Sky Transit Center. Route 79L would essentially provide a loop service through the main section of Tolleson, extending south to Lower Buckeye Road between 75th and 99th Avenues before crossing I-10 to connect passengers at the 79th Avenue Park-and-Ride and Desert Sky Transit Center. The circulator would use 83rd Avenue to cross to the north of I-10 to access the 79th Avenue Park-and-Ride. Route 79L would operate 15 minute peak period service, with 30 minute off peak frequencies.

Feeder Bus Service

The feeder bus service described in this section includes routes that are outside the Phoenix West Study Area. To provide service to West Valley residents, new transit service will be required. Accordingly, the feeder routes described in this section were added to improve the overall connection from the West Valley to the Phoenix West Study Area. Service frequencies indicated for these routes are suggestive.

Route 91 – Similar to circulator Routes 35L, 6751L, and 79L, Route 91 would connect directly with the Phoenix West BRT service at the 79th Avenue Park-and-Ride. Route 91 would operate as a to/from linear feeder route that would connect riders from Northern Avenue to the Desert Sky Transit Center and 79th Avenue Park-and-Ride. Route 91 would generally use 91st Avenue and extend through the western areas of Glendale and Phoenix. Route 91 would operate at 15 minute peak period service, with 30 minute off peak service.

Route 107N – The BRT Build Alternative would introduce Route 107N as a feeder bus route to provide a connection to the BRT service operating in an exclusive guideway from the 79th Avenue Park-and-Ride. Serving northeast Avondale, Route 107N would generally follow 107th Avenue from Camelback Road, head west along McDowell Road before entering I-10 at 115th Avenue. The bus route would truncate at the 79th Avenue Park-and-Ride, requiring passengers to transfer to the BRT system to connect with downtown Phoenix and the METRO LRT system. Route 107N would operate at 15 minute peak period service, with 30 minute off peak service.

Route 107S – Whereas Route 107N would provide localized feeder bus service north of I-10, Route 107S would serve southeast Avondale along 115th Avenue north of Lower Buckeye Road. Route 107S would access the freeway at 115th Avenue and connect to the 79th Avenue Park-and-Ride, requiring a transfer to the BRT system to access the METRO LRT system. Route 107S would operate at 15 minute peak period service, with 30 minute off peak service.

Route DysN – Also serving as a new feeder bus service, Route DysN would provide bus service along Dysart Road north of I-10 through western Avondale and the City of Litchfield Park. Route DysN would access the freeway at Dysart Avenue and travel along I-10 to the 79th Avenue Park-and-Ride, requiring that passengers transfer to BRT at the 79th Avenue Park-and-Ride. Route DysN would operate at 15 minute peak period service, with 30 minute off peak service.

Route DysS – Providing feeder bus service to southwest Avondale, the BRT Build Alternative would introduce Route DysS as a feeder route to connect passengers to BRT at the 79th Avenue Park-and-Ride using I-10. The DysS route would access I-10 at Dysart Road and provide 15 minute peak period service and 30 minute off peak service.

Route EstN – Serving the City of Goodyear, Route EstN would be introduced as a new feeder bus route that would generally follow Pebble Creek Parkway north of I-10 from Camelback Road to I-10. Route EstN would travel along I-10 to the 79th Avenue Park-and-Ride, requiring a transfer to BRT to access the METRO LRT system. Route EstN would operate at 15 minute peak period service, with 30 minute off peak service.

Route EstS – Route EstS would serve as a new feeder bus route providing service to the area of Goodyear directly south of I-10 along Estrella Parkway to just north of Lower Buckeye Road. Connecting to I-10 at Estrella Parkway, Route EstS would travel along I-10 to the 79th Avenue Park-and-Ride, where a transfer to BRT would be required to connect to downtown Phoenix and the METRO LRT system. Route EstS would operate at 15 minute peak period service, with 30 minute off peak service. Figure 7 shows the BRT Build Alternative and associated bus routes.

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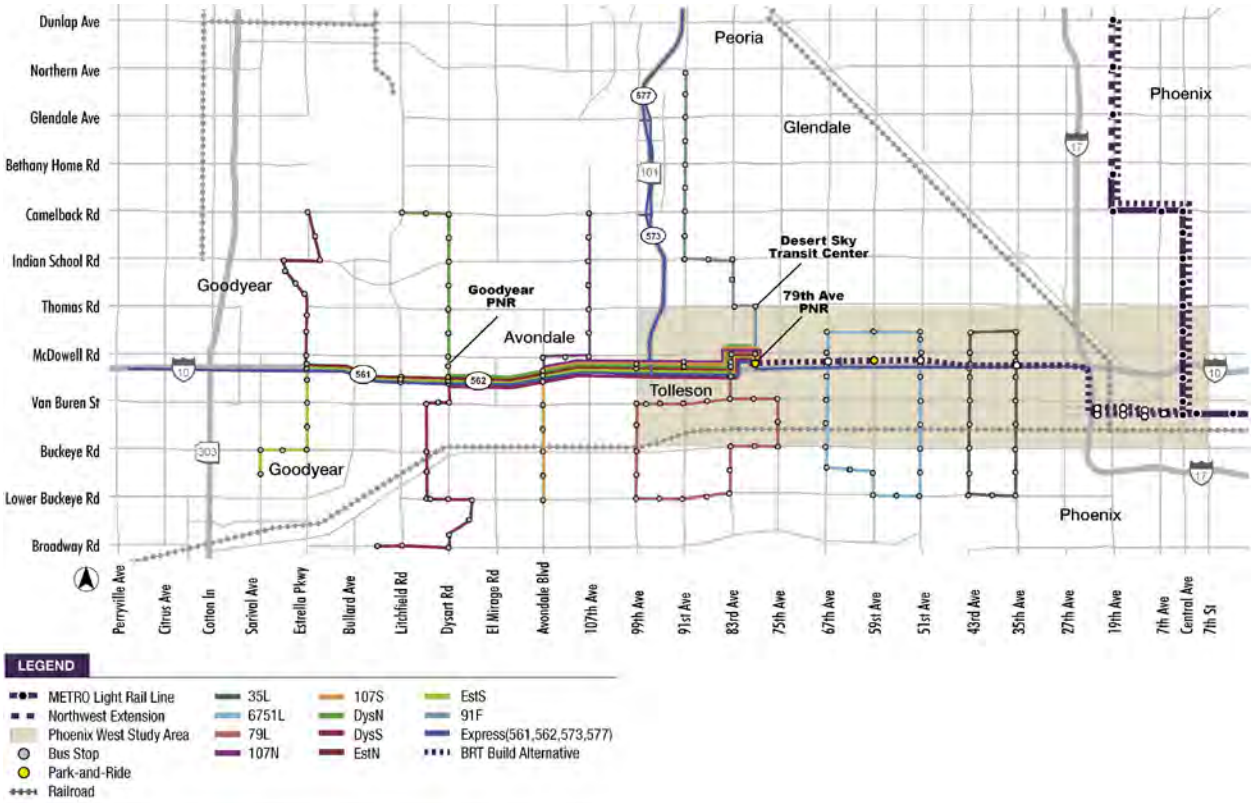
Figure 7 BRT Build Alternative and Bus Routes



Source: METRO 2010

4.0 SUMMARY OF ALTERNATIVES

The No-Build, LRT Build and BRT Build Alternatives are meant to represent a buildup of transit services with a varying level of capital investment for each alternative. The No-Build Alternative presented in this report utilizes bus routes currently in operation and future routes identified in the MAG *RTP 2010 Update*.

The LRT and BRT Build Alternatives, while representing a higher capital investment compared to the No-Build Alternatives, offer passengers efficient and reliable service through operation of transit within a separate guideway. One of the distinguishing characteristics of the LRT Build Alternative from the BRT Build Alternative is the movement of vehicles through Downtown Phoenix. The LRT Build Alternative, recommended by METRO, would operate in a separate guideway whereas the BRT service would operate in mixed traffic. Modified express bus routes and the addition of circulators and feeder bus service are designed to maximize ridership potential along these fixed-route services.

In addition to the varying physical alignments associated with each alternative, bus route frequencies vary between each to maximize ridership based on individual alternative configurations and operating frequencies. Most of the frequencies for existing bus routes remain consistent for each alternative. The additional circulators and feeder bus service

affiliated with the Build Alternatives represent increased transit service in the West Valley. Table 6 summarizes peak and off-peak headways for the background bus network in each of the alternatives.

Table 6 Summary of Headways for the Proposed Phoenix West Alternatives

Route	No-Build		LRT Build		BRT Build	
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
High Capacity Transit						
CP/EV Starter Line	10	10	10	10	10	10
New LRT	N/A	N/A	10	10	N/A	N/A
New BRT	N/A	N/A	N/A	N/A	10	10
Bus						
Express Bus						
460	10	N/A	N/A	N/A	N/A	N/A
561	30	N/A	30	N/A	30	N/A
562	30	N/A	30	N/A	30	N/A
573	30	N/A	30	N/A	30	N/A
577	N/A	N/A	30	N/A	30	N/A
579	30	N/A	N/A	N/A	N/A	N/A
Local Bus/Supergrid						
1	30	30	30	30	30	30
3	15	30	15	30	15	30
8	30	30	30	30	30	30
10	30	30	30	30	30	30
13	30	30	30	30	30	30
15	30	30	30	30	30	30
17	15	30	15	30	15	30
19	30	30	30	30	30	30
27	30	30	30	30	30	30
29	20	30	20	30	20	30
35	20	30	20	30	20	30
43	30	30	30	30	30	30
51	35	35	35	35	35	35
59	30	30	30	30	30	30
67	30	30	30	30	30	30
131	60	60	60	60	60	60
685	180	180	180	180	180	180
Circulators						
DASH-G	12	12	12	12	12	12
MARY	30	30	30	30	30	30
79L	N/A	N/A	15	30	15	30
6751L	N/A	N/A	15	30	15	30
35L	N/A	N/A	15	30	15	30

Route	No-Build		LRT Build		BRT Build	
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Feeder Bus Service						
91	N/A	N/A	15	30	15	30
107N	N/A	N/A	15	30	15	30
107S	N/A	N/A	15	30	15	30
DysN	N/A	N/A	15	30	15	30
DysS	N/A	N/A	15	30	15	30
EstN	N/A	N/A	15	30	15	30
EstS	N/A	N/A	15	30	15	30

Source: METRO 2010

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Appendix A

METRO/ADOT/MAG/COP Working Agreement

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DRAFT MOA IN REVISION

Appendix B

Phoenix West High Capacity Transit Study
Economic Impact Assessment

DRAFT

PHOENIX WEST

HIGH CAPACITY TRANSIT STUDY

ECONOMIC IMPACT ASSESSMENT

April 2010

METRO

METRO

PHOENIX WEST EXTENSION
CORRIDOR ECONOMIC IMPACT ASSESSMENT

FINAL REPORT

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CORRIDOR ECONOMIC IMPACT ASSESSMENT
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LIST OF ACRONYMS

AA	Alternatives Analysis
EIA	Economic Impact Assessment
AA/EIS	Alternatives Analysis/Environmental Impact Statement
ADOT	Arizona Department of Transportation
BNSF	Burlington Northern Santa Fe
BRT	Bus Rapid Transit
CBD	Central Business District
FTA	Federal Transit Administration
HCT	High Capacity Transit
LRT	Light Rail Transit
MAG	Maricopa Association of Governments
METRO	Valley Metro Rail, Inc.
NEPA	National Environmental Policy Act
PWE	Phoenix West Extension
UPRR	Union Pacific Railroad

1.0 INTRODUCTION

The purpose of this analysis is to assist URS and METRO in evaluating the potential economic development and socioeconomic impacts of the proposed Phoenix West Extension of the METRO LRT system. This project will extend the Metro system by providing service into the western portion of the government mall area / State government complex, and beyond within (or near) the I-10 right-of-way out to approximately 79th Avenue. This route will provide access to the overall High Capacity Transit (HCT) system to the bourgeoning population and labor force in the West I-10 corridor. The study area encompasses land on each side of the proposed rail line beginning at 7th Avenue and terminating just beyond the final potential station location at 79th Avenue. There are six potential station areas being evaluated inside the corridor, although the locations, or the precise route alignment, have not yet been determined.

Under the NEPA guidelines, operations impacts include any permanent impacts that may occur as a result of, or partially as a result, of the HCT improvement. These are driven by land use and development changes that result in permanent gains or losses of population, employment and tax revenues. In this study, the socioeconomic impacts of the Phoenix West Extension are compared to existing conditions and to a No-Build future scenario with no LRT improvements. The potential socioeconomic impacts of the Phoenix West Extension on the corridor are measured in terms of:

- Land use (acres by use)
- Housing units, households and population
- Non-residential square footage and employment
- Property values
- Taxable sales
- State and local sales and property tax revenue

For each of these variables, we will show the difference between the No-Build future and the LRT future scenario.

1.1 SUMMARY OF FINDINGS

Table 1-1 below summarizes the level of impacts for each of the key variables and indicates the percent difference between the scenarios. These figures are for the entire study area, however detailed information for the six sub-parts of the study area are included in the body of the report.

Table 1-1 Impact Summary for Phoenix West Extension Study Area

	Existing	No-Build Future 2030	LRT Future 2030	LRT Impact Level	LRT Impact Percent
Land Use (Acres)					
Single Family	6,832.78	7,483.69	7,309.09	-174.60	-2.3%
Multi- family	1,098.96	1,077.30	1,247.91	170.61	15.8%
Retail	1,865.77	2,193.11	2,231.05	37.94	1.7%
Office	93.01	375.95	529.73	153.78	40.9%
Industrial	3,981.17	5,457.00	5,197.61	-259.39	-4.8%
Hotel	59.10	61.57	74.09	12.53	20.3%
Public	1,905.89	1,948.14	2,011.69	63.55	3.3%
Transportation	207.49	224.13	219.71	-4.42	-2.0%
Open Space	561.67	561.44	561.44	0.00	0.0%
Vacant	2,776.50	0.00	0.00	0.00	NA
TOTAL	19,382.34	19,382.34	19,382.34	0.00	0.0%
Residential					
Total Housing Units	61,347	67,930	72,774	4,844	7.1%
Single Family	46,217	51,609	50,891	-718	-1.4%
Multifamily	15,130	16,321	21,882	5,561	34.1%
Households	58,185	65,503	70,370	4,867	7.4%
Vacancy Rate	5.2%	3.6%	3.3%	-0.3%	-7.6%
Population in Households	214,962	234,275	250,662	16,387	7.0%
Population per Household	3.69	3.58	3.56	-0.01	-0.4%
Non-residential					
Inventory (Sq. Feet)					
Retail	7,573,524	11,840,888	13,393,960	1,553,073	13.1%
Office	2,149,075	5,126,940	9,169,466	4,042,526	78.8%
Industrial	53,862,692	73,112,399	69,344,866	-3,767,533	-5.2%
Hotel	1,544,670	1,609,108	1,957,390	348,281	21.6%
TOTAL	65,129,961	91,689,335	93,865,683	2,176,347	2.4%
Employment					
Retail	18,326	24,700	29,726	5,026	20.3%
Office	2,067	5,203	17,588	12,385	238.0%
Industrial	39,876	61,806	56,468	-5,337	-8.6%
Hotel	1,545	1,609	1,957	348	21.6%
Public	17,518	22,470	25,238	2,768	12.3%
Other	5,356	6,408	6,408	0	0.0%
TOTAL	84,688	122,195	137,386	15,191	12.4%
Annual Revenue					
Assessed Value (000)	$12,823,375	$16,454,307	$17,575,086	$1,120,779	6.8%
Property Tax Revenue *	$184,649,713	$242,460,446	$261,602,223	$19,141,777	7.9%
Taxable Sales (000)	$23,560,680	$31,147,224	$39,457,828	$8,310,604	26.7%
Sales Tax Revenue **	$114,397,278	$149,368,892	$186,492,111	$37,123,219	24.9%
TOTAL REVENUE	$299,046,991	$391,829,338	$448,094,334	$56,264,996	14.4%

Source: Applied Economics, 2010; Maricopa Association of Governments, 2007.

* Based on full cash assessed value. ** Includes retail sales, lease taxes and utility taxes.

The percent difference in the impacts under the LRT future varies widely depending on the impact variable that is being projected. The table begins with the existing and future land use data that shows the reassignment of about 590 net acres under the LRT Alternative, or about 3.1 percent of the total 19,382 net acres. In general these impacts

result in increased multi-family residential development, and redirect some the land earmarked for industrial uses to the retail, office, pubic and hotel categories.

In terms of residential impacts, the results show an increase of about 4,844 housing units (7 percent) under the LRT future compared to No-Build future. The vast majority of these residential impacts are in the Primary Corridor Impact Area. The change in housing units includes the addition of about 5,400 more multi-family units and 700 less single family units. Combined with a slight (0.3 percent) overall decline in vacancy rates, this translates into about 4,867 additional households in the future. Even with the decline in population per household caused by the addition of more multifamily housing, this implies approximately 16,400 more people living in the Study Area under the LRT future, bringing total population to about 250,700 people.

In terms of non-residential impacts, the LRT future includes a net increase of about 2.2 million square feet of building space, bringing the future total for the Study Area to about 93.9 million square feet. The net LRT impact (about 2.4 percent), includes a significant shift from industrial space to retail and office development. Note that the reduction of about 3.8 million square feet of industrial space compared to the No-Build future still implies the addition of more than 15.5 million square feet of industrial space over existing conditions. The land use reassignments result in about 1.6 million more square feet of retail space and about 4.0 million square feet of office space, along with about 350,000 square feet of hotel/motel space.

It is important to note that these square footage impacts are driven by development and redevelopment. This means that the change in square footage is sometimes driven by more than the net difference between existing and future acres. Also, the floor area ratios vary between existing conditions, the No-Build future and the LRT future. All of these assumptions also vary by sub-area (part) within the Primary Corridor Impact Area.

The built-space impacts by land use, combined with somewhat lower vacancy rates, result in a total employment impact of about 15,200 jobs over the No-Build future. This would bring total future employment in the Study Area to close to 137,400 jobs under the LRT future. Industrial employment would be about 5,300 jobs less than the No-Build future, but that loss would be more than offset the addition of about 5,000 retail jobs, 12,400 office jobs and about 2,800 public/quasi public jobs.

In terms of assessed value, the changes in land use stemming from new development as well as redevelopment are translated into land and improvement values. The changes from industrial uses to higher value office, retail and hotel uses result in a 6.8 percent increase in value, or about $1.1 billion, under the LRT future as compared to the No-Build future. This change in assessed value can then be translated into property tax revenues resulting in a 7.9 percent increase over the No-Build future. The change in tax revenues is not directly proportional to the change in assessed value because assessed value includes non-taxable public and open space areas. Also, assessment ratios vary by type of land use, so increases in residential value have a lesser impact on property taxes than increases in nonresidential value.

In terms of taxable sales, which include retail sales as well as taxes on residential and commercial property leases, utility usage and hotel/motel revenues, the LRT future results include 26.7 percent more taxable sales in the study area overall. This is due to a combination of increases in the amount of retail and hotel space, as well as increases in projected occupancy rates for all land uses under the LRT future. Applying differential sales tax rates to the projected taxable sales by type, results in a 25 percent increase in total state and local sales tax revenues with LRT over the No-Build future.

1.2 REPORT ORGANIZATION

The balance of this report is organized as follows.

- Sections 2 and 3 provide the base data for the analysis, including a definition of the study area and all of the existing scenario data on land use, assessed value, square footage and vacancy rates. The MAG No-Build projections are also included in the base data.

- Section 4 provides a literature review of studies of comparable metro area LRT systems, and specifically the research on transit oriented development potential and implied changes in land and improvement values, rents and occupancy rates resulting from light rail. This data provides a basis for the assumptions regarding increases in occupancy, lease rates and assessed value within the station areas for the Phoenix West Extension.

- Section 5 describes the socioeconomic impact projections under the No-Build future versus the LRT future including land use changes, housing units, population, nonresidential square footage and employment. It incorporates the impacts of new development on vacant land as well as redevelopment of parcels within study area for each of the scenarios. Section 5 provides detail on how changes in land use translate into changes in the number of housing units, population, nonresidential square footage and employment by study area and by land use.

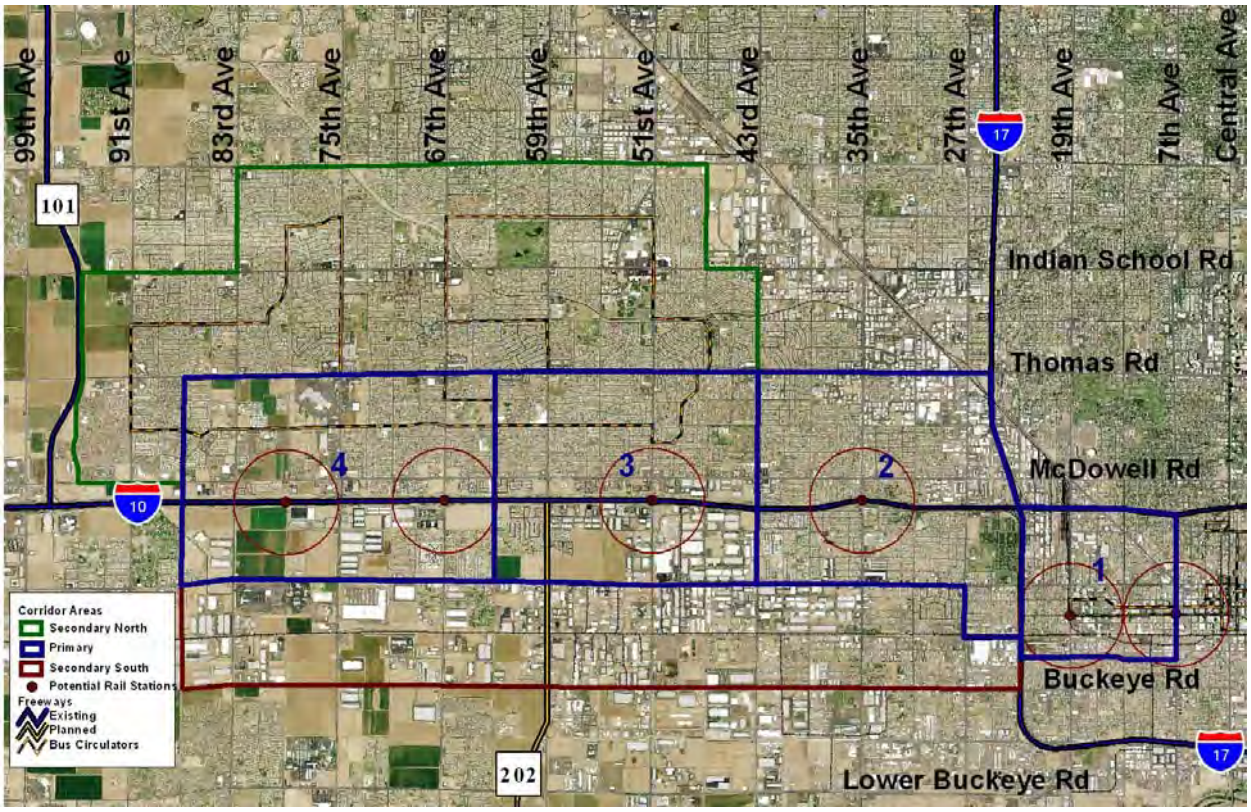
- Finally Section 6 presents the analysis of future assessed value and corresponding property tax revenues by jurisdiction, as well as projected taxable sales and sales tax revenues. The socioeconomic impacts in terms of acres, square footage and housing units provide the basis for the projections of assessed value and taxable sales. Increases in assessed value are assumed to occur on all parcels within one half mile of the station areas. In addition there are increases in value based on new development and redevelopment. These changes in assessed value are translated into property tax revenues by jurisdiction under the No-Build future and the LRT future based on the location of the land within one of 12 tax rate areas the cover the Phoenix West Extension study area.

- In addition, Section 6 also looks at differences in sales tax revenues under the No-Build and LRT future scenarios. Increases in taxable sales and corresponding increases sales tax revenues occur as a result of new retail and hotel development, as well as increases in other types of development that result in increased utility usage and increased rents from both residential and nonresidential uses. These increases in taxable sales are then translated into increased sales tax revenues for the City of Phoenix, City of Tolleson, Maricopa County and the state.

2.0 STUDY AREA DEFINITION

The study area encompasses land on each side of the proposed rail line beginning at 7th Avenue and terminating just beyond the final potential station location at 79th Avenue (**Map 2-1**). The study area does not extend east of 7th Avenue due to the minimal amount of developable land in that area. Six potential station areas have been evaluated in this report that are planned along the route. However, specific locations, or the precise route alignment, have not yet been determined. Although the main area of economic impact resulting from a light rail line and/or stations can be expected to be within a half mile, it is felt that there is likely some lesser impact just beyond that distance. That expectation, along with the lack of a definite route alignment, led to the creation of a primary study area extending roughly one mile to each side of the expected route, the variation caused by using arterial streets as the boundaries.

Map 2-1 Study Area Boundaries



The primary impact area has been further divided into four smaller component areas. These sub-areas each contain one or two potential station locations. Furthermore, each sub-area has its own land use characteristics regarding intensity of development and amount of developable land available. Defining these areas in this way makes it possible to study areas small enough to be similar in nature, while large enough to form meaningful conclusions from the data. As shown on **Table 2-1**, the total primary study

area encompasses about 14 square miles, with three sub-areas of similar size, and a smaller sub-area for the densely developed downtown/Capital Mall section.

Table 2-1 Study Area - Phoenix West Extension

Study Area	Net Acres	Square Miles	Pop. (Sq. Mi.)	Emp. (Sq. Mi.)	General Boundaries East	West	North	South	Station 1	Station 2
Primary Corridor Impact Area										
Part 1	1,001.65	1.57	5,895	10,647	7th Ave	I-17	I-10	Grant St	7th Ave	19th Ave
Part 2	2,392.51	3.74	9,494	3,984	I-17	43rd Ave	Thomas Rd	Van Buren St	35th Ave	
Part 3	2,660.07	4.16	8,970	2,312	43rd Ave	63rd Ave	Thomas Rd	Van Buren St	51st Ave	
Part 4	3,062.76	4.79	5,569	1,564	63rd Ave	87th Ave	Thomas Rd	Van Buren St	67th Ave	79th Ave
Total	9,116.99	14.25	7,627	3,415						
Secondary Impact Area										
North	5,849.02	9.14	10,640	1,401	43rd Ave	Loop 101	Camelback Rd	Thomas Rd		
South	4,416.33	6.90	1,314	3,367	I-17	87th Ave	Van Buren St	Buckeye Rd		
Total	19,382.34	30.28	7,098	2,796						

Source: Applied Economics, 2009.

In addition to the primary study area are included two secondary areas which are felt could be impacted indirectly from the construction of the light rail extension. The secondary area to the north is primarily residential, with retail nodes along Thomas and Indian School Roads. The area was defined as being within a half mile of the Maryvale circulator bus. This bus system operates on a 30-minute schedule throughout the residential neighborhoods and charges no fare, mainly serving to transport people to major stops or to other transit options. Given the nature and accessibility of the service it is felt that a sizable portion of the area residents would use it to access the proposed light rail extension.

The secondary area to the south is considerably smaller and includes very little residential, but does include a high concentration of industrial employment with an employment density of 2,747 industrial employees per square mile. Therefore, persons coming to this area would not be shopping, i.e. carrying packages, and while the distances from a station are over a half mile, use of alternative modes such as bicycles or local bus can be expected, as is the case with other transit services. Traveling a distance of 1.25 to 1.5 miles by bike or by bus is not viewed as unreasonable for regular commuters.

3.0 DEMOGRAPHIC AND LAND USE DATA

Current conditions of the study area have been examined to define the area as it is now in order to compare it to what it can be reasonably expected to become with the addition of the light rail extension. This examination includes a No-Build socioeconomic profile, current land use, future land use as defined without the light rail component, commercial property rents and vacancy rates.

Table 3-1 shows population and employment projections to 2030, without the presence of the light rail extension. Little growth in population would be expected, while employment, especially industrial employment, is projected to grow more than other types of employment given that this is the predominant type of development in the study area. Industrial employment currently accounts for 47 percent of total employment in all study areas combined, and is projected to account for 51 percent of total employment by 2030 under the No-Build scenario.

Table 3-1 No-Build MAG Projections

	Primary		Secondary North		Secondary South		All Study Areas		Maricopa County	
	Level	Growth*	Level	Growth*	Level	Growth*	Level	Growth*	Level	Growth*
Total Population										
2005	109,853		97,396		10,058		217,306		3,681,025	
2010	118,065	1.5%	100,539	0.6%	10,880	1.6%	229,483	1.1%	4,216,499	2.8%
2020	123,397	0.4%	101,509	0.1%	11,220	0.3%	236,126	0.3%	5,230,300	2.2%
2030	124,684	0.1%	101,623	0.0%	11,423	0.2%	237,730	0.1%	6,135,000	1.6%
Employment to Population Ratio										
2005	0.443		0.131		2.310		0.390		0.475	
2010	0.485	1.8%	0.152	2.9%	2.509	1.7%	0.435	2.2%	0.512	1.5%
2020	0.524	0.8%	0.176	1.5%	2.877	1.4%	0.486	1.1%	0.533	0.4%
2030	0.548	0.4%	0.188	0.7%	3.035	0.5%	0.514	0.6%	0.551	0.3%
Total Employment										
2005	48,654		12,802		23,233		84,689		1,747,532	
2010	57,241	3.3%	15,280	3.6%	27,295	3.3%	99,816	3.3%	2,157,424	4.3%
2020	64,717	1.2%	17,827	1.6%	32,283	1.7%	114,826	1.4%	2,788,101	2.6%
2030	68,383	0.6%	19,138	0.7%	34,674	0.7%	122,195	0.6%	3,378,800	1.9%
Industrial Employment										
2005	20,914		4		18,959		39,876		357,712	
2010	25,596	4.1%	525	165.2%	22,552	3.5%	48,672	4.1%	442,821	4.4%
2020	28,216	1.0%	600	1.3%	27,598	2.0%	56,414	1.5%	535,119	1.9%
2030	30,607	0.8%	993	5.2%	30,206	0.9%	61,806	0.9%	614,631	1.4%

Sources: Maricopa Association of Governments, 2007; Applied Economics, 2009.

* Compound annual growth rate.

Table 3-2 shows the population characteristics of the study area. In key areas the resident population is significantly disadvantaged economically in comparison to the Maricopa County population as a whole. The table also shows a population in need of transportation options as shown by the numbers of households without vehicles, or that use public transportation. It may be noted that there are some discrepancies in

population numbers in tables **3-1** and **3-2,** such as the apparent decline in total population in Study Area Secondary South. This is due to the fact that data on population characteristics was taken from Census Block Groups, which do not always match the study area geographies.

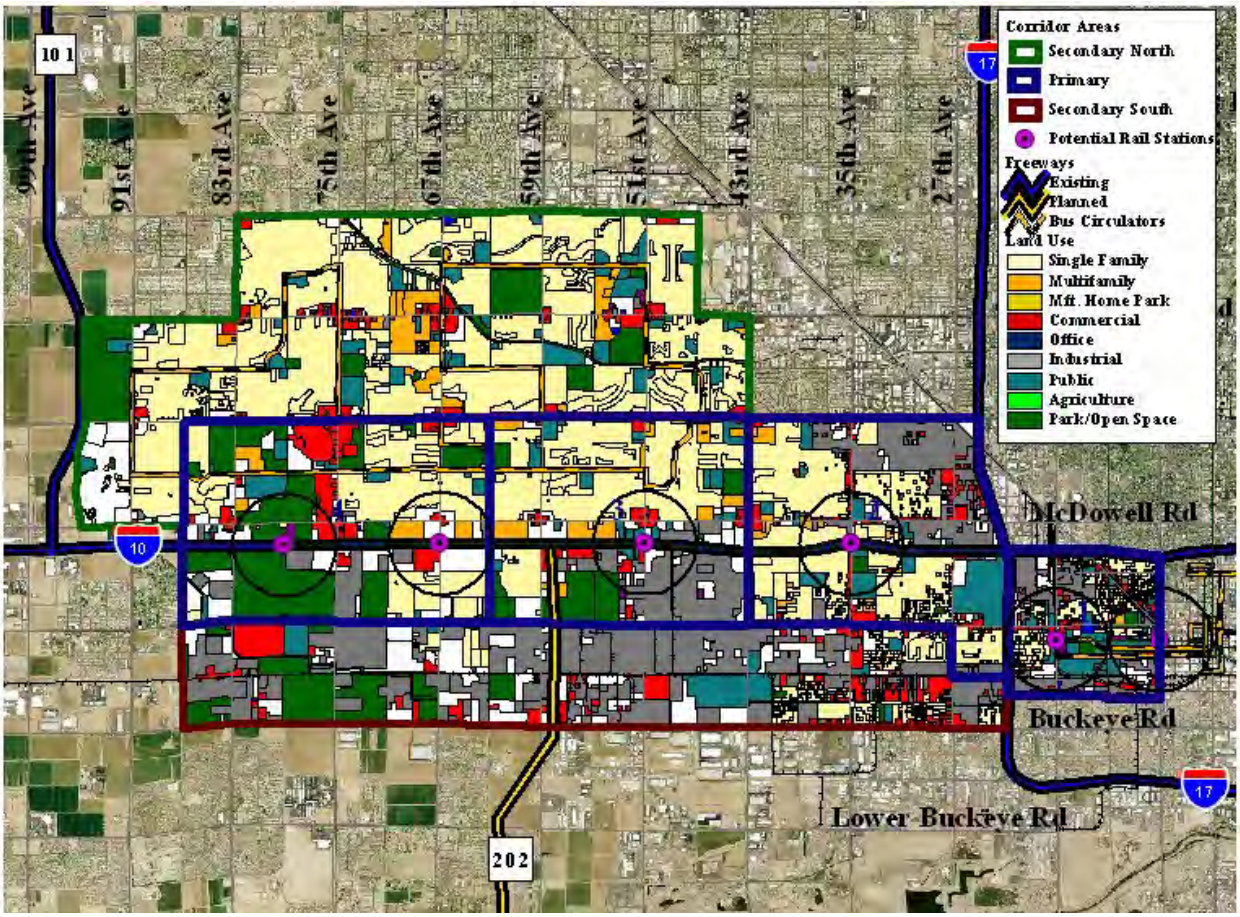
Table 3-2 Population Characteristics

	Study Areas							
	Primary		Secondary North		Secondary South		Maricopa County	
Population Characteristics	**Total**	**Percent**	**Total**	**Percent**	**Total**	**Percent**	**Total**	**Percent**
Total Population	102,979		92,684		12,452		3,072,149	
Population per Household	3.70		3.65		4.17		2.71	
Total Households	27,852	100.0%	25,378	100.0%	2,984	100.0%	1,133,048	100.0%
1-Person	4,691	16.8%	3,305	13.0%	463	15.5%	277,526	24.5%
2 or More Persons	23,161	83.2%	22,073	87.0%	2,521	84.5%	855,522	75.5%
Median Income	$30,483		$37,834		$26,446		$43,220	
Total Workers	34,828	100.0%	34,305	100.0%	3,837	100.0%	1,406,442	100.0%
Private Vehicle	30,203	86.7%	31,439	91.6%	3,355	87.4%	1,264,572	89.9%
Drove Alone	19,933	57.2%	22,980	67.0%	2,330	60.7%	1,050,341	74.7%
Public Transportation	2,015	5.8%	1,162	3.4%	75	2.0%	29,461	2.1%
Did Not Work at Home	34,265	98.4%	33,782	98.5%	3,795	98.9%	1,354,723	96.3%
Worked at Home	563	1.6%	523	1.5%	42	1.1%	51,719	3.7%
Total Housing Units	29,739	100.0%	26,268	100.0%	3,375	100.0%	1,250,231	100.0%
Total Occupied Units	27,863	93.7%	25,395	96.7%	3,047	90.3%	1,132,886	90.6%
Owner Occupied	15,600	52.5%	18,119	69.0%	1,518	45.0%	764,563	61.2%
No Vehicle	937	3.2%	792	3.0%	111	3.3%	22,530	1.8%
Renter Occupied	12,263	41.2%	7,276	27.7%	1,529	45.3%	368,323	29.5%
No Vehicle	3,038	10.2%	1,228	4.7%	334	9.9%	56,228	4.5%

Source: U.S. Bureau of the Census, 2000.

Maps 3-1 and 3-2, along with the accompanying **Table 3-3,** show the existing and projected land uses in the study area, again, without the inclusion of the light rail extension. In the absence of the rail line, the already heavily industrial area could be expected to become even more so. Under the previously anticipated scenario, there would be significant additions of single family housing and industrial space, but little office, public, or mixed use development.

Map 3-1 Existing Land Use



Map 3-2 No-Build Future Land Use

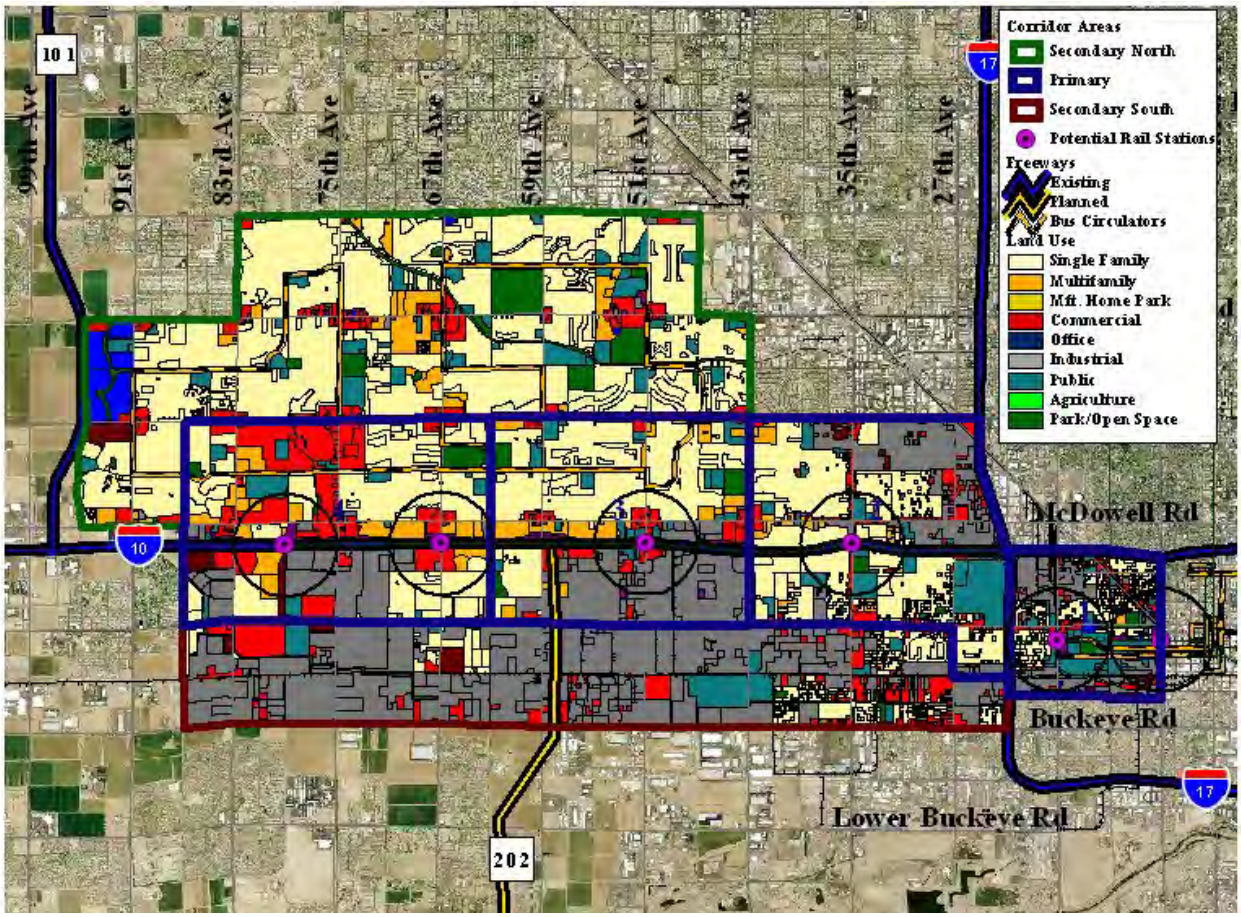


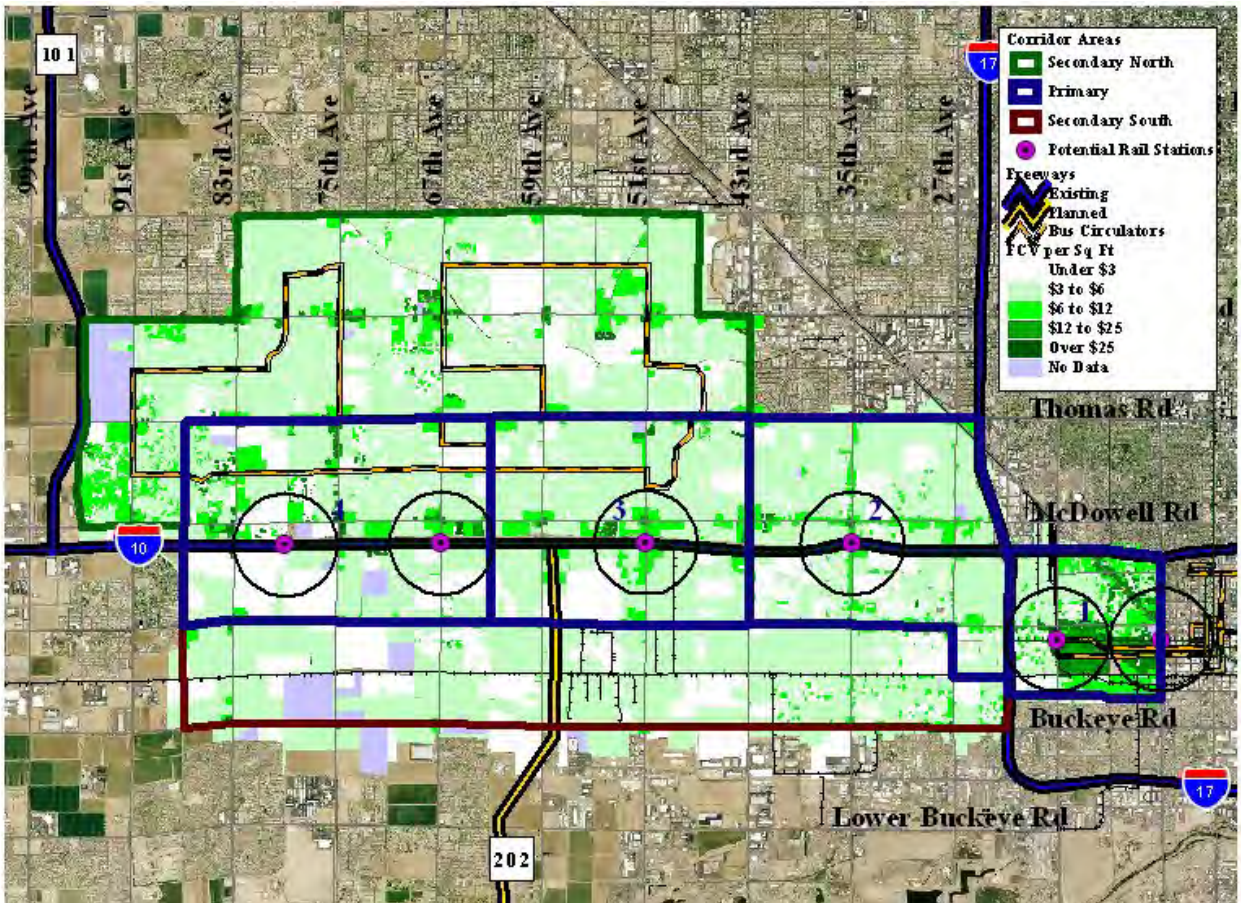
Table 3-3 Acres by Land Use

Impact Area	Single Family	Multi-family	Retail	Office	Industrial	Hotel	Public	Trans-portation	Open Space	Vacant
Existing										
Primary	2,798.07	739.10	951.79	24.90	1,530.82	59.10	943.03	126.97	376.47	1,566.74
1	167.06	63.13	165.58	9.01	184.18	5.93	239.44	76.12	10.00	81.22
2	914.19	203.94	279.38	7.40	442.87	5.63	208.18	29.76	198.81	102.37
3	942.76	244.53	159.88	2.86	612.00	31.63	186.67	7.40	70.79	401.57
4	774.07	227.51	346.96	5.64	291.78	15.91	308.74	13.70	96.87	981.59
Secondary North	3,709.73	307.42	360.67	63.15	11.14	0.00	823.82	3.93	174.54	394.62
Secondary South	324.98	52.44	553.32	4.96	2,439.21	0.00	139.04	76.59	10.66	815.14
Total	6,832.78	1,098.96	1,865.77	93.01	3,981.17	59.10	1,905.89	207.49	561.67	2,776.50
Share	35.3%	5.7%	9.6%	0.5%	20.5%	0.3%	9.8%	1.1%	2.9%	14.3%
No-Build Future										
Primary	3,299.47	766.46	1,307.14	57.89	2,145.11	61.57	964.01	138.87	376.47	0.00
1	191.42	58.28	152.21	12.51	229.90	6.78	246.52	94.02	10.00	0.00
2	1,057.84	116.84	253.85	12.20	504.38	5.63	213.19	29.76	198.81	0.00
3	978.54	286.20	200.54	5.28	891.05	31.63	187.64	8.40	70.79	0.00
4	1,071.66	305.13	700.54	27.89	519.78	17.53	316.65	6.70	96.87	0.00
Secondary North	3,781.64	289.59	428.76	314.87	21.56	0.00	829.40	8.67	174.54	0.00
Secondary South	402.58	21.26	457.21	3.19	3,290.34	0.00	154.73	76.59	10.43	0.00
Total	7,483.69	1,077.30	2,193.11	375.95	5,457.00	61.57	1,948.14	224.13	561.44	0.00
Share	38.6%	5.6%	11.3%	1.9%	28.2%	0.3%	10.1%	1.2%	2.9%	0.0%
Difference With No-Build Future										
Primary	501.40	27.35	355.36	33.00	614.28	2.47	20.98	11.90	0.00	-1,566.74
1	24.37	-4.85	-13.37	3.51	45.73	0.85	7.08	17.90	0.00	-81.22
2	143.65	-87.09	-25.52	4.81	61.51	0.00	5.01	0.00	0.00	-102.37
3	35.79	41.67	40.66	2.43	279.05	0.00	0.97	1.00	0.00	-401.57
4	297.59	77.62	353.59	22.25	228.01	1.61	7.92	-7.00	0.00	-981.59
Secondary North	71.91	-17.83	68.08	251.72	10.42	0.00	5.58	4.74	0.00	-394.62
Secondary South	77.60	-31.18	-96.10	-1.77	851.13	0.00	15.69	0.00	-0.23	-815.14
Total	650.91	-21.66	327.34	282.94	1,475.83	2.47	42.25	16.65	-0.23	-2,776.50

Source: Maricopa Association of Governments; Maricopa County Assessor; Applied Economics, 2010.

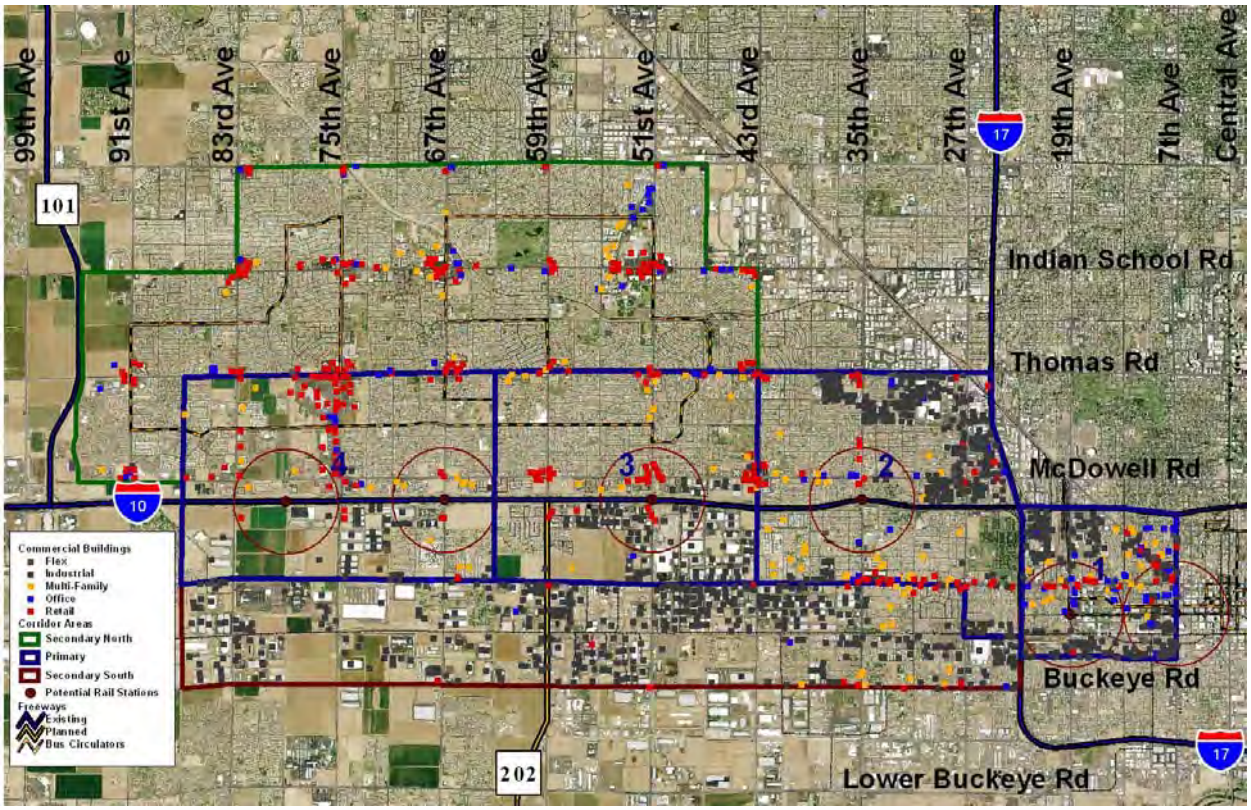
Map 3-3 shows land values per square foot throughout the study area. It can be seen that the highest values (darkest green colors) are in the downtown/Capital Mall area at the far eastern portion of the study area. As this is the most intensely developed area, this is to be expected. Elsewhere in the study areas land values tend to be low, aside from retail nodes located near arterial intersections.

Map 3-3 Land Values



The inventory of commercial real estate, especially industrial in the study area is substantial. Map 3-4 illustrates the distribution of commercial real estate by type based on an inventory of building provided by the City of Phoenix from the CoStar database.

Map 3-4 Existing Commercial Buildings



A review of commercial real estate buildings indicates that the study area lags most other parts of the metro area in value and market stability, as measured by lease values and vacancy levels. The southwest portion of the metro area is heavily industrialized, as shown on **Table 3-4**, though the area hasn't attracted the types of "clean" industries that command higher rental rates. Vacancy rates are also high, which is a drag on the local economy. Data from the CoStar Group, **Table 3-5**, tells much the same story, with generally above average vacancy rates that are progressively higher going west.

Table 3-4 Industrial Market Conditions

Submarket	Total Square Feet	Vacant Square Feet	Vacancy Rate	Asking Rent WH/Dist	Asking Rent R&D/Flex
Scottsdale	4,543,248	599,747	13.20%	$ 12.23	$ 12.38
Black Canyon	4,766,773	582,432	12.20%	$ 11.55	$ 16.38
Scottsdale Airpark	7,435,097	1,218,401	16.40%	$ 11.11	$ 12.97
Chandler	19,469,865	3,238,336	16.60%	$ 8.94	$ 12.68
East Mesa	4,029,935	1,137,550	28.20%	$ 8.33	$ 9.41
Deer Valley	13,550,761	1,825,392	13.50%	$ 7.91	$ 12.66
Central Phoenix	2,792,831	306,107	11.00%	$ 6.34	$ 10.93
West Mesa	7,410,441	1,624,831	21.90%	$ 6.30	$ 9.71
Tempe	41,267,460	4,331,730	10.50%	$ 5.77	$ 13.71
Gilbert	5,178,048	885,277	17.10%	$ 5.61	$ 12.00
Sky Harbor Airport	44,560,087	5,205,662	11.70%	$ 5.12	$ 11.46
West Central Phoenix	27,598,881	2,336,482	8.50%	$ 4.37	$ -
Southwest Phoenix	**58,874,392**	**12,838,914**	**21.80%**	**$ 4.26**	**$ 13.21**
North Glendale	2,860,094	1,099,578	38.40%	$ 4.16	$ -
Pinal County	3,596,114	543,995	15.10%	$ 3.84	$ -
Glendale	2,633,157	1,393,163	52.90%	$ 3.65	$ 11.31
Grand Ave	20,111,497	1,947,719	9.70%	$ 2.49	$ 3.90
Totals	270,678,681	41,115,316	15.20%	$ 4.76	$ 12.57

Source: Grubb & Ellis, Third Quarter 2009.

Table 3-5 Industrial Built Space Availability

Study Area / Part		Rentable Square Feet Total	Rentable Square Feet Percent of County	Available Square Feet Total	Available Square Feet Percent of County	Vacancy Rate
Maricopa County		270,678,681	100.00%	41,115,316	100.00%	15.19%
Primary	**1**	4,608,954	1.70%	362,010	0.88%	7.85%
	2	6,934,236	2.56%	860,017	2.09%	12.40%
	3	8,357,563	3.09%	2,177,100	5.30%	26.05%
	4	6,555,247	2.42%	2,759,390	6.71%	42.09%
Total Primary		80,318,692	29.67%	17,485,704	42.53%	21.77%
Secondary North		322,521	0.12%	21,121	0.05%	6.55%
Secondary South		27,084,171	10.01%	5,147,549	12.52%	19.01%

Source: CoStar Group; Applied Economics, 2009.

The office market appears somewhat healthier in terms of vacancies, (**Table 3-6**), but the southwest portion of the metro area also has the lowest rental values. The share of office space located in the submarket is also much lower than other parts of the metro area. CoStar data for the office market is shown on **Table 3-7**, with high vacancy rates in all sub-areas, except the center of the primary corridor where there is very little office space.

Table 3-6 Office Market Conditions

Submarket	Total Square Feet	Vacant Square Feet	Vacancy Rate	Average Rental Rate
Downtown	19,766,066	3,268,625	16.50%	$25.28
Northeast	30,058,203	7,757,629	25.80%	$24.93
Central	20,293,785	4,329,012	21.30%	$24.43
Southeast	22,423,182	5,613,065	25.00%	$22.75
Northwest	20,500,822	4,163,973	20.30%	$21.51
Southwest	14,607,797	2,792,840	19.10%	$21.12
Metro Total	127,649,855	27,925,144	21.90%	$23.64

Source: Colliers International, Second Quarter 2009.

Table 3-7 Office Built Space Availability

		Rentable Square Feet		Available Square Feet		
Study Area / Part		**Total**	**Percent of County**	**Total**	**Percent of County**	**Vacancy Rate**
Maricopa County		127,649,855	100.00%	27,925,144	100.00%	21.88%
Primary	**1**	1,099,409	0.86%	253,687	0.91%	23.07%
	2	115,987	0.09%	8,852	0.03%	7.63%
	3	9,743	0.01%	0	0.00%	0.00%
	4	98,330	0.08%	15,329	0.05%	15.59%
Total Primary		1,323,469	1.04%	277,868	1.00%	21.00%
Secondary North		782,007	0.61%	242,365	0.87%	30.99%
Secondary South		43,599	0.03%	25,000	0.09%	57.34%

Source: CoStar Group; Applied Economics, 2009.

The retail market in the southwest part of the metro area is near the average for the metro area in both vacancies and lease rates, as shown on **Table 3-8**. However, the region has the fifth highest vacancy rate and the fifth lowest lease rate. As the CoStar data on **Table 3-9** shows, retail vacancies appear to be low, but are higher than the county average for the two sub-areas with the most space.

Table 3-8 Retail Market Conditions

Submarket	Rentable Square Feet	Vacant Square Feet	Vacancy Rate	Average Rental Rate
North Scottsdale	15,059,664	1,445,728	9.60%	$22.44
Sun City	8,901,914	907,995	10.20%	$22.01
Apache Junction	4,757,333	313,984	6.60%	$21.26
Maricopa (city)	514,488	22,123	4.30%	$21.00
Paradise Valley	7,998,068	927,776	11.60%	$20.91
Scottsdale	4,619,080	300,240	6.50%	$18.51
Tempe/Ahwatukee	18,029,847	1,640,716	9.10%	$17.54
West/Southwest Phoenix	**18,837,261**	2,015,587	**10.70%**	**$17.22**
North Bell Road	15,797,619	1,895,714	12.00%	$17.13
Mesa/Chandler/Gilbert	37,362,333	4,595,567	12.30%	$15.91
East Phoenix	3,439,447	220,125	6.40%	$14.46
Northwest Phoenix	11,988,547	1,738,339	14.50%	$12.28
Metro Total	147,305,601	16,056,311	10.90%	$17.37

Source: CB Richard Ellis, Third Quarter 2009.

Table 3-9 Retail Built Space Availability

		Rentable Square Feet		Available Square Feet		
Study Area / Part		**Total**	**Percent of County**	**Total**	**Percent of County**	**Vacancy Rate**
Maricopa County		147,305,601	100.00%	16,056,311	100.00%	10.90%
Primary	**1**	363,452	0.25%	16,351	0.10%	4.50%
	2	974,896	0.66%	33,588	0.21%	3.45%
	3	758,649	0.52%	42,631	0.27%	5.62%
	4	2,580,179	1.75%	428,628	2.67%	16.61%
Total Primary		4,677,176	3.18%	521,198	3.25%	11.14%
Secondary North		2,721,186	1.85%	402,652	2.51%	14.80%
Secondary South		175,162	0.12%	1,230	0.01%	0.70%

Source: CoStar Group; Applied Economics, 2009.

4.0 TRANSIT IMPACT LITERATURE REVIEW

In order to study the connections between public transportation, land use, and land value, a review was made of existing transportation literature. While there seems to be a considerable amount of transit literature, the variety of subject areas, scopes, and purposes greatly limit the amount of relevant information available.

Some additional limits have been self-imposed as a decision was made to focus whenever possible upon metropolitan areas similar to metro Phoenix. Even though not a primary focus, the experiences in other areas have been reviewed in order to note any trends or anomalies that might be relevant to the local market. A matrix of metropolitan areas was created, (**Table 4-1**) to compare such factors as population size, light rail ridership, size and age of the system, and station spacing. These various attributes were compared with Phoenix to identify the preferred group of metro areas for study.

The metro areas deemed most appropriate as comparatives for Phoenix were Dallas, Denver, Portland, Sacramento, and Salt Lake City. These are all western metro areas that share some of the expansive development practices that evolved in Phoenix, and that have substantive light rail experience. The first two areas (Dallas and Denver) have been considered to be especially relevant. The Dallas DART system has been the subject of multiple studies by the same researchers, which provides some continuity and consistency over time. Denver has a notable focus on transit oriented development which quickly became to be seen as a major component in any economic success of light rail development.

While the intent has been to focus on specific areas and quantitative information, the initial reviews were more general in nature and identified certain commonalities related to transit development and economic impacts. Such articles and studies have also served to identify some of the numerous pitfalls involved in using studies performed in one area as predictive for another. With that in mind, this review attempts to look at qualities common in general, with the tighter focus of providing a range of quantitative data regarding economic impacts. The ultimate assumptions used in this study will start with the potential impact ranges and then refer back to the qualitative information to form more specific quantitative factors.

"Each community's experience with a transit investment is unique in terms of the physical, political, demographic, and economic characteristics of an area for which a transit investment is planned. In fact, even individual investments within a single community are unique and may not result in parallel economic impacts."
– TCRP Report 35, Transportation Research Board, 1998

Table 4-1 Comparison of Transit Systems in Selected Metropolitan Areas

Metropolitan Area	Research desirability	July 1, 2008 Pop.	Pop % of Phoenix	Ridership to Population %	Miles per Station	Year Started	Light Rail Miles	Stations	Avg Daily Ridership	Ridership per Mile	Commuter Rail Miles
Phoenix-Mesa-Scottsdale, AZ		4,281,899		0.96%	0.71	Dec-08	20.0	28	41,000	2,050	0
Atlanta-Sandy Springs-Marietta, GA	No. System is commuter only, with exceptional ridership.	5,376,285	126%	4.28%	1.26	Jun-79	0.0	38	230,000	NA	48
Charlotte-Gastonia-Concord, NC-SC	No. System has only been in operation a year longer than Phoenix.	1,701,799	40%	0.95%	0.64	Nov-07	9.6	15	16,140	1,681	0
Dallas-Fort Worth-Arlington, TX	Yes. System has been in operation over a decade, similar statistics.	6,300,006	147%	1.04%	1.37	Jun-96	48.0	35	65,800	1,371	34
Denver-Aurora, CO	Yes. System has been in operation 15 years, notable focus on TOD.	2,506,626	59%	2.56%	0.95	Oct-94	35.0	37	64,117	1,832	0
Minneapolis-St. Paul-Bloomington, MN-WI	No. System in operation 5 years, climates too different.	3,229,878	75%	0.87%	0.71	Jun-04	12.0	17	27,945	2,329	40
Portland-Vancouver-Beaverton, OR-WA	Yes. Long history. Ridership is exceptional, but system may provide goals.	2,207,462	52%	4.87%	0.63	Sep-86	52.6	84	107,600	2,046	14.7
Sacramento--Arden-Arcade--Roseville, CA	Yes. High ridership, state capital, dozen years operation.	2,109,832	49%	2.42%	0.80	1987	37.4	47	51,000	1,364	0
Salt Lake City, UT	Maybe. Much smaller population, but system comparable and successful.	1,115,692	26%	5.23%	0.76	1999	19.0	25	58,300	3,068	44
San Diego-Carlsbad-San Marcos, CA	No? Trolley System. Much higher pop density.	3,001,072	70%	na	0.98	1981	52.0	53	107,000	2,058	22
Santa Ana-Anaheim-Irvine, CA	No. Commuter rail only, stations widely separated.	3,010,759	70%	na	7.91		0.0	11	na	NA	87

Source: Transit Operators, Applied Economics, 2010.

4.1 RIDERSHIP

It is well-accepted that the primary factor in real estate is location, but where transit is concerned, that point should be expanded to include accessibility. A location is important for the type of local characteristics present, such as good schools, safe neighborhoods, etc, but is also important for the ability to reach destinations of value, such as employment, services, entertainment, etc. This is one reason why the presence of a rail line might have a marginal or even a negative effect on land values, but transit stations generally have positive economic effects, sometimes in very large measure.

In most studies on economic impacts the focus is on the area within a quarter or half mile from a station where there is likely to be transit oriented development, i.e. within a comfortable walking distance. But it has also been reported that people will ride transit from beyond that distance if they have a good feeder-bus system, the issue again being access more than location. This is important to note since the Maryvale area in Phoenix has such a local feeder-bus system.

Transit ridership is obviously a key component for the success in any transit oriented development and its accompanying economic impact. The Metro Light Rail system in Phoenix has been in operation for less than a year and is showing ridership statistics that are well above expectations. From January to October of 2009 average weekday ridership has increased by 34 percent, to 41,000 persons. In terms of ridership per mile, as shown on **Table 4-2**, the Metro Light Rail system is approximately equal to Portland and higher than any of the comparative areas except Salt Lake City, which is especially significant given that these other rail systems have been in place much longer and have more route miles.

Table 4-2 Ridership Comparisons for Selected Metropolitan Areas

Metropolitan Area	July 1, 2008 Pop. Est.	Population Difference	Service Began	Light Rail Miles	Size Difference	Avg Daily Ridership*	Ridership per Mile
Phoenix	4,281,899		Dec-08	**20.0**	**NA**	**41,000**	2,050
Dallas-Fort	6,300,006	47%	Jun-96	45.0	+125%	65,800	1,462
Denver	2,506,626	-41%	Oct-94	35.0	+75%	64,100	1,831
Portland	2,207,462	-48%	Sep-86	52.6	+163%	107,600	2,046
Sacramento	2,109,832	-51%	1987	37.4	+87%	62,000	1,658
Salt Lake City	1,115,692	-74%	1999	21.0	+5%	58,300	2,776

Source: Transit Operators, Applied Economics, 2009.

*Weekday ridership or boardings

Table 4-3 shows the growth in ridership for the comparative metro areas between the year their starter lines began service and the most current available data. While the increases in ridership are striking, it should be noted that ridership increases are far in excess of increases in the length of the rail lines. As rail systems expand more areas become accessible to wider populations and the ridership levels increase exponentially rather than in a direct proportion to system length.

Table 4-3 Ridership Growth for Selected Metropolitan Areas

Metropolitan Area	Year	Miles	Change	Riders	Change
Dallas	1996	20.0		19,000	
	2008	48.0	140%	65,800	246%
Portland	1986	15.0		19,500	
	2009	52.6	251%	107,600	452%
Sacramento	1987	18.3		10,000	
	2009	37.5	105%	62,000	520%
Salt Lake City	1999	15.0		19,800	
	2008	19.0	27%	58,300	194%

Source: Transit Operators, "Rail Transit Works", MaryPIRG Foundation;
Applied Economics, 2009-2010.

Another important note is that light rail ridership is not primarily created at the expense of bus ridership. Persons riding on rail systems do so largely by choice. In a survey conducted in April of 2009 among Phoenix Metro passengers, only 40 percent of those questioned had been weekly users of public transit previously, while 35 percent never used it, and 17 percent used it only occasionally. Automobiles were available to 68 percent of the riders and half of those had two or more. These types of findings are not unique. For example, in a Dallas survey, 59 percent of those riders with automobiles replied they would drive alone to their destination if light rail weren't available. In a 2001 Denver survey, 65 percent of the light rail riders responding reported they had an automobile available, and another 10 percent said they could have gotten a ride but preferred taking the train.

The Phoenix survey also indicated that only about 40 percent of the Metro riders were commuting to work or to the University. This suggests a great deal of non-work related travel. According to October 2009 data, Metro ridership only falls by 26 percent on Saturdays from the average weekday ridership. By comparison, ridership in Dallas decreases by 55 percent. This also indicates a significant amount of special event trips.

4.2 TRANSIT-ORIENTED DEVELOPMENT

While ridership is an obvious component of a successful transit system, the primary economic impact of public transit is to be derived from property development along the rail lines. Research into the economic benefits of light rail is not extensive at this time, especially regarding commercial property, but the information that is available generally indicates very positive economic effects. While caution is urged when looking at evidence from different metropolitan areas, it is also supportive of the positive effects when similar results are seen across multiple areas.

Research shows that the greatest economic impacts occur around access points, or stations. Regarding station development, design is a major consideration and planners need to be cognizant there is a difference between transit "adjacent" and transit-oriented design. In some cases impediments to access can trump location. An example of this can be found at the Mineral Street station in Denver, where the retail uses are disconnected from the rail station. In contrast, the Englewood City Center in Denver has been celebrated for reviving a lower-income community by replacing an aging shopping center. In general, it appears that the most successful designs incorporate significant density of residences, employment, or both, essentially creating pedestrian-oriented neighborhoods. One interesting result of this neighborhood concept, as reported by a Workman and Brod study in San Francisco is that people are willing to pay a premium to be near a transit station, even without intending to use the system.

As reported in the "Transit-Oriented Development Strategic Plan" produced by the Community Planning and Development Department in Denver in 2006, there are national shifts in demographics and employer location strategies that will make transit oriented design increasingly desirable in the future. Greater congestion is also expected to make transit access more desirable, as older and smaller households show greater interest in more convenient lifestyles.

A number of factors will be involved in the economic impacts associated with the proposed light rail extension, including specific locations, design, access, and the character and amenities of surrounding areas. While all of these will play a role in the level of success of the extension, the amount of vacant land available, primarily in the western portion of the study area, and the number of properties elsewhere that show potential for redevelopment provide considerable opportunities for creating substantial economic impacts.

4.3 LRT IMPACT ASSUMPTIONS

The literature search was focused on specific areas and on current research. Transit studies are affected by methodology and the timing of the study, which can create limitations on their usefulness. However, such studies are not in great supply, particularly regarding economic impacts on commercial properties. **Table 4-4** lists the

transit studies used primarily to gain insight on transit-oriented development potential and the economic impacts of light rail.

Table 4-4 Land Use and Land Value Research Bibliography

Author	Report	Date
Arrington, G.B., Parsons Brinckerhoff	Light-Rail Transit and Transit-Oriented Development	November 2003
Center for Transit-Oriented Development	Capturing the Value of Transit	November 2008
Cervero, R. et al, Transportation Research Board	TCRP Report 102: Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects	2004
Cervero, R., Aschauer, D., Cambridge Systematics, Transportation Research Board	TCRP Report 35: Economic Impact Analysis of Transit Investments: Guidebook for Practitioners	1998
Jackson, M.,The Denver Post	Light-Rail Can Turn Into Money Train	October 30, 2008
Ridlington, E., Kellett, G., MaryPIRG Foundation	Rail Transit Works, Light Rail Success Stories from Across the Country	Spring 2003
Royal Institute of Chartered Surveyors Policy Unit	Land Value and Public Transport, Stage 1 - Summary of Findings	October 2002
Smith, J., Gihring, T., Victoria Transport Policy Institute	Financing Transit Systems Through Value Capture	November 2006
ULI - the Urban Land Institute	Light-Rail Transit Phoenix, Arizona	December 2-7, 2001
Weinstein, B., Clower, T., University of North Texas, Center for Economic Development and Research	An Assessment of the DART LRT on Taxable Property Valuations and Transit Oriented Development	September 2002
Weinstein, B., Clower, T., University of North Texas, Center for Economic Development and Research	The Initial Economic Impacts of the DART LRT System	July 1999
Transit Cooperative Research Program	Research Results Digest: Transit-Oriented Development and Joint Development in the United States: A Literature Review	October 2002
Belzer, D., Strategic Economics	Real Estate Market Analysis for Transit Corridor	October 29, 2008
Himanshu, J. et al	Simulating Impact of Light Rail on Urban Growth in Phoenix: An Application of Urbanism Modeling Environment	October 14, 2008
ECONorthwest, Parsons Brinckerhoff Quade & Douglas	TCRP Report 78: Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners	January 2002
Denver Community Planning & Development	Transit-Oriented Development Strategic Plan	August 2, 2006
Cervero, R., Duncan, M., Institute of Urban and Regional Development, University of California, Berkeley	Rail Transit's Value-Added: Effects of Proximity to Light and Commuter Rail Transit on Commercial Land Values in Santa Clara County, California	June 2001
Reconnecting America, Center for Transit-Oriented Development	Why Transit-Oriented Development and Why Now?	2007
METRO	METRO Passenger Intercept Survey Results	August 31, 2009
Reconnecting America, Center for Transit-Oriented Development	Hidden In Plain Sight: Capturing the Demand for Housing Near Transit	September 2004

Source: Applied Economics, 2009.

The specific information derived from these studies was limited in some cases, and sometimes varied widely. As stated elsewhere, impacts in different cities can be expected to vary, and even impacts for different areas within the same city or metropolitan area can vary significantly due to several factors. Given the lack of solid research on this subject, the impacts found were compared to cities outside the primary research focus, and to anecdotal evidence to determine reasonableness.

Since the impacts could vary widely, the assumptions shown on **Table 4-5** were developed based on the available data, looking at the norms for the metropolitan areas and systems that are most similar to Phoenix, avoiding isolated and/or extreme cases. The economic impacts are felt to be reasonable compared to the existing data and the general experiences of other metropolitan areas. However, since an effort was made to be conservative in the determination of assumptions, the actual results for the Phoenix West Extension may well be more positive.

Table 4-5 Real Estate and Occupancy Assumptions

Metropolitan Area	Station Areas	Primary Corridor	Secondary North	Secondary South
Residential				
Land	9.50%	5.00%	5.00%	0.00%
Property Values	9.00%	2.00%	2.00%	0.00%
Rents	20.00%	7.00%	2.00%	0.00%
Retail				
Land	25.00%	10.00%	5.00%	0.00%
Property Values	10.00%	5.00%	2.00%	0.00%
Rents	20.00%	5.00%	2.00%	0.00%
Vacancy	-7.00%	-3.00%	-5.00%	0.00%
Office				
Land	10.00%	5.00%	0.00%	0.00%
Property Values	10.00%	5.00%	0.00%	0.00%
Rents	7.00%	5.00%	0.00%	0.00%
Vacancy	-8.00%	-3.00%	0.00%	0.00%
Industrial				
Land	7.00%	3.00%	0.00%	0.00%
Property Values	3.00%	0.00%	0.00%	0.00%

Source: Multiple Studies from Comparable Areas, see bibliography.
Applied Economics, 2009.

Since it is the transit stations that drive the economic impacts it is logical that the benefits from the light rail extension are greatest within the station areas. Local convenience brings substantial benefits to residential and retail uses. Office value increases because of the convenience factor, and since increasingly skilled employees are attracted to transit oriented locations. Industrial uses are not greatly impacted and there is little located industrial development within station areas. However, for the Phoenix West Extension the type of manufacturing uses that may be attracted to the area in the future could differ in type from the warehousing type operations prevalent currently.

The remainder of the primary corridor and the secondary north area can be expected to achieve some positive benefits due to the presence of the circulator bus line. The use of the circulator bus effectively expands the accessibility to the rail line when measured in time rather than distance. The secondary south corridor is not expected to appreciably benefit from the light rail extension due to distance, the type of industrial uses present, and the lack of residential land.

5.0 FUTURE LAND USE AND SOCIOECONOMIC IMPACTS

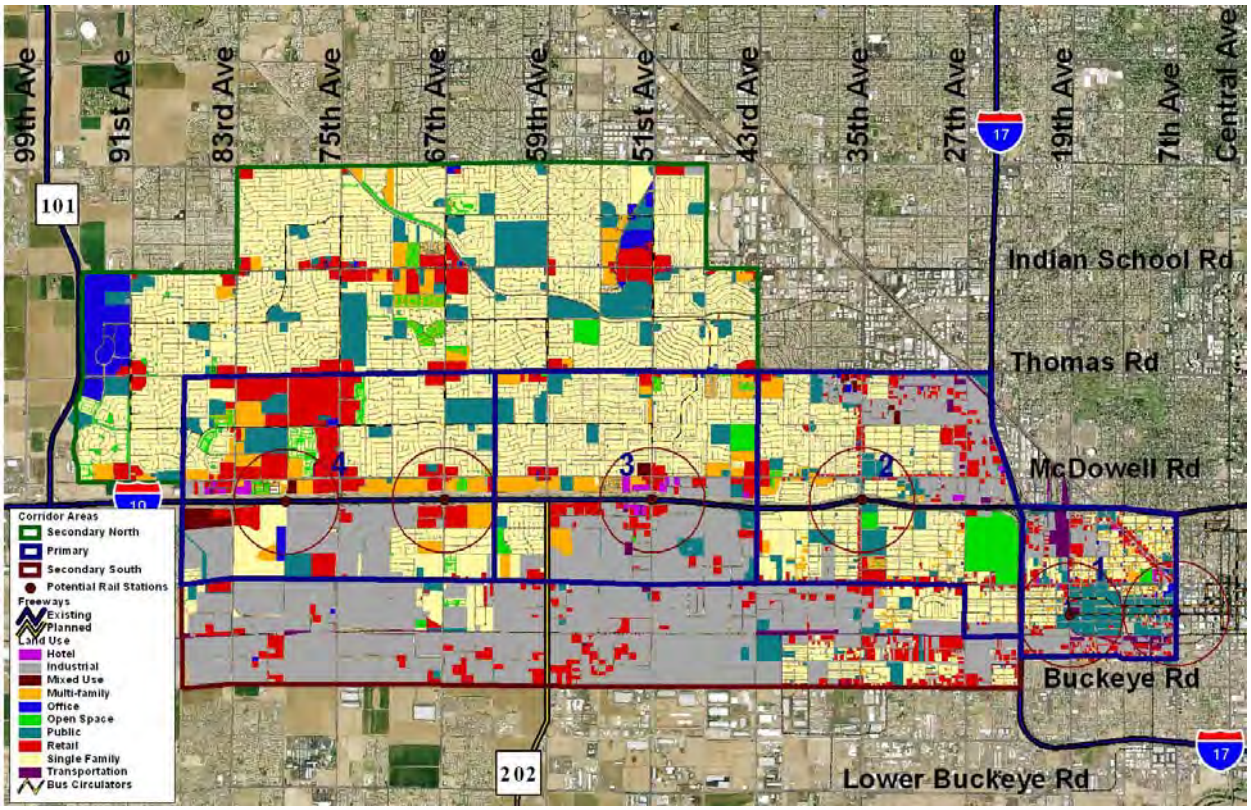
The purpose of this section of the report is to quantify future land use and socioeconomic conditions in the proposed HCT corridor of the Phoenix West Extension. This includes a No-Build scenario, as well the potential impact of LRT on future development patterns and development densities. No-Build future land use, housing, population and employment are based on approved estimates for 2005 and projections for 2030 from the Maricopa Association of Governments (MAG). The "LRT Alternative" starts with the data from MAG, and then applies different land use and development density assumptions to specific parts of the Phoenix West Extension corridor. These alternative assumptions are based on our literature research concerning the impact of LRT, our experience with similar projections, and a detailed understanding of development in the area.

5.1 FUTURE LAND USE

Future land use in the study area will be significantly impacted by the presence of a light rail extension. Construction of the system will cause changes in the development patterns of vacant land, and create opportunities for the redevelopment of currently underutilized property. A base map of 51,079 Maricopa County Assessors parcels containing data on valuation and existing land uses was utilized as a platform to calculate land use by acreage. Future land use alternatives began with land use classifications from the Maricopa Association of Governments (MAG) that were the same in the case of existing parcels. In some cases there were differences between the Assessor's and MAG's land use classifications for existing development, generally for non-residential uses. Such differences were reconciled by reviewing the specific parcels in question.

The land use projections from MAG did not take into consideration the extension of the light rail system. Existing land uses generally remained the same in the future, with some exceptions, such as mobile home parks, and vacant land was projected to develop in typical suburban patterns along the lines defined by local General Plans. As shown on **Map 5-1** the No-Build future includes the addition of large amounts of industrial development in an area already largely industrial. There is some limited mixed use development expected, while single family housing continues to be added in accordance with past development practices.

Map 5-1 Future Land Use Without Light Rail Transit



Map 5-2 displays future land use with the impact of the light rail extension. While the secondary study areas develop as before, there are significant changes in the primary corridor. The most notable change is the large increase in mixed use development in the station areas. Besides changes in the development of vacant land, additional land is projected to redevelop as property values increase. Redevelopment parcels were identified as those where the current full cash value was no more than 20 percent greater than the land value alone. Redevelopment can involve a change in land use, typically to a higher intensity of development, or the replacement of property improvements while retaining the current land use, also generally at a greater intensity of development.

Map 5-2 Potential Future Land Use With Light Rail Transit

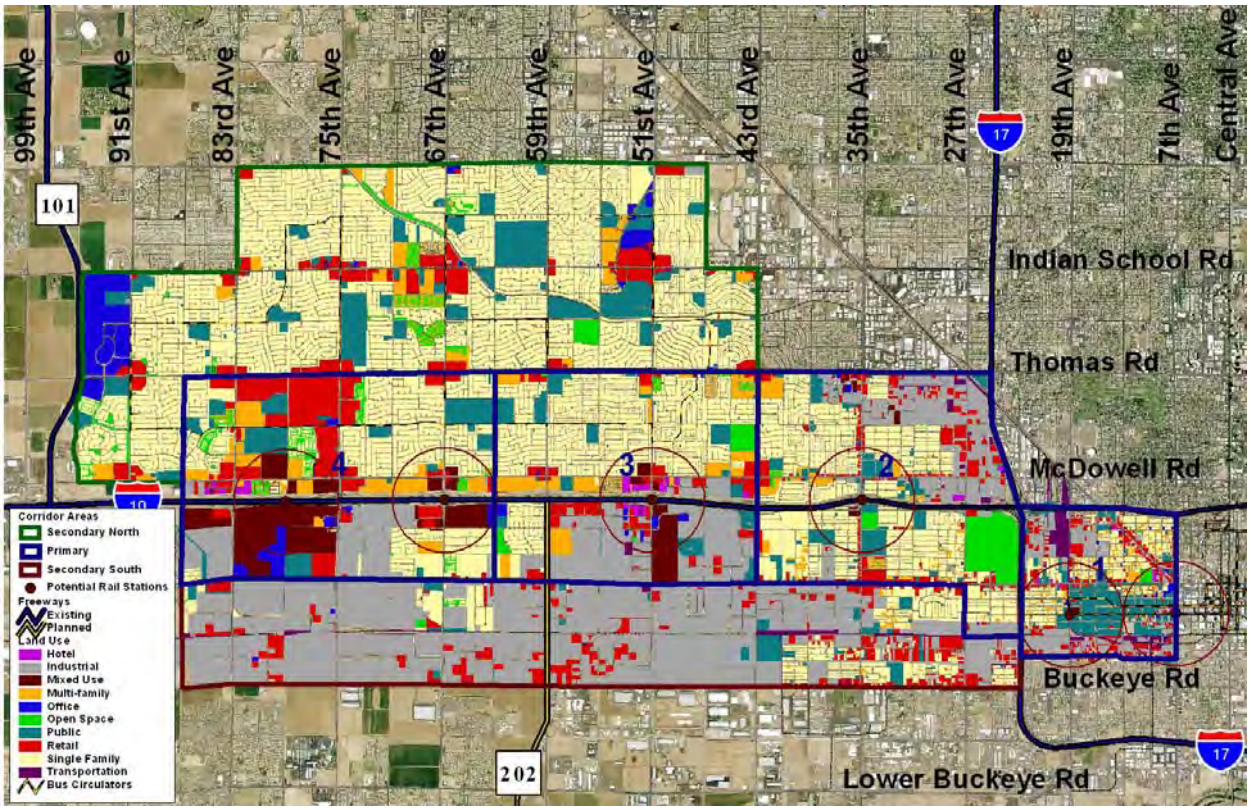


Table 5-1 shows the acreage for each study area by land use as it exists currently and as it is expected to develop with and without the construction of the Phoenix West light rail extension. For land use modeling purposes the mixed use classification was removed and the acreage was reassigned to specific land uses. This was done separately for each study area as it is expected that the proportions of multi-family, retail, office, hotel, and public land uses will vary from one area to another.

Table 5-1 Development Difference in Land Use Acreage

Impact Area	Single Family	Multi-family	Retail	Office	Industrial	Hotel	Public	Trans-portation	Open Space	Vacant
No-Build Future										
Primary	3,299.47	766.46	1,307.14	57.89	2,145.11	61.57	964.01	138.87	376.47	0.00
1	191.42	58.28	152.21	12.51	229.90	6.78	246.52	94.02	10.00	0.00
2	1,057.84	116.84	253.85	12.20	504.38	5.63	213.19	29.76	198.81	0.00
3	978.54	286.20	200.54	5.28	891.05	31.63	187.64	8.40	70.79	0.00
4	1,071.66	305.13	700.54	27.89	519.78	17.53	316.65	6.70	96.87	0.00
Secondary North	3,781.64	289.59	428.76	314.87	21.56	0.00	829.40	8.67	174.54	0.00
Secondary South	402.58	21.26	457.21	3.19	3,290.34	0.00	154.73	76.59	10.43	0.00
Total	7,483.69	1,077.30	2,193.11	375.95	5,457.00	61.57	1,948.14	224.13	561.44	0.00
Share	38.6%	5.6%	11.3%	1.9%	28.2%	0.3%	10.1%	1.2%	2.9%	0.0%
Future With LRT										
Primary	3,124.88	937.06	1,345.08	211.67	1,885.72	74.09	1,027.56	134.45	376.47	0.00
1	190.42	62.35	151.58	13.54	229.90	6.39	246.86	90.60	10.00	0.00
2	1,046.84	125.04	254.72	13.66	504.38	5.63	213.68	29.76	198.81	0.00
3	969.39	315.67	232.86	57.27	776.35	31.63	198.71	7.40	70.79	0.00
4	918.23	433.99	705.93	127.20	375.09	30.44	368.30	6.70	96.87	0.00
Secondary North	3,781.64	289.59	428.76	314.87	21.56	0.00	829.40	8.67	174.54	0.00
Secondary South	402.58	21.26	457.21	3.19	3,290.34	0.00	154.73	76.59	10.43	0.00
Total	7,309.09	1,247.91	2,231.05	529.73	5,197.61	74.09	2,011.69	219.71	561.44	0.00
Share	37.7%	6.4%	11.5%	2.7%	26.8%	0.4%	10.4%	1.1%	2.9%	0.0%
Difference With LRT										
Primary	-174.60	170.61	37.94	153.78	-259.39	12.53	63.55	-4.42	0.00	0.00
1	-1.00	4.07	-0.63	1.02	0.00	-0.39	0.34	-3.42	0.00	0.00
2	-11.01	8.20	0.87	1.45	0.00	0.00	0.48	0.00	0.00	0.00
3	-9.16	29.48	32.32	51.99	-114.70	0.00	11.07	-1.00	0.00	0.00
4	-153.43	128.86	5.39	99.31	-144.69	12.91	51.65	0.00	0.00	0.00
Secondary North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Secondary South	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	-174.60	170.61	37.94	153.78	-259.39	12.53	63.55	-4.42	0.00	0.00

Source: Maricopa Association of Governments; Maricopa County Assessor; Applied Economics, 2010.

With the addition of the light rail extension, the primary study areas are expected to become more diverse, with significant acreage taken out of industrial and single family uses and added to multi-family and office uses. As each study area has different characteristics, the shifting of land uses varies.

5.1.1 PRIMARY CORRIDOR IMPACT AREA - PART 1

Part 1 is largely developed, so additional development opportunities are limited. There should be a slight decrease in single family housing, with increases in multi-family, office, and public uses. Much of this will be a product of the redevelopment of substandard or underused properties into more productive land uses with increased intensity of development.

5.1.2 PRIMARY CORRIDOR IMPACT AREA - PART 2

Part 2 is also substantially developed, without much difference between the MAG no-build future and the LRT future. The largest change expected is the addition of more multi-family housing at the expense of single family residential.

5.1.3 PRIMARY CORRIDOR IMPACT AREA - PART 3

Part 3 offers more development possibilities, both in vacant land and redevelopment. The vacant land, along the southern border of the study area, is expected to develop primarily as industrial, with some housing, in both the no-build and transit-oriented development scenarios. But there appears to be significant redevelopment potential within the station area with a reduction of about 115 acres of industrial land being redistributed into multi-family, retail, office, and public uses. There are also some lower quality retail properties that could be redeveloped into mixed use projects.

5.1.4 PRIMARY CORRIDOR IMPACT AREA - PART 4

Part 4 offers the most new development potential with about 982 acres of vacant land. There are substantial modifications to the no-build land use plan in this study area. About 150 acres of single family and 145 acres of industrial land have been reassigned, primarily as mixed use. With the mixed use designation, multi-family and office would experience major gains, while retail would not change significantly. Since the area does have such large amounts of vacant land it is underserved in terms of public uses, so a gain of about 50 acres is expected. Given the presence of the freeway and light rail, it is expected that additional hotel/motel space is warranted. Both station areas are envisioned to have a high density urban character of development.

Some benefits are expected in northern secondary study area due to the access to the rail line, but changes in land use are not foreseen. The secondary study area to the south is also not anticipated to have changes in land use.

5.2 SOCIOECONOMIC PROJECTIONS

Socioeconomic projections under both the No-Build and LRT scenarios were prepared for the four parts of the Primary Corridor, as well as a north and south Secondary Impact Areas. After completing the review of existing studies on the impacts of LRT in comparative areas, we determined that there would not likely be any measureable economic or fiscal impacts of the proposed LRT within the South Secondary Impact Area. The area is simply too far removed from the proposed route, and the impacts of LRT on predominantly industrial areas in other metropolitan areas have been minimal at best. However, the area is carried through in the analysis at the No-Build levels, for consideration in the ridership forecasts. This is due to its very large industrial (warehouse) employment base, and the likelihood that some of this large workforce would find a 1-mile distance from an LRT station acceptable.

In the case of the No-Build scenario, the future acres by land use, and levels of housing, population and employment by land use were aggregated directly from Socioeconomic

Analysis Zone (SAZ) data provided by the Maricopa Association of Governments (MAG). The employment data was then used to develop projections of the likely increase in non-residential square footage, which are needed for the calculation of future property and sales tax revenues for the No-Build scenario.

For the LRT Alternative, impacts on land use, development density and occupancy (as compared to the No-Build scenario), are used to drive projections of the levels of housing and population, and non-residential square footage and employment by land use. The impacts are calculated as marginal changes to the No-Build levels, and are tied to the specific impact areas and parcels discussed in Section 5.1.

5.2.1 PRIMARY CORRIDOR IMPACT AREA

Socioeconomic projections for the Primary Corridor Impact Area are summarized in **Table 5-2**. These impacts are aggregated from the results of the impacts within each of the four parts of the Primary Corridor, which are detailed in subsequent sections of the report. The table begins by repeating the existing and future land use data from Section 5.1, which shows the reassignment of about 877 net acres under the LRT Alternative, or about 9.6 percent of the total 9,117 net acres. In general these impacts increase multi-family residential development, and redirect some the land earmarked for industrial uses to the retail, office, pubic and hotel categories.

In terms of residential impacts, the results show an increase of about 4,700 housing units (13 percent) under the LRT future compared to No-Build future. This is driven the addition of about 5,400 more multi-family units and 700 less single family units. Combined with a slight (0.4 percent) overall decline in vacancy rates, this translates into about 4,700 new households. Even with the decline in population per household caused by the addition of more multifamily housing, this implies approximately 12,700 more people living in the Primary Corridor Impact Area under the LRT future, bringing total population to about 135,600 people.

Table 5-2 Socioeconomic Impact Projections – Primary Corridor Impact Area

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	2,798.07	3,299.47	3,124.88	-174.60
Multi- family	739.10	766.46	937.06	170.61
Retail	951.79	1,307.14	1,345.08	37.94
Office	24.90	57.89	211.67	153.78
Industrial	1,530.82	2,145.11	1,885.72	-259.39
Hotel	59.10	61.57	74.09	12.53
Public	943.03	964.01	1,027.56	63.55
Mixed Use	0.00	0.00	0.00	0.00
Transportation	126.97	138.87	134.45	-4.42
Open Space	376.47	376.47	376.47	0.00
Vacant	1,566.74	0.00	0.00	0.00
TOTAL	9,116.99	9,116.99	9,116.99	0.00
Residential				
Total Housing Units	31,022	36,281	41,002	4,721
Single Family	21,580	25,626	24,909	-718
Multifamily	9,443	10,655	16,094	5,439
Households	29,385	34,903	39,606	4,703
Vacancy Rate	5.3%	3.8%	3.4%	-0.4%
Population in Households	108,652	122,884	135,621	12,737
Population per Household	3.70	3.52	3.42	-0.10
Non-residential				
Inventory (Sq. Feet)				
Retail	4,677,176	8,281,260	9,834,333	1,553,073
Office	1,323,469	2,151,250	6,193,776	4,042,526
Industrial	26,456,000	34,429,492	30,661,959	-3,767,533
Hotel	1,544,670	1,609,108	1,957,390	348,281
TOTAL	34,001,315	46,471,111	48,647,458	2,176,347
Employment				
Retail	10,094	14,348	18,618	4,270
Office	1,271	2,407	14,655	12,248
Industrial	20,914	30,607	25,269	-5,337
Hotel	1,545	1,609	1,957	348
Public	12,868	17,096	19,864	2,768
Other	1,962	2,316	2,316	0
TOTAL	48,653	68,383	82,680	14,297

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

In terms of non-residential impacts, the LRT future includes a net increase of about 2.1 million square feet of building space, bringing the future total for the Primary Corridor Impact Area to about 48.6 million square feet. The net LRT impact (about 4.6 percent), includes a significant shift from industrial space to retail and office development. Note that the reduction of about 3.8 million square feet of industrial space compared to the No-Build future still implies the addition of more than 4.1 million square feet of industrial space over existing conditions. The land use reassignments result in about 1.5 million more square feet of retail space and about 4.0 million square feet of office space, along with about 350,000 square feet of hotel/motel space.

It is important to note that these square footage impacts are driven by development and redevelopment. This means that the change in square footage is sometimes driven by more than net difference between existing and future acres. Also, the floor area ratios vary between existing conditions, the No-Build future and the LRT future. All of these assumptions also vary by subarea (part) within the Primary Corridor Impact Area.

The built-space impacts by land use, combined with somewhat lower vacancy rates, result in a total employment impact of about 14,300 jobs over the No-Build future. This would bring total future employment in the Primary Corridor Impact Area to over 82,000 jobs. Industrial employment would be about 5,300 jobs less than the No-Build future, but that loss would be more than offset the addition of about 4,300 retail jobs, 12,000 office jobs and about 2,800 public/quasi public jobs.

The following sub-sections describe the factors and results for each of the four parts of the Primary Corridor Impact Area.

5.2.1.1 PRIMARY CORRIDOR IMPACT AREA - PART 1

The Socioeconomic projections for Part 1 of the Primary Corridor Impact Area are summarized in **Table 5-3**. The table shows the reassignment of about 10.9 net acres under the LRT future compared to the No-Build future. The potential impact in this area is restricted since much of land within ½ mile of the LRT route is fully developed, mostly with government office buildings. The only substantial tracts of available land are further north and south, and are embedded in industrial areas. Some additional redevelopment is possible, especially in the residential area west of the 19th Avenue, but the amount cannot be determined until specific stations areas are identified and analyzed in more detail.

In terms of residential impacts, the results show a net increase of about 384 housing units (12 percent) in the LRT future compared to No-Build future. This is based on the development and redevelopment of about 4.0 more acres of multifamily land and 1.0 acre of single family land. This impact, combined with a projected decline in the relatively high vacancy rates in the area, would translate into an additional 400 households.

Table 5-3 Socioeconomic Impact Projections – Primary Corridor Impact Area – Part 1

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	167.06	191.42	190.42	-1.00
Multi- family	63.13	58.28	62.35	4.07
Retail	165.58	152.21	151.58	-0.63
Office	9.01	12.51	13.54	1.02
Industrial	184.18	229.90	229.90	0.00
Hotel	5.93	6.78	6.39	-0.39
Public	239.44	246.52	246.86	0.34
Mixed Use	0.00	0.00	0.00	0.00
Transportation	76.12	94.02	90.60	-3.42
Open Space	10.00	10.00	10.00	0.00
Vacant	81.22	0.00	0.00	0.00
TOTAL	1,001.65	1,001.65	1,001.65	0.00
Residential				
Total Housing Units	3,082	3,145	3,529	384
Single Family	1,818	2,084	2,103	19
Multifamily	1,264	1,062	1,426	365
Households	2,744	2,855	3,269	414
Vacancy Rate	11.0%	9.2%	7.4%	-1.8%
Population in Households	9,226	9,520	10,573	1,053
Population per Household	3.36	3.33	3.23	-0.10
Non-residential				
Inventory (Sq. Feet)				
Retail	363,452	404,864	482,563	77,699
Office	1,099,409	1,527,636	1,743,778	216,142
Industrial	4,608,954	5,174,548	5,174,548	0
Hotel	154,897	177,215	187,999	10,784
TOTAL	6,226,712	7,284,264	7,588,889	304,625
Employment				
Retail	1,139	1,196	1,455	259
Office	1,112	2,117	2,871	754
Industrial	3,866	4,571	4,571	0
Hotel	155	177	188	11
Public	10,180	12,874	12,889	15
Other	211	111	111	0
TOTAL	16,663	21,046	22,085	1,039

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

Even with the decline in population per household caused by the addition of more multifamily housing, this implies approximately 1,000 more people living in Part 1 of the Primary Corridor Impact Area under the LRT future, bringing the total future population to about 10,600 people.

In terms of non-residential impacts, the LRT future for Part 1 of the Primary Corridor Impact Area includes a net increase of about 300,000 square feet of nonresidential space, bringing the future total for the area to about 7.6 million square feet. The net LRT impact (about 4.2 percent), includes redevelopment of parking lots and other small infill parcels adding about 78,000 square feet of retail space and 216,000 square feet of office space compared to the No-Build future.

The built-space impacts by land use, combined with slightly lower vacancy rates in the LRT future, result in a total employment impact of over 1,000 jobs over the No-Build future. This would bring total future employment in Part 1 to just over 22,000 jobs.

5.2.1.2 PRIMARY CORRIDOR IMPACT AREA - PART 2

Socioeconomic projections for Part 2 of the Primary Corridor Impact Area are summarized in **Table 5-4**. The table shows the reassignment of about 22.0 net acres of land under the LRT Alternative compared to the No-Build future. Like Part 1, the potential impact in this area is limited since much of land within ½ mile of the LRT route is fully developed, as is the land near the 35th Avenue station site. A small amount of mixed use redevelopment is possible on a few key parcels near the station site.

Residential impacts show a net increase of about 590 housing units (6 percent) in the LRT future compared to No-Build future. This is based on the development and redevelopment of about 8.2 more acres of multifamily land and 11.0 acres of single family land. This impact, combined with a very small projected decline in the low vacancy rates in the area, would translate into an additional 600 households.

With the decline in population per household caused by the addition of more multifamily housing, these housing unit additions translate into about a 1,500 person increase in the household population of the area. This would bring the total future population of Part 2 of the Primary Corridor Impact Area under the LRT future about 38,600 people.

The LRT future for non-residential in Part 2 of the Primary Corridor Impact Area shows a net increase of about 160,000 square feet of building space, driven by the addition of about 87,000 square feet of retail space and 72,000 square feet of office space. These additions would bring the future total for the area to about 9.3 million square feet. However, the net LRT impact would only be about 1.8 percent higher than the No-Build future.

Part 2 of the Primary Corridor Impact Area experiences higher than average vacancy rates that could be stabilized by the addition of LRT. The combination of new space and better lower vacancy rates result in a total employment impact of about 750 jobs over the No-Build future. This would bring total future employment in Part 2 to about 17,000 jobs.

Table 5-4 Socioeconomic Impact Projections – Primary Corridor Impact Area – Part 2

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	914.19	1,057.84	1,046.84	-11.01
Multi- family	203.94	116.84	125.04	8.20
Retail	279.38	253.85	254.72	0.87
Office	7.40	12.20	13.66	1.45
Industrial	442.87	504.38	504.38	0.00
Hotel	5.63	5.63	5.63	0.00
Public	208.18	213.19	213.68	0.48
Mixed Use	0.00	0.00	0.00	0.00
Transportation	29.76	29.76	29.76	0.00
Open Space	198.81	198.81	198.81	0.00
Vacant	102.37	0.00	0.00	0.00
TOTAL	2,392.51	2,392.51	2,392.51	0.00
Residential				
Total Housing Units	9,478	9,857	10,446	589
Single Family	7,279	8,429	8,612	184
Multifamily	2,199	1,429	1,834	405
Households	9,085	9,600	10,201	601
Vacancy Rate	4.2%	2.6%	2.3%	-0.3%
Population in Households	35,493	37,083	38,615	1,532
Population per Household	3.91	3.86	3.79	-0.08
Non-residential				
Inventory (Sq. Feet)				
Retail	974,896	1,064,084	1,151,850	87,767
Office	115,987	196,290	268,811	72,521
Industrial	6,934,236	7,729,963	7,729,963	0
Hotel	147,145	147,145	147,145	0
TOTAL	8,172,264	9,137,482	9,297,769	160,288
Employment				
Retail	2,878	3,035	3,536	501
Office	114	245	475	230
Industrial	9,884	10,253	10,253	0
Hotel	147	147	147	0
Public	1,496	2,070	2,091	21
Other	376	507	507	0
TOTAL	14,895	16,257	17,009	752

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

5.2.1.3 PRIMARY CORRIDOR IMPACT AREA - PART 3

Socioeconomic projections for Part 3 of the Primary Corridor Impact Area are summarized in **Table 5-5**. The table shows the reassignment of about 250 net acres under the LRT Alternative compared to the No-Build future. The potential impact in this area is much greater than in Parts 1 and 2 of the Primary Corridor Impact Area since there is vacant land where future use can be impacted by the addition of LRT. It also has the advantage of combining the LRT with the confluence of Interstate 10 and the proposed Loop 202 extension.

For residential impacts the results show a net increase of about 1,400 housing units (12 percent) in the LRT future compared to No-Build future. This based on the development and redevelopment of about 29.5 more acres of multifamily land and 9.2 acres of single family land. Combined with a very small decline in the low vacancy rates in the area, this would translate into an additional 1,350 households.

With population per household expected to be unaffected, the population of the Part 3 of the Primary Corridor Impact Area would be about 5,000 people higher in the LRT future than in the No-Build future. This would bring the total population of the area up to about 45,800 people.

For non-residential impacts, the LRT future for Part 3 of the Primary Corridor Impact Area shows a net increase of only about 325,000 square feet (2.2 percent) of building space between the No-Build and the LRT future. The change includes a shift of some of the growth in industrial space on station-area parcels to retail and office space. However, the area could still experience a net increase of some 2.1 million square feet of industrial space. The shift with LRT could generate the potential for some 1.9 million square feet of retail and office space, some of which would likely result from one or more significant mixed-use projects. These additions would bring the future total non-residential building area to about 14.3 million square feet.

The built-space impacts for Part 3 of the Primary Corridor Impact Area by land use, combined with slightly lower vacancy rates in the LRT future, result in a total employment impact of nearly 3,600 jobs over the No-Build future. This would bring total future employment in Part 3 to nearly 18,000 jobs.

Table 5-5 Socioeconomic Impact Projections – Primary Corridor Impact Area – Part 3

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	942.76	978.54	969.39	-9.16
Multi- family	244.53	286.20	315.67	29.48
Retail	159.88	200.54	232.86	32.32
Office	2.86	5.28	57.27	51.99
Industrial	612.00	891.05	776.35	-114.70
Hotel	31.63	31.63	31.63	0.00
Public	186.67	187.64	198.71	11.07
Mixed Use	0.00	0.00	0.00	0.00
Transportation	7.40	8.40	7.40	-1.00
Open Space	70.79	70.79	70.79	0.00
Vacant	401.57	0.00	0.00	0.00
TOTAL	2,660.07	2,660.07	2,660.07	0.00
Residential				
Total Housing Units	10,511	11,517	12,912	1,395
Single Family	6,590	6,841	6,857	16
Multifamily	3,921	4,676	6,055	1,379
Households	9,951	11,118	12,487	1,369
Vacancy Rate	5.3%	3.5%	3.3%	-0.2%
Population in Households	37,282	40,764	45,783	5,019
Population per Household	3.75	3.67	3.67	0.00
Non-residential				
Inventory (Sq. Feet)				
Retail	758,649	1,135,996	1,623,067	487,072
Office	9,743	41,433	1,432,034	1,390,601
Industrial	8,357,563	12,002,349	10,448,943	-1,553,406
Hotel	826,693	826,693	826,693	0
TOTAL	9,952,648	14,006,471	14,330,737	324,266
Employment				
Retail	1,801	2,345	3,456	1,111
Office	45	45	4,219	4,174
Industrial	5,534	9,510	7,309	-2,201
Hotel	827	827	827	0
Public	703	703	1,185	482
Other	698	675	675	0
TOTAL	9,608	14,105	17,672	3,567

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

5.2.1.4 PRIMARY CORRIDOR IMPACT AREA - PART 4

Socioeconomic projections for Part 4 of the Primary Corridor Impact Area are summarized in **Table 5-6**. The table shows the reassignment of about 600 net acres under the LRT Alternative compared to the No-Build future. The potential impact in this area is much greater even than in Part 3 since there is a large amount of vacant land where the future use can be impacted by the addition of LRT.

In the case of residential impacts, the results show a net increase of over 2,300 housing units (20 percent) in the LRT future compared to No-Build future. This based on the development and redevelopment of about 129 more acres of multifamily land and 153 less acres of single family land. Combined with a very small decline in the low vacancy rates in the area, this would translate into an additional 2,300 households.

With population per household in Part 4 expected to decline by about 5 percent due to the influx of multifamily housing, the population of the Part 4 of the Primary Corridor Impact Area would be about 5,100 people higher in the LRT future than in the No-Build future. This would bring the total population of the area up to about 40,600 people.

In the case of non-residential, the LRT future for Part 4 of the Primary Corridor Impact Area shows a net increase of approaching 1.4 million square feet (8.6 percent) of building space between the No-Build and the LRT future. The difference includes the shift of much of the growth in industrial space, (some 2.2 million square feet) on station-area parcels to retail, office and hotel/motel space. The shift due to LRT could generate the potential for some 3.2 million square feet of new retail and office space, some of which would likely result from one or more significant mixed-use projects similar to those in Part 3 of the Primary Corridor Impact Area. These additions would bring the future total non-residential building area to about 17.4 million square feet.

The built-space impacts for Part 4 of the Primary Corridor Impact Area by land use, combined with slightly lower vacancy rates in the LRT future, result in a total employment impact of nearly 8,900 jobs over the No-Build future. This 52 percent increase in employment over the No-Build scenario would bring total future employment in Part 4 to nearly 26,000 jobs.

Table 5-6 Socioeconomic Impact Projections – Primary Corridor Impact Area – Part 4

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	774.07	1,071.66	918.23	-153.43
Multi- family	227.51	305.13	433.99	128.86
Retail	346.96	700.54	705.93	5.39
Office	5.64	27.89	127.20	99.31
Industrial	291.78	519.78	375.09	-144.69
Hotel	15.91	17.53	30.44	12.91
Public	308.74	316.65	368.30	51.65
Mixed Use	0.00	0.00	0.00	0.00
Transportation	13.70	6.70	6.70	0.00
Open Space	96.87	96.87	96.87	0.00
Vacant	981.59	0.00	0.00	0.00
TOTAL	3,062.76	3,062.76	3,062.76	0.00
Residential				
Total Housing Units	7,951	11,762	14,116	2,354
Single Family	5,892	8,273	7,337	-936
Multifamily	2,059	3,489	6,779	3,290
Households	7,606	11,330	13,649	2,320
Vacancy Rate	4.3%	3.7%	3.3%	-0.4%
Population in Households	26,651	35,518	40,650	5,133
Population per Household	3.50	3.13	2.98	-0.16
Non-residential				
Inventory (Sq. Feet)				
Retail	2,580,179	5,676,316	6,576,852	900,535
Office	98,330	385,891	2,749,153	2,363,262
Industrial	6,555,247	9,522,632	7,308,506	-2,214,127
Hotel	415,934	458,055	795,552	337,498
TOTAL	9,649,690	16,042,894	17,430,062	1,387,168
Employment				
Retail	4,276	7,773	10,171	2,398
Office	0	0	7,090	7,090
Industrial	1,630	6,273	3,136	-3,137
Hotel	416	458	796	337
Public	489	1,449	3,699	2,250
Other	677	1,023	1,023	0
TOTAL	7,487	16,976	25,914	8,939

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

5.2.2 SECONDARY IMPACT AREA - NORTH

The Socioeconomic projections for north portion of the Secondary Impact Area are summarized in **Table 5-7**. The table shows that no direct reassignment of land from one land use category to another is assumed under the LRT Alternative compared to the No-Build future.

In terms of residential impacts, the LRT future impacts include an increase of 120 multi-family units due to higher unit-per-acre densities on the remaining land for development, and a small 5 percent reduction in the relatively low vacancy rates in the area. Compared to the No-Build future, this results in a net increase of about 164 households.

These relatively small impacts in the number of housing units and households will likely be overshadowed by the impact from a 3 percent overall increase in the population per household. Together, these impacts imply approximately 3,200 more population in households in the LRT future versus the No-Build future. This would bring the total population of the north portion of the Secondary Impact Area to about 104,000 people.

In terms of non-residential impacts, the LRT future for the north portion of the Secondary Impact Area includes no net increase in the projected square feet of building space, which should reach about 6.7 million square feet in the future. However, it does make the No-Build projection for the addition of 2.9 million square feet of office space in the future seem more reasonable.

While there would likely be no impact in terms of built space, the LRT future incorporates slightly lower vacancy rates that result in a total employment impact of nearly 900 jobs over the No-Build future. This would bring total future employment in the North Secondary Impact Area to just over 20,000 jobs.

Table 5-7 Socioeconomic Impact Projections Secondary Impact Area – North

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	3,709.73	3,781.64	3,781.64	0.00
Multi- family	307.42	289.59	289.59	0.00
Retail	360.67	428.76	428.76	0.00
Office	63.15	314.87	314.87	0.00
Industrial	11.14	21.56	21.56	0.00
Hotel	0.00	0.00	0.00	0.00
Public	823.82	829.40	829.40	0.00
Mixed Use	0.00	0.00	0.00	0.00
Transportation	3.93	8.67	8.67	0.00
Open Space	174.54	174.54	174.54	0.00
Vacant	394.62	0.00	0.00	0.00
TOTAL	5,849.02	5,849.02	5,849.02	0.00
Residential				
Total Housing Units	27,947	28,930	29,053	123
Single Family	22,833	23,555	23,555	0
Multifamily	5,114	5,374	5,497	123
Households	26,604	28,040	28,203	164
Vacancy Rate	4.8%	3.1%	2.9%	-0.2%
Population in Households	97,240	101,381	105,031	3,651
Population per Household	3.66	3.62	3.72	0.11
Non-residential				
Inventory (Sq. Feet)				
Retail	2,721,186	3,314,338	3,314,338	0
Office	782,007	2,947,684	2,947,684	0
Industrial	322,521	458,700	458,700	0
Hotel	0	0	0	0
TOTAL	3,825,714	6,720,722	6,720,722	0
Employment				
Retail	5,562	7,564	8,321	756
Office	743	2,743	2,880	137
Industrial	4	993	993	0
Hotel	0	0	0	
Public	3,528	4,243	4,243	0
Other	2,965	3,595	3,595	0
TOTAL	12,802	19,138	20,032	894

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

5.2.3 SECONDARY IMPACT AREA - SOUTH

The Socioeconomic projections for south portion of the Secondary Impact Area are summarized in **Table 5-8**. The table shows that, as mentioned above, there would not likely be any measureable economic or fiscal impacts of the proposed LRT within the South Secondary Impact Area compared with the No-Build future. The area is too far removed from the proposed route, and the impacts of LRT on predominantly industrial areas in other metropolitan areas have been relatively small. However, the area is carried through in the analysis at the No-Build levels for consideration in the ridership forecasts.

The No-Build future indicates the addition of over 11 million square feet of industrial space that will propel employment in the area from around 23,000 jobs currently, to over 34,000 jobs in the future. This increase in the employment base should help increase ridership on the proposed LRT system.

Table 5-8 Socioeconomic Impact Projections Secondary Impact Area – South

	Existing	No-Build Future	LRT Future	Net LRT Impact
Land Use				
Single Family	324.98	402.58	402.58	0.00
Multi- family	52.44	21.26	21.26	0.00
Retail	553.32	457.21	457.21	0.00
Office	4.96	3.19	3.19	0.00
Industrial	2,439.21	3,290.34	3,290.34	0.00
Hotel	0.00	0.00	0.00	0.00
Public	139.04	154.73	154.73	0.00
Mixed Use	0.00	0.00	0.00	0.00
Transportation	76.59	76.59	76.59	0.00
Open Space	10.66	10.43	10.43	0.00
Vacant	815.14	0.00	0.00	0.00
TOTAL	4,416.33	4,416.33	4,416.33	0.00
Residential				
Total Housing Units	2,378	2,719	2,719	0
Single Family	1,805	2,427	2,427	0
Multifamily	573	291	291	0
Households	2,196	2,561	2,561	0
Vacancy Rate	7.6%	5.8%	5.8%	0.0%
Population in Households	9,070	10,010	10,010	0
Population per Household	4.13	3.91	3.91	0.00
Non-residential				
Inventory (Sq. Feet)				
Retail	175,162	245,289	245,289	0
Office	43,599	28,006	28,006	0
Industrial	27,084,171	38,224,207	38,224,207	0
Hotel	0	0	0	0
TOTAL	27,302,932	38,497,502	38,497,502	0
Employment				
Retail	2,670	2,787	2,787	0
Office	53	53	53	0
Industrial	18,959	30,206	30,206	0
Hotel	0	0	0	0
Public	1,122	1,131	1,131	0
Other	430	497	497	0
TOTAL	23,233	34,674	34,674	0

Sources:

Existing & No-Build Future: Maricopa Association of Governments, 2007.

LRT Future & Square Footage Estimates: Applied Economics, 2010.

6.0 REVENUE IMPACTS

The assessed value calculations reflect the increases in land value over time for the No-Build and LRT scenarios. Changes in assessed value are driven by general increases in value due to proximity to the rail line, increases due to new development on vacant land and increases due to redevelopment. The results of the assessed value model form the basis for the property tax calculations.

6.1 ASSESSED VALUE

6.1.1 Existing Assessed Value

The first step is to estimate existing assessed value by land use and by tax rate area for each part of the primary and secondary impact area. The parcel database used in the demographic and land use data includes information about land value and improvement value for each parcel from the Maricopa County Assessor. This information was categorized by land use category for single family, multi-family, retail, office, industrial, hotel, public, open space, transportation and vacant. All mixed use land was allocated to other categories including retail, office and multi-family so that characteristics for these specific land uses could be applied. The process was repeated for each part of the primary and secondary study areas. Also, it was necessary to separate out hotels as a land use category for the sales tax calculations.

In addition to summing assessed value by land use, it was also necessary to break it down by tax rate area so that property taxes could be calculated by jurisdiction. Tax rate areas are based on the location of each parcel by county, city, school district and other special districts. In this corridor, there are no unified districts so all of the school districts include a combination of an elementary and high school district.

The final step in estimating existing assessed value was to separate the land into those parcels that were in a station area (within 0.5 miles of a station) versus outside the station area, since the rate of increase in assessed value for existing properties varied depending on proximity to potential station locations in the LRT scenario. The final result showed a breakdown of existing land value and improvement value by study area part, by land use, by tax rate area for parcels within station areas and parcels outside of station areas.

6.1.2 Future Assessed Value

The next step was to model future assessed value under the No-Build and LRT scenarios. The projected changes in land use formed the basis for projecting assessed value, however, a number of additional calculations were necessary.

The first step was to look at the four possible cases for what may happen to a parcel in the future. These cases included:

1) Vacant land that will develop for the first time
2) Redevelopment into a different land use
3) Redevelopment within the same land use, but at a higher density and value
4) No new construction on parcels already developed

Each of these cases needed to be treated differently in the assessed value calculations. Information was extracted from the parcel database to identify the subset of parcels that fell into cases 1, 2 and 3 under the No-Build scenario and the LRT scenario. The data for each of these cases also included detail on land use, tax rate area and location in, or out, of a station area.

6.1.2.1 Case 1 – Vacant Land

In the case of vacant land, the existing assessed value of that vacant land was subtracted out of future assessed value. New land value was added based on the average existing land value per acre in that part of the study area for the new land use. Then, based on the projected number of new square feet, using the same existing and future floor area ratios by study area part as in the socioeconomic projections, the number of square feet added by new development was estimated by land use. Construction costs per square foot by land use were then multiplied by projected new square feet as a proxy for the additional improvement value. Construction costs per square foot were taken from R.S. Means Building Construction Cost Data, 2010 and were adjusted for construction costs in Phoenix specifically. **Table 6-1** shows estimated costs per square foot by type of building.

Table 6-1 Construction Cost per Square Foot

Land Use	Cost per Unit /Per Square Ft	Study Area
Single Family	$125,000	All areas
Multi- family (1 to 3 Story)	$83,378	Areas 2 - 6
Multi- family (4 to 7 Story)	$103,779	Area 1
Retail Low (strip center)	$72.29	Areas 2 - 6
Retail High (restaurant)	$150.79	Area 1
Retail High (store)	$73.18	Area 1
Office (1 to 4 story)	$105.55	All areas
Industrial/Warehouse	$57.66	All areas
Hotel	$88.70	All areas

Source: R.S. Means Building Construction Cost Data, 2010.
Note: All data indexed to Phoenix at a rate of 88.7% of national costs based on data from R.S. Means.

6.1.2.2 Case 2– Redevelopment into a Different Use

The next case involved the subset of parcels in each part of the study area that had redevelopment potential within different land use. The first step was to subtract existing land and improvement values for these specific parcels from future assessed value. Next, the future land value was adjusted to be equal to the greater of existing vacant land value, or average existing land value in that part of the study area for developed land in the appropriate land use category. Finally, the new improvement value was estimated based on projected new square feet times construction cost by type of use.

6.1.2.3 Case 3 – Redevelopment within the Same Use

The third case included parcels where there was redevelopment potential, but the future use was likely to be the same as the current use. For example, older retail strip centers could redevelop as new retail centers, or older apartments could redevelop as new higher density apartments. To estimate future assessed value in this case, existing land and improvement value for these specific parcels were subtracted out. Next, the future land value was adjusted to be equal to the greater of existing vacant land value, or average existing land value in that part of the study area for developed land in the appropriate category. Finally, the new improvement value was estimated based on projected new square feet times construction cost by type of use. It is important to note that net new square feet is not the same as new square feet constructed. This is particularly true in the case of redevelopment within the same land use. New square feet constructed, not net new square feet, were used to calculate the amount of additional improvement value based on construction costs.

6.1.2.4 Case 4 – Increases in Existing Development Value

Although many of the parcels in each part of the study area were already developed, these parcels are projected to experience increases in assessed value in the LRT scenario based on their proximity to station area. The amount of increase also varies for land and improvement value and by type of land use by study area part. The rates of increase that were applied to existing development are shown in **Table 6-2**. Note that no increases were applied to assessed value in the No-Build scenario.

Table 6-2 Real Estate Value Assumptions

Land Use	Station Areas	Primary Corridor	Secondary North	Secondary South
Residential				
Land Value	9.50%	5.00%	5.00%	0.00%
Improvement Value	9.00%	2.00%	2.00%	0.00%
Retail and Hotel				
Land Value	25.00%	10.00%	5.00%	0.00%
Improvement Value	10.00%	5.00%	2.00%	0.00%
Office				
Land Value	10.00%	5.00%	0.00%	0.00%
Improvement Value	10.00%	5.00%	0.00%	0.00%
Industrial				
Land Value	7.00%	3.00%	0.00%	0.00%
Improvement Value	3.00%	0.00%	0.00%	0.00%

Source: Multiple Studies from Comparable Areas. See detailed table in Section 4.0 for list.

6.1.2.5 Total Future Assessed Value

In order to arrive at the final projections of future assessed value, existing value by land use for each part of the study area was added to net changes in value due to new development plus net changes due to redevelopment in different uses plus changes due to redevelopment within the same use. Total assessed value was calculated for both the No-Build scenario and the LRT scenario.

In Part 1, there are a total of 1,001.65 acres, with only 81.22 acres of vacant land (**Table 6-3**). Since this area includes the state capital complex, the majority of the existing value is in public uses that are exempt from property tax. Under both future scenarios, all vacant land is developed. There is a small amount of new public development, but most of the new development is in industrial and single family uses. About 34 percent of the increase in assessed value under the LRT scenario is in industrial and 15 percent is in single family residential, compared to existing assessed value. An additional 29 percent of the increase in assessed value is in office, with about 644,000 net new square feet of office space.

Under the No-Build scenario in Part 1, industrial assessed value accounts for 44 percent of the total increase in assessed value, due to the larger amount of new net industrial development than in the LRT scenario. About 17 percent of the increase in assessed value is in single family, which is slightly higher than in the LRT scenario. The increase in retail assessed value is fairly minimal in the No-Build scenario. Overall, total future assessed value under the LRT scenario is 6 percent greater than under the No-Build scenario. Note that the percentage difference in assessed value under the LRT scenario versus the No-Build is significantly less than the difference in property tax revenues because assessed value in Area 1 includes a large amount of public property

value at the capital complex that is not taxable and that does not increase in value over time.

Table 6-3 Assessed Value Primary Corridor – Part 1

	Existing			
Land Use	Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	167.06	1,818	$30,570,500	$109,034,888
Multi- family	63.13	1,264	$16,364,149	$51,891,164
Retail	165.58	363,452	$70,593,715	$31,988,675
Office	9.01	1,099,409	$4,337,168	$14,492,052
Industrial	184.18	4,608,954	$44,059,533	$79,902,145
Hotel	5.93	154,897	$3,038,697	$3,720,406
Public	239.44	na	$148,365,500	$653,692,313
Transportation	76.12	0	$20,979,517	$1,125,006
Open Space	10.00	0	$2,740,000	$2,617,537
Vacant	81.22	0	$30,146,625	$0
TOTAL	1,001.65	6,226,712	$371,195,404	$948,464,186
	Future LRT - Total			
Land Use	Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	190.42	2,103	$41,538,939	$160,965,132
Multi- family	62.35	1,426	$18,022,728	$92,235,709
Retail	151.58	482,563	$78,077,977	$51,338,752
Office	13.54	1,743,778	$7,321,703	$129,987,063
Industrial	229.90	5,174,548	$68,618,976	$193,095,336
Hotel	6.39	187,999	$3,972,415	$13,939,909
Public	246.86		$152,964,386	$653,674,064
Transportation	90.60		$25,265,167	$664,149
Open Space	10.00		$2,740,000	$2,617,537
Vacant	0.00		$0	$0
TOTAL	1,001.65	7,588,889	$398,522,291	$1,298,517,650
	Future No-Build - Total			
Land Use	Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	191.42	2,084	$39,608,992	$152,117,106
Multi- family	58.28	1,167	$15,233,698	$61,969,553
Retail	152.21	404,864	$65,710,165	$40,222,176
Office	12.51	1,527,636	$6,431,678	$105,847,899
Industrial	229.90	5,174,548	$66,629,114	$192,186,667
Hotel	6.78	177,215	$3,499,933	$12,647,851
Public	246.52		$152,752,720	$653,674,064
Transportation	94.02		$27,623,167	$664,149
Open Space	10.00		$2,740,000	$2,617,537
Vacant	0.00		$0	$0
TOTAL	1,001.65	7,284,264	$380,229,467	$1,221,947,001

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

In Part 2, there are a total of 2,392.51 acres, including 102.37 acres of vacant land under the existing scenario (**Table 6-4**). The largest share of existing assessed value is in single family. Under the LRT scenario there is a 53 percent increase in assessed value for single family, primarily due to the addition of 1,520 units (although there were only 1,333 net new units). The other significant increase is in industrial value, which accounts for 25 percent of the total increase in assessed value, due to both redevelopment and new development.

Under the No-Build scenario 60 percent of the total increase in assessed value is in single family with the addition of 1,337 new units (1,149 net new units). About 34 percent increase of the total increase is in industrial assessed value, which is slightly more than under the LRT scenario. Overall, total future assessed value under the LRT scenario is 7 percent greater than under the No-Build scenario.

Table 6-4 Assessed Value Primary Corridor – Part 2

Land Use	Existing Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	914.19	7,279	$137,290,040	$529,879,229
Multi- family	203.94	2,199	$33,474,448	$91,553,074
Retail	279.38	974,896	$79,569,602	$72,910,876
Office	7.40	115,987	$2,181,572	$5,697,388
Industrial	442.87	6,934,236	$79,817,456	$261,187,754
Hotel	5.63	147,145	$1,634,500	$3,404,428
Public	208.18	na	$40,571,700	$130,888,123
Transportation	29.76	0	$6,446,000	$967,728
Open Space	198.81	0	$30,927,500	$9,484,330
Vacant	102.37	0	$19,105,600	$276,238
TOTAL	2,392.51	8,172,264	$431,018,418	$1,106,249,168

Land Use	Future LRT - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	1,046.84	8,612	$170,165,219	$732,034,913
Multi- family	125.04	1,834	$27,232,333	$143,632,997
Retail	254.72	1,151,850	$82,138,477	$101,571,614
Office	13.66	268,811	$4,013,204	$26,001,472
Industrial	504.38	7,729,963	$93,638,904	$357,690,279
Hotel	5.63	147,145	$1,797,950	$3,574,649
Public	213.68		$41,642,743	$130,888,123
Transportation	29.76		$6,446,000	$967,728
Open Space	198.81		$30,927,500	$9,484,330
Vacant	0.00		$0	$0
TOTAL	2,392.51	9,297,769	$458,002,330	$1,505,846,105

Land Use	Future No-Build - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	1,057.84	8,429	$164,088,122	$691,329,122
Multi- family	116.84	1,262	$23,925,012	$93,678,550
Retail	253.85	1,064,084	$72,975,534	$91,272,400
Office	12.20	196,290	$3,461,716	$18,026,704
Industrial	504.38	7,729,963	$91,201,006	$357,583,830
Hotel	5.63	147,145	$1,634,500	$3,404,428
Public	213.19		$41,548,268	$130,888,123
Transportation	29.76		$6,446,000	$967,728
Open Space	198.81		$30,927,500	$9,484,330
Vacant	0.00		$0	$0
TOTAL	2,392.51	9,137,482	$436,207,659	$1,396,635,214

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

In Part 3, there are a total of 2,660.70 acres, including 401.57 acres of vacant land in the existing scenario (**Table 6-5**). The largest share of existing assessed value is in

single family (59 percent) and there is also a significant share (22 percent) in multi-family. Under the LRT scenario the majority of the increase in assessed value is in industrial, office and multi-family, each of which account for 22 to 27 percent of the total increase. Retail development accounts for about 13 percent of the total increase.

In the No-Build scenario, about 68 percent of the total increase in assessed value over the existing scenario is from industrial development. The No-Build scenario includes construction of 5.0 million square feet of industrial space with a net addition of 3.6 million square feet. There is 70 percent more net industrial square footage added under the No-Build scenario than under the LRT scenario. Although the increase in multi-family value accounts for 14 percent of total assessed value growth under the No-Build scenario, there only a 24 percent increase in multi-family value, compared to 75 percent under the LRT scenario. Retail development accounts for 9 percent of the total increase under the No-Build scenario. Overall, total future assessed value under the LRT scenario is 13 percent greater than under the No-Build scenario.

Table 6-5 Assessed Value Primary Corridor – Part 3

Land Use	Existing Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	942.76	6,590	$159,154,500	$636,440,284
Multi- family	244.53	3,921	$53,011,120	$219,241,601
Retail	159.88	758,649	$52,749,679	$72,240,622
Office	2.86	9,743	$1,009,000	$1,521,487
Industrial	612.00	8,357,563	$90,168,970	$275,467,665
Hotel	31.63	826,693	$8,945,426	$48,618,742
Public	186.67	na	$33,586,100	$99,795,977
Transportation	7.40	0	$1,703,500	$950,675
Open Space	70.79	0	$7,531,500	$3,590,048
Vacant	401.57	0	$36,972,406	$31,758
TOTAL	2,660.07	9,952,648	$444,832,201	$1,357,898,859

Land Use	Future LRT - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	969.39	6,857	$172,139,181	$686,978,476
Multi- family	315.67	6,055	$71,521,983	$404,397,328
Retail	232.86	1,623,067	$85,211,623	$141,681,841
Office	57.27	1,432,034	$20,288,111	$151,753,821
Industrial	776.35	10,448,943	$116,564,404	$461,699,745
Hotel	31.63	826,693	$11,093,767	$53,321,161
Public	198.71		$35,753,156	$99,795,977
Transportation	7.40		$1,703,500	$950,675
Open Space	70.79		$7,531,500	$3,590,048
Vacant	0.00		$0	$0
TOTAL	2,660.07	14,330,737	$521,807,225	$2,004,169,072

Land Use	Future No-Build - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	978.54	6,841	$165,240,231	$669,246,491
Multi- family	286.20	4,587	$62,045,455	$274,835,448
Retail	200.54	1,135,996	$66,011,906	$101,428,953
Office	5.28	41,433	$1,867,011	$4,895,644
Industrial	891.05	12,002,349	$130,819,739	$547,742,950
Hotel	31.63	826,693	$8,945,426	$48,618,742
Public	187.64		$33,760,627	$99,795,977
Transportation	8.40		$1,934,862	$950,675
Open Space	70.79		$7,531,500	$3,590,048
Vacant	0.00		$0	$0
TOTAL	2,660.07	14,006,471	$478,156,757	$1,751,104,929

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

In Part 4, there are a total of 3,062.76 acres, including 981.59 acres of vacant land under the existing scenario (**Table 6-6**). The large amount of vacant land creates significant potential for new development in area 4. The largest share of existing assessed value is in single family (38 percent) and there is also a significant share (16 percent) in multi-family. The remaining existing assessed value is primarily in retail and industrial uses.

Under the LRT scenario the majority of the increase in assessed value over the existing scenario is in retail, office and multi-family, each of which account for 20 to 30 percent of the total increase. Single family development accounts for about 14 percent of the total increase.

In the No-Build scenario, about 31 percent of the total increase in assessed value over the existing scenario is in single family, and an additional 30 percent of the increase is in retail. The increase in multi-family value accounts for 15 percent of total assessed value growth under the No-Build scenario and industrial development accounts for 21 percent of the total increase. Overall, total future assessed value under the LRT scenario is 18 percent greater than under the No-Build scenario.

Table 6-6 Assessed Value Primary Corridor – Part 4

Land Use	Existing Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	774.07	5,892	$129,416,894	$517,764,144
Multi- family	227.51	2,059	$61,249,748	$207,960,670
Retail	346.96	2,580,179	$103,306,909	$176,560,221
Office	5.64	98,330	$1,916,000	$5,010,407
Industrial	291.78	6,555,247	$47,036,619	$189,817,018
Hotel	15.91	415,934	$4,655,000	$24,889,782
Public	308.74	na	$42,732,800	$92,013,517
Transportation	13.70	0	$384,000	$216,443
Open Space	96.87	0	$1,340,750	$250
Vacant	981.59	0	$111,223,087	$438,005
TOTAL	3,062.76	9,649,690	$503,261,807	$1,214,670,457

Land Use	Future LRT - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	918.23	7,337	$160,944,653	$715,834,177
Multi- family	433.99	6,779	$127,611,279	$647,993,765
Retail	705.93	6,576,852	$225,737,436	$492,602,657
Office	127.20	2,749,153	$43,029,548	$285,890,339
Industrial	375.09	7,308,506	$62,624,965	$267,421,511
Hotel	30.44	795,552	$9,768,726	$60,518,698
Public	368.30		$50,977,813	$92,013,517
Transportation	6.70		$384,000	$216,443
Open Space	96.87		$1,340,750	$250
Vacant	0.00		$0	$0
TOTAL	3,062.76	17,430,062	$682,419,169	$2,562,491,357

Land Use	Future No-Build - Total Acres	Sq Ft/ Units	Land Value	Improvement Value
Single Family	1,071.66	8,273	$179,194,545	$816,689,395
Multi- family	305.13	3,413	$88,683,145	$356,969,413
Retail	700.54	5,676,316	$207,708,649	$413,882,469
Office	27.89	385,891	$9,198,024	$36,190,457
Industrial	519.78	9,522,606	$83,910,577	$393,841,610
Hotel	17.53	458,055	$5,126,394	$28,625,837
Public	316.65		$43,828,465	$92,013,517
Transportation	6.70		$384,000	$216,443
Open Space	96.87		$1,340,750	$250
Vacant	0.00		$0	$0
TOTAL	3,062.76	16,042,868	$619,374,550	$2,138,429,391

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

In Part 5, there are a total of 5,849.02 acres, including 394.62 acres of vacant land in the existing scenario (**Table 6-7**). The largest share of existing assessed value is in single family (69 percent) with an additional 8 percent of total value in multi-family. The remaining existing assessed value is primarily in public and retail uses.

Under the LRT scenario the majority of the increase in assessed value over the existing scenario is in office development, which accounts for 46 percent of the total increase with 2.2 million net new square feet of office space. Single family development accounts for about 28 percent of the total increase and retail accounts for 15 percent.

In the No-Build scenario, about 55 percent of the total increase in assessed value over the existing scenario is in office, and an additional 17 to 19 percent each is in retail and single family. Overall, total future assessed value under the LRT scenario is 2 percent greater than under the No-Build scenario since this area is not within the primary corridor.

Table 6-7 Assessed Value Secondary Corridor – North

Land Use	Existing Acres	Existing Sq Ft/ Units	Existing Land Value	Existing Improvement Value
Single Family	3,709.73	22,833	$620,681,140	$2,483,463,175
Multi- family	307.42	5,114	$73,332,676	$307,693,634
Retail	360.67	2,721,186	$131,941,041	$185,888,641
Office	63.15	782,007	$19,030,971	$59,349,067
Industrial	11.14	322,521	$2,850,000	$3,653,813
Hotel	0.00	0	$0	$0
Public	823.82	na	$127,429,362	$425,479,731
Transportation	3.93	0	$2,021,500	$333,555
Open Space	174.54	0	$7,679,250	$3,346,746
Vacant	394.62	0	$33,876,042	$193,837
TOTAL	5,849.02	3,825,714	$1,018,841,982	$3,469,402,199

Land Use	Future LRT - Total Acres	Future LRT - Total Sq Ft/ Units	Future LRT - Total Land Value	Future LRT - Total Improvement Value
Single Family	3,781.64	23,555	$664,445,205	$2,625,694,641
Multi- family	289.59	5,091	$76,271,867	$362,984,810
Retail	428.76	3,314,338	$163,444,816	$258,729,920
Office	314.87	2,947,684	$94,663,684	$295,507,768
Industrial	21.56	458,700	$5,516,049	$11,505,196
Hotel	0.00	0	$0	$0
Public	829.40		$128,292,008	$425,479,731
Transportation	8.67		$4,464,111	$333,555
Open Space	174.54		$7,679,250	$3,346,746
Vacant	0.00		$0	$0
TOTAL	5,849.02	6,720,722	$1,144,776,991	$3,983,582,367

Land Use	Future No-Build - Total Acres	Future No-Build - Total Sq Ft/ Units	Future No-Build - Total Land Value	Future No-Build - Total Improvement Value
Single Family	3,781.64	23,555	$633,411,148	$2,576,025,378
Multi- family	289.59	4,968	$72,605,233	$346,580,818
Retail	428.76	3,314,338	$156,847,764	$255,012,147
Office	314.87	2,947,684	$94,663,684	$295,507,768
Industrial	21.56	458,700	$5,516,049	$11,505,196
Hotel	0.00	0	$0	$0
Public	829.40		$128,292,008	$425,479,731
Transportation	8.67		$4,464,111	$333,555
Open Space	174.54		$7,679,250	$3,346,746
Vacant	0.00		$0	$0
TOTAL	5,849.02	6,720,722	$1,103,479,248	$3,913,791,339

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

In Part 6, there are a total of 4,416.33 acres, including 815.14 acres of vacant land in the existing scenario (**Table 6-8**). This area is outside the primary corridor and is not impacted by the LRT scenario. The largest share of existing assessed value is in industrial (73 percent) with an additional 9 percent of total value in single-family and 8 percent in retail. The remaining existing assessed value is primarily in public and vacant uses.

In this part of the Secondary Corridor, there is no difference between the No-Build scenario and the LRT scenario in terms of future assessed value. The bulk of the increase in assessed value compared to the existing scenario is in industrial uses with over 17.2 million new square feet constructed and a net addition of 11.1 square feet by build out.

Table 6-8 Assessed Value Secondary Corridor - South

Land Use	Existing Acres	Existing Sq Ft/ Units	Existing Land Value	Existing Improvement Value
Single Family	324.98	1,805	$37,567,957	$129,780,381
Multi- family	52.44	573	$8,588,200	$15,497,332
Retail	553.32	175,162	$109,380,988	$51,927,814
Office	4.96	43,599	$1,139,500	$2,590,704
Industrial	2,439.21	27,084,171	$371,392,432	$1,062,349,163
Hotel	0.00	0	$0	$0
Public	139.04	na	$23,463,800	$41,714,337
Transportation	76.59	0	$13,979,000	$464,712
Open Space	10.66	0	$1,005,000	$120,091
Vacant	815.14	0	$86,514,103	$65,129
TOTAL	4,416.33	27,302,932	$653,030,980	$1,304,509,663

Land Use	Future LRT - Total Acres	Future LRT - Total Sq Ft/ Units	Future LRT - Total Land Value	Future LRT - Total Improvement Value
Single Family	402.58	2,427	46,455,019	225,306,930
Multi- family	21.26	232	3,491,200	13,148,809
Retail	457.21	245,289	92,123,328	35,786,888
Office	3.19	28,006	713,000	2,583,775
Industrial	3,290.34	38,224,207	500,797,880	2,011,209,036
Hotel	0.00	0	0	0
Public	154.73		26,112,418	41,714,337
Transportation	76.59		13,979,000	464,712
Open Space	10.43		976,500	88,138
Vacant	0.00		0	0
TOTAL	4,416.33	38,497,502	$684,648,345	$2,330,302,625

Land Use	Future No-Build - Total Acres	Future No-Build - Total Sq Ft/ Units	Future No-Build - Total Land Value	Future No-Build - Total Improvement Value
Single Family	402.58	2,427	46,455,019	225,306,930
Multi- family	21.26	232	3,491,200	13,148,809
Retail	457.21	245,289	92,123,328	35,786,888
Office	3.19	28,006	713,000	2,583,775
Industrial	3,290.34	38,224,207	500,797,880	2,011,209,036
Hotel	0.00	0	0	0
Public	154.73		26,112,418	41,714,337
Transportation	76.59		13,979,000	464,712
Open Space	10.43		976,500	88,138
Vacant	0.00		0	0
TOTAL	4,416.33	38,497,502	$684,648,345	$2,330,302,625

Source: Applied Economics, 2010; Maricopa County Assessor, 2009.

6.2 PROPERTY TAXES

The calculation of property taxes includes applying the appropriate assessment ratio and tax rate to assessed value by land use in each part of the study area. However, since the property tax revenues are shown by jurisdiction, it is important to share out the revenues based on the share of assessed value by tax rate area.

6.2.1 Tax Rate Areas

Tax rate areas are determined by the combination of city and school district. There are twelve tax rate areas within the Phoenix West Extension study areas (**Table 6-9**). One is in the unincorporated county, nine are in Phoenix and two are in Tolleson. All tax rate areas include a portion of the tax to countywide special districts such as flood control and libraries. Additionally, there are two high school districts and nine elementary districts included in the study area. There is also the Western Maricopa Education Center (WESTMEC) overlay that applies in five of the tax rate areas.

Table 6-9 Tax Rate Areas

					Tax Rate by Jurisdition				
TRA	City	High School District	Elementary District	Total Tax Rate	City	High School	Elem	County - wide	WESTMEC
4500	Unincorporated	Tolleson Union	Fowler	7.6607	0.0000	2.0963	2.9394	2.575	0.05
6813	Phoenix	Phoenix Union	Alhambra	12.5344	1.8200	2.9451	5.1943	2.575	0
8313	Phoenix	Phoenix Union	Cartwright	12.14	1.8200	2.9451	4.7499	2.575	0.05
513	Phoenix	Phoenix Union	ISAAC	14.7147	1.8200	2.9451	7.3746	2.575	0
2113	Phoenix	Phoenix Union	Murphy	10.7957	1.8200	2.9451	3.4556	2.575	0
113	Phoenix	Phoenix Union	Phoenix	10.8343	1.8200	2.9451	3.4942	2.575	0
213	Phoenix	Phoenix Union	Riverside	8.8468	1.8200	2.9451	1.5067	2.575	0
4513	Phoenix	Tolleson Union	Fowler	9.4807	1.8200	2.0963	2.9394	2.575	0.05
9213	Phoenix	Tolleson Union	Pendergast	11.7437	1.8200	2.0963	5.2024	2.575	0.05
1713	Phoenix	Tolleson Union	Tolleson	10.4008	1.8200	2.0963	3.9095	2.575	0
4517	Tolleson	Tolleson Union	Fowler	10.1681	2.5074	2.0963	2.9394	2.575	0.05
1717	Tolleson	Tolleson Union	Tolleson	11.0882	2.5074	2.0963	3.9095	2.575	0

Source: Maricopa County Assessor, 2009 rates.
Countywide taxes include special levies for flood control, libraries and other.

6.2.2 Property Tax Calculations

In order to estimate property taxes under the Existing, No-Build and LRT scenarios, an assessment ratio was applied to assessed value depending on the type of land use. Single and multi-family residential property is assessed at 10 percent, commercial property is assessed at 20 percent and vacant land is assessed at 16 percent to arrive at net assessed value. Land in public, transportation and open space uses was assumed to be exempted from property taxes.

The appropriate tax rates were then applied to net assessed value, depending on the share of value by use that fell into each tax rate area. Each of the study areas parts includes a different combination of tax rate areas.

Table 6-10 summarizes the total property tax impact by study area part. Detailed results are shown in **Tables 6-11** through **6-15**. The greatest impact from the light rail in terms of property tax increases would be in Parts 1, 3 and 4 where the difference between the LRT Scenario and the No-Build scenario ranges from 12 to 20 percent. This means that there would be a projected 12 to 20 percent increase on top of normal projected growth, based on the extension of light rail to this area. Part 2 would experience a lesser increase due to the limited amount of vacant land, and more importantly, the limited potential for redevelopment. For the primary corridor as a whole, there would be a projected 14 percent difference in future property tax revenues as a result of the Phoenix West Extension. Impacts in the secondary area are more limited since none of the parcels are within station areas and so the increase in assessed value for existing development are limited to 2 percent or less.

Table 6-10 Property Tax Impact Summary

	Total Property Tax Revenues			
Study Area	**Existing**	**No-Build Future**	**LRT Future**	**Percent Difference LRT vs Baseline**
1	$8,112,253	$13,597,282	$15,224,140	12%
2	$25,935,298	$31,816,370	$34,171,099	7%
3	$28,860,950	$38,929,429	$44,477,424	14%
4	$24,762,339	$41,506,654	$49,663,164	20%
5	$51,444,447	$63,097,130	$64,552,814	2%
6	$33,867,997	$53,513,581	$53,513,581	0%
Primary Corridor Total	$87,670,840	$125,849,735	$143,535,827	14%
Secondary Area Total	$85,312,444	$116,610,711	$118,066,396	1%

Source: Applied Economics, 2010.

Table 6-11 Property Tax Impact Primary Corridor– Part 1

					School Districts			
	Phoenix	**Tolleson**	**County***	**WESTMEC**	**Murphy**	**Phoenix Elem**	**Phoenix Union**	**Total**
Existing	$1,383,855	$0	$1,957,927	$0	$18,071	$2,513,063	$2,239,336	$8,112,253
Residential	$378,306	$0	$535,241	$0	$6,198	$720,040	$612,171	$2,251,956
Nonres	$917,762	$0	$1,298,482	$0	$0	$1,636,488	$1,485,110	$5,337,842
Vacant	$87,787	$0	$124,204	$0	$11,873	$156,535	$142,056	$522,455
No-Build Future	$2,284,610	$0	$3,232,347	$0	$250,815	$4,132,584	$3,696,926	$13,597,282
Residential	$489,451	$0	$692,493	$0	$8,018	$931,585	$792,024	$2,913,572
Nonres	$1,795,159	$0	$2,539,854	$0	$242,796	$3,200,999	$2,904,902	$10,683,710
Vacant	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$2,557,950	$0	$3,619,077	$0	$278,301	$4,629,572	$4,139,240	$15,224,140
Residential	$569,228	$0	$805,363	$0	$9,325	$1,083,425	$921,117	$3,388,459
Nonres	$1,988,722	$0	$2,813,713	$0	$268,976	$3,546,147	$3,218,123	$11,835,681
Vacant	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	12%	0%	12%	0%	11%	12%	12%	12%

Source: Applied Economics, 2010.

*County taxes include countywide special levies for flood control, libraries and other.

Table 6-12 Property Tax Impact Primary Corridor – Part 2

					School Districts					
	Phoenix	Tolleson	County*	WESTMEC	Alhambra	Isaac	Murphy	Phoenix Elem	Phoenix Union	Total
Existing	$3,341,547	$0	$4,727,738	$0	$604,149	$9,648,094	$203,403	$2,003,118	$5,407,247	$25,935,298
Residential	$1,441,798	$0	$2,039,907	$0	$0	$5,458,389	$87,763	$864,298	$2,333,099	$12,225,255
Nonres	$1,843,309	$0	$2,607,978	$0	$586,200	$4,065,232	$112,204	$1,104,987	$2,982,818	$13,302,729
Vacant	$56,440	$0	$79,853	$0	$17,949	$124,473	$3,436	$33,833	$91,330	$407,314
No-Build Future	$4,098,897	$0	$5,799,263	$0	$740,339	$11,838,469	$249,503	$2,457,118	$6,632,781	$31,816,370
Residential	$1,770,898	$0	$2,505,529	$0	$0	$6,704,302	$107,796	$1,061,580	$2,865,644	$15,015,748
Nonres	$2,327,999	$0	$3,293,735	$0	$740,339	$5,134,167	$141,707	$1,395,538	$3,767,137	$16,800,622
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$4,393,332	$0	$6,215,840	$0	$776,069	$12,775,581	$267,426	$2,633,620	$7,109,232	$34,171,099
Residential	$1,952,979	$0	$2,763,144	$0	$0	$7,393,629	$118,879	$1,170,730	$3,160,285	$16,559,646
Nonres	$2,440,353	$0	$3,452,697	$0	$776,069	$5,381,952	$148,546	$1,462,890	$3,948,946	$17,611,453
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	7%	0%	7%	0%	5%	8%	7%	7%	7%	7%

Source: Applied Economics, 2010.

*County taxes include countywide special levies for flood control, libraries and other.

Table 6-13 Property Tax Impact Primary Corridor – Part 3

					School Districts					
	Phoenix	Tolleson	County*	WESTMEC	Cartwright	Isaac	Fowler	Tolleson Union	Phoenix Union	Total
Existing	$4,055,865	$0	$5,738,381	$55,879	$5,308,413	$6,722,538	$585,920	$417,862	$5,976,092	$28,860,950
Residential	$1,943,482	$0	$2,749,707	$33,385	$3,171,498	$2,188,655	$303,836	$216,688	$2,840,492	$13,447,744
Nonres	$2,004,627	$0	$2,836,216	$21,347	$2,027,907	$4,302,602	$267,694	$190,912	$2,975,647	$14,626,952
Vacant	$107,756	$0	$152,457	$1,147	$109,008	$231,281	$14,390	$10,262	$159,952	$786,253
No-Build Future	$5,445,492	$0	$7,704,473	$71,907	$6,831,037	$9,512,934	$775,783	$553,267	$8,034,535	$38,929,429
Residential	$2,131,889	$0	$3,016,272	$36,621	$3,478,952	$2,400,829	$333,291	$237,694	$3,115,858	$14,751,406
Nonres	$3,313,603	$0	$4,688,201	$35,286	$3,352,085	$7,112,105	$442,492	$315,574	$4,918,677	$24,178,023
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$6,221,244	$0	$8,802,035	$82,113	$7,800,557	$10,874,068	$886,167	$631,990	$9,179,250	$44,477,424
Residential	$2,429,767	$0	$3,437,720	$41,738	$3,965,049	$2,736,285	$379,860	$270,906	$3,551,221	$16,812,546
Nonres	$3,791,477	$0	$5,364,315	$40,375	$3,835,509	$8,137,783	$506,307	$361,084	$5,628,029	$27,664,878
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	14%	0%	14%	14%	14%	14%	14%	14%	14%	14%

Source: Applied Economics, 2010.

*County taxes include countywide special levies for flood control, libraries and other.

Table 6-14 Property Tax Impact Primary Corridor – Part 4

					School Districts						
	Phoenix	Tolleson	County*	WESTMEC	Cartwright	Fowler	Pender-gast	Tolleson	Tolleson Union	Phoenix Union	Total
Existing	$4,413,056	$370,662	$5,668,690	$97,749	$4,743,073	$2,510,112	$533,010	$963,543	$2,521,577	$2,940,867	$24,762,339
Residential	$1,650,539	$23,825	$2,359,708	$42,027	$2,401,346	$820,458	$290,573	$296,560	$861,232	$1,488,917	$10,235,184
Nonres	$2,472,361	$298,617	$2,848,939	$47,975	$2,016,159	$1,454,743	$208,732	$574,253	$1,429,510	$1,250,087	$12,601,376
Vacant	$290,156	$48,220	$460,044	$7,747	$325,567	$234,910	$33,706	$92,730	$230,836	$201,863	$1,925,779
No-Build Future	$6,424,321	$673,632	$9,781,149	$168,313	$8,072,550	$4,389,718	$901,756	$1,689,857	$4,400,101	$5,005,256	$41,506,654
Residential	$2,596,393	$37,478	$3,711,956	$66,111	$3,777,456	$1,290,628	$457,088	$466,505	$1,354,767	$2,342,152	$16,100,534
Nonres	$3,827,928	$636,154	$6,069,193	$102,203	$4,295,094	$3,099,090	$444,668	$1,223,352	$3,045,334	$2,663,105	$25,406,120
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$7,678,202	$824,381	$11,709,997	$201,321	$9,605,858	$5,286,178	$1,070,154	$2,037,446	$5,293,667	$5,955,960	$49,663,164
Residential	$2,976,157	$42,959	$4,254,888	$75,780	$4,329,968	$1,479,403	$523,944	$534,739	$1,552,923	$2,684,728	$18,455,490
Nonres	$4,702,045	$781,422	$7,455,108	$125,541	$5,275,889	$3,806,775	$546,209	$1,502,707	$3,740,744	$3,271,231	$31,207,673
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	20%	22%	20%	20%	19%	20%	19%	21%	20%	19%	20%

Source: Applied Economics, 2010.

*County taxes include countywide special levies for flood control, libraries and other.

Table 6-15 Property Tax Impact Secondary Corridor - North

					School Districts						
	Phoenix	Tolleson	County*	WESTMEC	Alhambra	Cartwright	Pender- gast	Tolleson	Tolleson Union	Phoenix Union	Total
Existing	$7,809,452	$0	$11,049,088	$191,978	$919,418	$15,362,644	$3,148,806	$1,072,506	$1,843,892	$10,046,662	$51,444,447
Residential	$6,343,011		$8,974,314	$156,140	$793,616	$12,742,350	$2,289,824	$819,355	$1,362,025	$8,350,661	$41,831,297
Nonres	$1,465,877		$2,073,975	$35,824	$125,754	$2,619,285	$858,652	$253,053	$481,681	$1,695,347	$9,609,450
Vacant	$564		$799	$14	$48	$1,009	$331	$97	$185	$653	$3,700
No-Build Future	$9,585,445	$0	$13,561,824	$235,428	$1,082,045	$18,594,026	$4,130,430	$1,367,749	$2,397,747	$12,142,436	$63,097,130
Residential	$6,604,093		$9,343,703	$162,567	$826,281	$13,266,834	$2,384,075	$853,081	$1,418,087	$8,694,380	$43,553,101
Nonres	$2,981,351		$4,218,121	$72,861	$255,764	$5,327,192	$1,746,355	$514,668	$979,660	$3,448,056	$19,544,028
Vacant	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$9,806,399	$0	$13,874,438	$240,860	$1,108,213	$19,029,561	$4,218,633	$1,397,922	$2,449,468	$12,427,319	$64,552,814
Residential	$6,787,502		$9,603,196	$167,082	$849,229	$13,635,280	$2,450,285	$876,772	$1,457,470	$8,935,840	$44,762,656
Nonres	$3,018,897		$4,271,242	$73,779	$258,985	$5,394,281	$1,768,348	$521,150	$991,997	$3,491,479	$19,790,158
Vacant	$0		$0	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	2%	0%	2%	2%	2%	2%	2%	2%	2%	2%	2%

Table 6-16 Property Tax Impact Secondary Corridor – South

					School Districts						
	Phoenix	Tolleson	County*	WESTMEC	Fowler	Murphy	Riverside	Tolleson	Tolleson Union	Phoenix Union	Total
Existing	$5,087,600	$1,368,367	$9,083,369	$70,222	$4,128,191	$2,403,548	$1,783,397	$953,497	$3,455,385	$5,534,420	$33,867,997
Residential	$340,972	$7,386	$492,942	$2,140	$125,795	$444,461	$25,721	$11,516	$95,889	$429,078	$1,975,900
Nonres	$4,549,531	$1,304,468	$8,233,720	$65,255	$3,836,202	$1,877,738	$1,684,690	$902,867	$3,219,998	$4,893,350	$30,567,819
Vacant	$197,098	$56,513	$356,706	$2,827	$166,194	$81,349	$72,985	$39,115	$139,499	$211,993	$1,324,278
No-Build Future	$8,035,283	$2,167,763	$14,355,187	$111,107	$6,531,787	$3,774,003	$2,823,996	$1,510,031	$5,467,981	$8,736,443	$53,513,581
Residential	$513,686	$11,127	$742,635	$3,224	$189,515	$669,597	$38,750	$17,349	$144,460	$646,421	$2,976,763
Nonres	$7,521,597	$2,156,636	$13,612,552	$107,884	$6,342,272	$3,104,406	$2,785,246	$1,492,682	$5,323,522	$8,090,022	$50,536,818
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRT Future	$8,035,283	$2,167,763	$14,355,187	$111,107	$6,531,787	$3,774,003	$2,823,996	$1,510,031	$5,467,981	$8,736,443	$53,513,581
Residential	$513,686	$11,127	$742,635	$3,224	$189,515	$669,597	$38,750	$17,349	$144,460	$646,421	$2,976,763
Nonres	$7,521,597	$2,156,636	$13,612,552	$107,884	$6,342,272	$3,104,406	$2,785,246	$1,492,682	$5,323,522	$8,090,022	$50,536,818
Vacant	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
% Difference LRT vs No-Build Future	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Source: Applied Economics, 2010.
*County taxes include countywide special levies for flood control, libraries and other.

6.3 TAXABLE SALES

The next component of the revenue impacts is sales taxes. The first step in the sales tax projections involves estimating taxable sales. Four categories of taxable sales were included: retail, leases, utilities and lodging revenues. Lease and utility revenues apply to all types of land uses including residential.

For the existing scenario, estimates of retail sales by study area part were based on a model created by Applied Economics for a citywide retail study for the City of Phoenix. Future retail sales under the No-Build and LRT scenarios were estimated based on the amount of existing retail square footage that was not redeveloped times the existing rate of sales per square foot, plus the amount of new retail square footage times the average rate of sales per square foot for new community centers from "Dollars and Cents of Shopping Centers," published by the International Council of Shopping Centers. Projected occupancy rates under the No-Build and LRT scenarios were also incorporated into the retail sales projections.

The next category of taxable sales includes leases. Commercial and long term residential leases are subject to local sales taxes, although they are exempt from state sales taxes. The lease rates used in the analysis are shown in Table 6-17. They do not vary by scenario, although the amount of leased square footage and the occupancy rate do vary. It was also necessary to make assumptions about the share of total space in each category that would be leased versus owner occupied as shown in **Table 6-17**.

Table 6-17 Lease Rate Assumptions

Lease Rates	Avg Lease Rate Area 1	Avg Lease Rate Other Areas	Percent Leased
Office	$21.71	$23.05	90%
Industrial	$7.68	$4.44	70%
Retail	$17.32	$17.32	90%
Hotel (ADR)	$126.43	$126.43	0%
Multi-Family (2 bdrm average)	$723.00	$598.00	100%

Source: CBRE, "Marketview", 4th Quarter 2009; Arizona Office of Tourism and Smith Travel Research, "Lodging Performance Indicators by County", 2009 YTD, December 2009; "For Rent Magazine", January 2010.

The next type of taxable sales is utility costs, in particular electric costs. Based on information from Arizona Public Service Company on the amount of kwh usage per square foot for different types of businesses and the cost per kwh, it was possible to make estimates as to the amount of annual utility costs per square foot and per housing unit for each of the land use categories. **Table 6-18** below details the assumptions regarding utility usage.

Table 6-18 Utility Cost Assumptions

Land Use	Kwh/Sq Ft Area 1	Kwh/Sq Ft Other Areas	$ per Kwh Area 1	$ per Kwh Other Areas	Cost per Unit All Areas
Office	27	15.2	0.0776	0.0982	
Industrial	19.1	19.1	0.0922	0.0922	
Retail	11.7	19.7	0.1162	0.0699	
Hotel	19.1	19.1	0.0667	0.0667	
Multi Family (800 kw/month)	na	na	na	na	$1,233
Single Family (1000 kw/month)	na	na	na	na	$1,541

Source: Arizona Public Service Company.

The final category of taxable sales included in the impact analysis for the Phoenix West Extension is hotel revenues. Hotel square footage was divided by 500 to estimate the number of rooms. Then, based on current data from the Arizona Office of Tourism, an average daily room rate was applied to the number of rooms, and multiplied by a long term average occupancy rate of 59.4 percent and by 365 days per year to estimate hotel sales based on hotel square footage in each study area part and each scenario.

Total taxable sales and square footage by study area part are summarized in **Table 6-19**. Taxable sales overall are greatest in Area 4, which has the most retail space and the most total nonresidential square footage in the future scenarios. However, Area 3 shows the greatest difference between the LRT scenario and the No-Build scenario, with a 36 percent increase in sales due to light rail. This difference is in part due to the difference in retail square footage between the two future scenarios, but it is also due to the projected difference in occupancy rates as a result of light rail. In the primary corridor as a whole, taxable sales are projected to be about 19 percent higher in the LRT scenario.

Table 6-19 Summary of Taxable Sales and Retail Square Footage by Study Area

	Taxable Sales (000)				Retail Square Footage			Total Square Footage		
Study Area	Existing	No-Build Future	LRT Future	Pct LRT vs No-Build	Existing	No-Build Future	LRT Future	Existing	No-Build Future	LRT Future
Area 1	$1,361,139	$1,479,378	$1,902,802	29%	363,452	404,864	482,563	6,226,712	7,284,264	7,588,889
Area 2	$3,643,247	$3,247,675	$4,237,320	30%	974,896	1,064,084	1,151,850	8,172,264	9,137,482	9,297,769
Area 3	$2,816,793	$3,676,789	$5,473,452	49%	758,649	1,135,996	1,623,067	9,952,648	14,006,471	14,330,737
Area 4	$6,361,721	$12,839,014	$17,011,990	33%	2,580,179	5,676,316	6,576,852	9,649,690	16,042,894	17,430,062
Area 5	$6,395,318	$7,357,627	$8,285,522	13%	2,721,186	3,314,338	3,314,338	3,825,714	6,720,722	6,720,722
Area 6	$2,982,463	$2,546,742	$2,546,742	0%	175,162	245,289	245,289	27,302,932	38,497,502	38,497,502
Primary	$14,182,900	$21,242,855	$28,625,564	35%	4,677,176	8,281,260	9,834,333	34,001,315	46,471,111	48,647,458
Secondary	$9,377,781	$9,904,369	$10,832,264	9%	2,896,348	3,559,627	3,559,627	31,128,646	45,218,224	45,218,224

Source: Applied Economics, 2010.

6.4 SALES TAX REVENUES

The final calculation in the revenue impacts is the conversion of taxable sales to sales tax revenues. The City of Phoenix has a variety of different tax rates that apply to different types of transactions, as do the county and the state (**Table 6-20**). Additionally, it was necessary to share out revenues to the City of Tolleson in Study Area Parts 4 and 6, where a portion of the area is in Tolleson. Tax rates are also different in Tolleson.

Table 6-20 Sales Tax Rates by Jurisdiction

Transaction Type	Phoenix	Tolleson	County	State
General Retail Sales	2.00%	2.50%	0.70%	5.60%
Bed Tax	5.00%	4.00%	1.77%	5.50%
Utilities	2.70%	2.50%	0.70%	5.60%
Commercial Leasing	2.10%	2.50%	0.50%	0.00%
Residential Long Term Rental	2.00%	2.50%	0.00%	0.00%

Source: City of Phoenix; Model City Tax Code, 2010.

Taxable sales by type (retail, utility, leasing and hotel) are multiplied by the appropriate tax rate in each jurisdiction within each study area part to project the impact on retail sales. Overall, the LRT scenario results in 16 to 19 percent more sales tax revenues in the Primary Corridor than the No-Build scenario (**Table 6-21**).

Area 3 shows the most significant differences between No-Build and LRT scenarios in percentage terms. However, Area 4 shows the largest absolute difference in sales tax revenues based on the increase in retail and other nonresidential square footage, as well as the total amount of development in this area. In the Primary Corridor as a whole, there would be an estimated $53.3 million per year in additional state and local sales tax revenues as a result of the Phoenix West Extension. This differential of about 32 percent is primarily due to increased retail and hotel square footage under the LRT scenario along with increased occupancy rates for all land uses.

Table 6-21 Annual Sales Tax Revenues by Jurisdiction

	Revenues by Jursidiction			
Study Area	**Phoenix**	**Tolleson**	**County**	**State**
Existing				
Area 1	$3,167,683	$0	$909,124	$4,786,644
Area 2	$8,220,144	$0	$2,617,300	$18,393,503
Area 3	$7,405,405	$0	$2,292,331	$13,152,231
Area 4	$12,305,941	$1,775,775	$4,561,079	$32,368,104
Area 5	$13,796,151	$0	$4,384,470	$33,016,923
Area 6	$4,990,768	$1,191,097	$1,939,540	$12,679,872
Primary Corridor Total	$31,099,172	$1,775,775	$10,379,834	$68,700,482
Secondary Corridor Total	$18,786,919	$1,191,097	$6,324,010	$45,696,796
No-Build Future				
Area 1	$3,460,388	$0	$1,005,789	$5,157,665
Area 2	$7,185,994	$0	$2,312,600	$16,372,330
Area 3	$9,181,203	$0	$2,847,783	$17,069,561
Area 4	$24,083,964	$3,548,635	$8,994,380	$65,745,672
Area 5	$15,780,520	$0	$4,980,278	$36,186,566
Area 6	$4,424,619	$1,026,314	$1,597,459	$8,837,098
Primary Corridor Total	$43,911,549	$3,548,635	$15,160,551	$104,345,228
Secondary Corridor Total	$20,205,139	$1,026,314	$6,577,737	$45,023,664
LRT Future				
Area 1	$4,353,117	$0	$1,263,669	$6,722,067
Area 2	$9,207,730	$0	$2,974,582	$21,434,091
Area 3	$12,846,119	$0	$3,958,657	$24,659,973
Area 4	$32,140,376	$4,659,399	$11,817,974	$84,250,659
Area 5	$17,708,817	$0	$5,587,248	$40,588,224
Area 6	$4,424,619	$1,026,314	$1,597,459	$8,837,098
Primary Corridor Total	$58,547,341	$4,659,399	$20,014,883	$137,066,789
Secondary Corridor Total	$22,133,437	$1,026,314	$7,184,707	$49,425,322
Percent Difference No-Build vs LRT				
Area 1	26%	0%	26%	30%
Area 2	28%	0%	29%	31%
Area 3	40%	0%	39%	44%
Area 4	33%	31%	31%	28%
Area 5	12%	0%	12%	12%
Area 6	0%	0%	0%	0%
Primary Corridor Total	33%	31%	32%	31%
Secondary Corridor Total	10%	0%	9%	10%

Source: Applied Economics, 2010.

6.5 OVERALL CONCLUSIONS

The Phoenix West Extension of the light rail system would create a significant economic development impact on the study area. It would create the impetus for redevelopment of a significant number of properties within station areas due to increases in land values, as well as supporting more intense development of vacant parcels. It would also result in increased overall employment within the study area, given the expected increase in density resulting from more office and retail development. As a direct result of the land use changes generated by the addition of LRT, Phoenix, Tolleson and Maricopa County would realize sizeable increases in property tax revenues as well as sales tax revenues from this area in the future as compared to the No-Build future. The Phoenix West Extension study area would benefit greatly over the long term from this type of transportation improvement.