

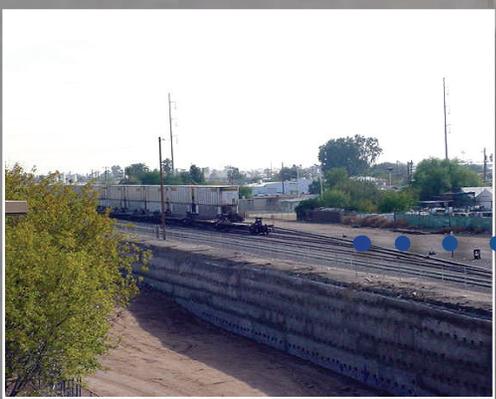
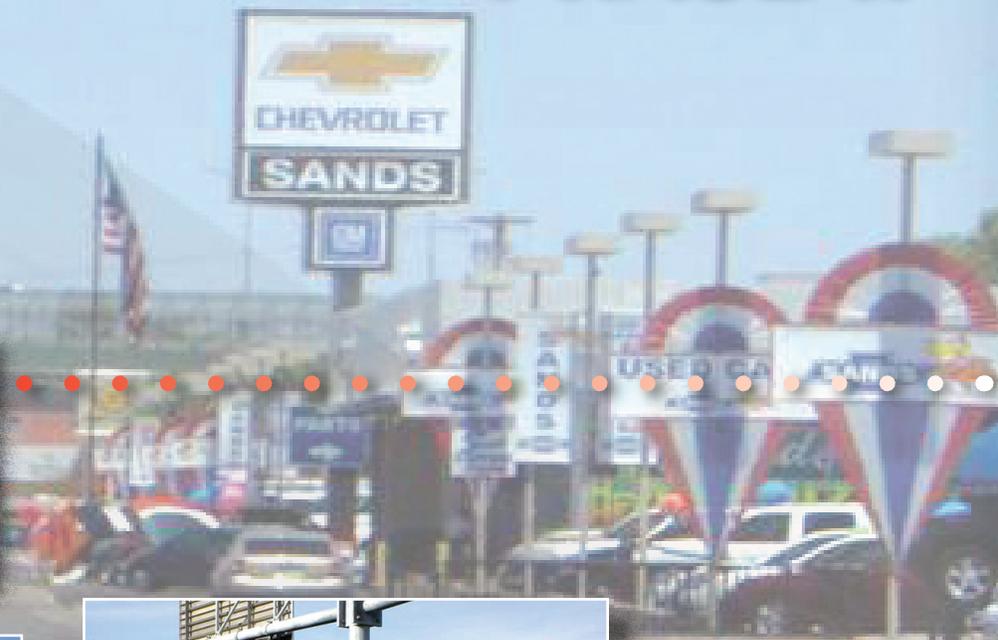
SR 101L to McDowell Road

# GRAND AVENUE

# MAJOR INVESTMENT STUDY

# PHASE II

 MARICOPA  
ASSOCIATION of  
GOVERNMENTS



February 2006

FINAL REPORT



**GRAND AVENUE  
MAJOR INVESTMENT STUDY PHASE II  
(SR 101L to McDowell Road)**

**FINAL REPORT**

Prepared for:

**Maricopa Association of Governments**

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**February 2006**



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## List of Acronyms

ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
ASG	Agency Steering Group
BNSF	Burlington Northern Santa Fe Railway
CCTV	Closed-Circuit Television
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIP	Capital Improvement Plan / Program
CMAQ	Congestion Mitigation and Air Quality
DCR	Design Concept Report
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FY	Fiscal Year
GUS	Glendale Urban Shuttle
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LOS	Level of Service
MAG	Maricopa Association of Governments
McDOT	Maricopa County Department of Transportation
MIS	Major Investment Study
MMDI	Metropolitan Model Deployment Initiative
MPA	Municipal Planning Areas
NEPA	National Environmental Policy Act of 1969
NRHP	National Register of Historic Places
PDO	Property Damage Only
RCRA	Resource Conservation and Recovery Act
ROSS	Regional Off-Street System
ROW	Right-of-Way
RPTA	Regional Public Transportation Authority
RR	Railroad
RTP	Regional Transportation Plan
SAZ	Socioeconomic Analysis Zones
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SMART	Strategically Managed Arterial
SR	State Route
TMC	Traffic Management Center
VMS	Variable Message Signs

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## 1.0 INTRODUCTION

Grand Avenue is a four- to six-lane major arterial street that runs diagonally across the one-mile grid system of arterial streets that make up the roadway network in Phoenix's greater metropolitan area. Grand Avenue is oriented northwest/southeast and passes through the communities of Peoria, Glendale and Phoenix within the 12.5 mile Study Area as shown in Exhibits 1.1 and 1.2. Originally constructed in the late 1800's, Grand Avenue served as a major connection between the agricultural communities of the West Valley and the business community in downtown Phoenix. With the introduction of rail activity parallel to Grand Avenue, the West Valley continued to develop and began to transform from an agriculture-centered region to an industrial/agriculture-centered region. This change in land use and economic generators, along with the population growth that the West Valley began to experience, has led to the overall reduction in service provided along Grand Avenue, both in terms of motorized and non-motorized transportation.

In 1998, ADOT commissioned the original *Grand Avenue Major Investment Study (MIS)*, (URS, 1999), which recommended eight grade separation projects to remove major six-legged intersections and provide additional grade separations with the Burlington Northern Santa Fe (BNSF) railroad. Seven of the eight grade separations have been constructed and the Grand Avenue Underpass at 59<sup>th</sup> Avenue and Glendale Avenue is expected to be complete in 2006.

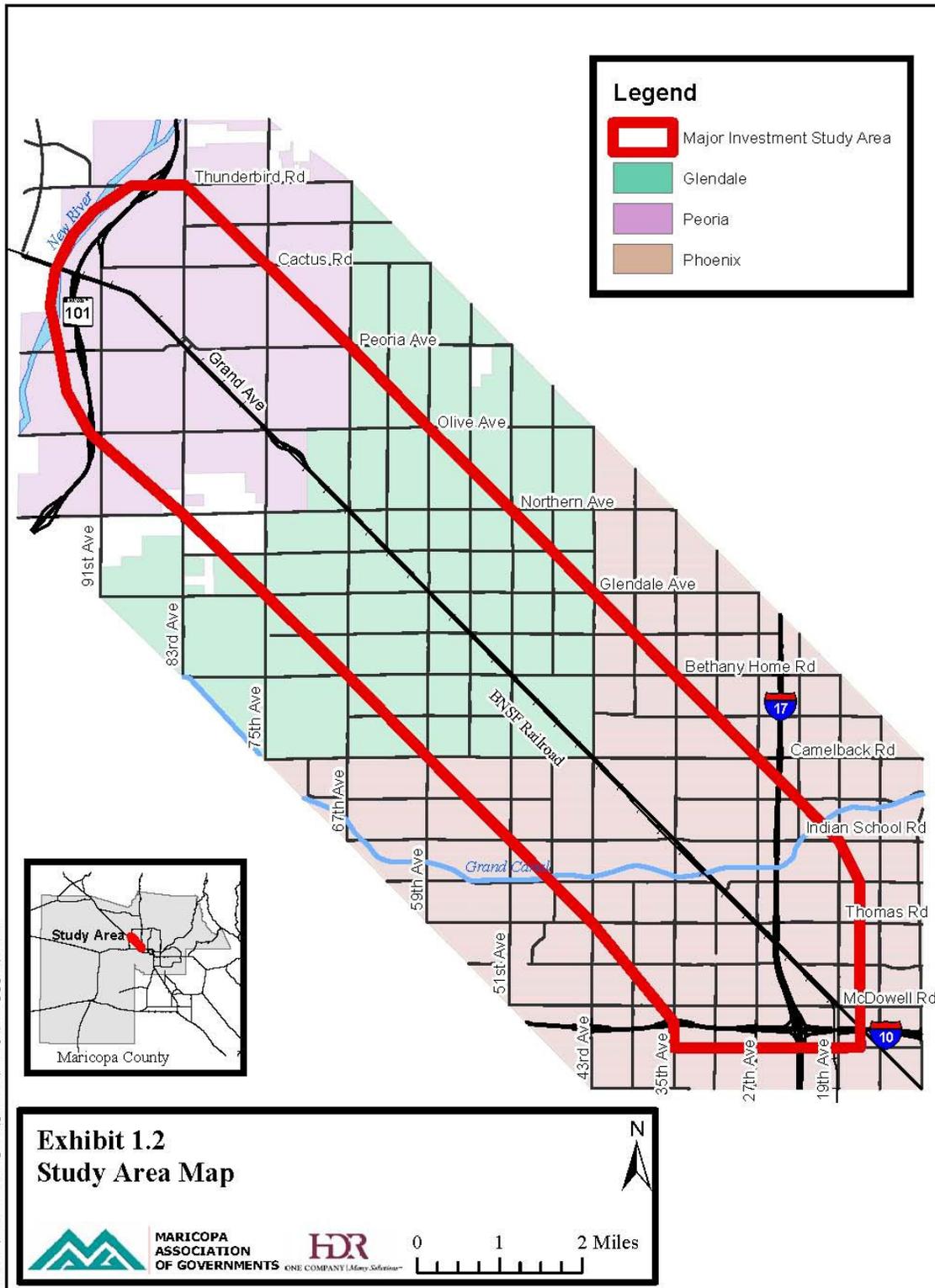
In November 2004, the voters of Maricopa County passed Proposition 400, which extended the one-half cent sales tax for another 20 years. The original tax, passed in 1985, has funded regional transportation improvements over the past two decades including the eight grade separations referenced above. The Regional Transportation Plan (RTP), which provides guidance for the revenues generated from the one-half cent sales tax, includes \$147 million for additional improvements to Grand Avenue within the Study Area. The purpose of this Study is to provide recommendations for improvement projects within the corridor. Consideration was given to pedestrians, bicyclists, transit and community mitigation projects in addition to traffic-related projects.

Six working papers were prepared during the Study, which form the basis of this Final Report. These working papers and other project documents were made available to the public and other stakeholders on the MAG website. The second through sixth working papers were modified slightly to make up this report while the first working paper, *Related Studies, Plans and Programs* is included as Appendix A at the end of this report.

The majority of the improvements recommended in Chapter 6 of the report will be administered by ADOT; however, there may be specific projects that utilize state or local funding as determined by further study and discussions. Additionally, a number of potential projects identified in the study process may be funded from other MAG RTP funding sources including the Streets, Transit, Pedestrian, Bicycle, and ITS programs. It is anticipated that specific funding for these potential projects will be addressed by those modal programs.



# Exhibit 1.2 Study Area Map



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## **2.0 SOCIOECONOMIC & ENVIRONMENTAL CONDITIONS**

### **2.1 Introduction**

This chapter provides a summary of the existing land uses and socioeconomic conditions within the Grand Avenue Study Area. This information will provide a baseline for the existing conditions in the Study Area and will be considered in evaluating the potential impacts of the major improvement alternatives that are identified.

Land use factors identified as part of this analysis include existing land use and General Plan land use. Socioeconomic factors that were considered included current and projected population and employment for the Study Area. A broad range of environmental justice populations were studied as part of this analysis. Environmental justice analysis included such populations as: minorities, the elderly, persons with disabilities, female heads of household (with own children), poverty, vehicle availability, and educational attainment, as well as a metric that considered the cumulative number of these populations for a geographic area.

### **2.2 Existing Land Use**

Existing land uses were determined using the MAG's Existing (Year 2000) Land Use Coverage. Existing land uses were analyzed for an area approximately one mile to each side of Grand Avenue. This area will define the "Study Area" for this report. MAG existing land use categories were consolidated to 17 categories which are summarized in Exhibit 2.1.

The breakdown of acreage and percentage of land within each of the defined land use categories is summarized in Exhibit 2.2, and illustrated in Exhibits 2.3 through 2.5.

The Study Area encompasses approximately 17,180 acres of land. Industrial land use accounts for a total of 2,916 acres (17 percent) of the Study Area, with the majority classified as heavy industrial. Residential land uses account for 7,534 acres (44 percent), commercial land uses represent a total of 1,971 acres (12 percent), vacant land contributes 1,656 acres (10 percent), and agricultural uses represent 1,500 acres (9 percent).

A total of 5,066 acres (30 percent) of the Study Area is within Peoria. The largest land use in Peoria's portion of the Study Area is residential (46 percent), followed by agriculture (22 percent), vacant land (9 percent), and commercial uses (8 percent).

A total of 6,031 acres (35 percent) of the Study Area is within Glendale. The major land uses in Glendale's portion of the Study Area are residential (42 percent), industrial (18 percent), commercial (13 percent), and vacant (13 percent).

A total of 6,082 acres (35percent) of the Study Area is within Phoenix. The largest land uses in Phoenix's portion of the Study Area include residential (44 percent), industrial (26 percent), and commercial (13 percent).

Residential land use is approximately the same for each of the three cities in the Study Area, ranging between 42 and 46 percent. Peoria has the greatest percentage of land in agriculture,

twice that of Glendale, while Phoenix has none. In contrast, 26 percent of the Phoenix portion of the Study Area is industrial, Glendale’s portion includes 18 percent industrial, and Peoria has only five percent in industrial. Both Phoenix and Glendale contain 13 percent commercial land use within the Study Area, while Peoria contains eight percent.

### Exhibit 2.1 Existing Land Use Definitions

Category	Description
<b>Residential Land Uses</b>	
Low Density Residential	Residential districts with four or less dwelling units per acre (du/acre). A residential lot in this category ranges from 10,890 square feet (sf) to many acres.
Medium Density Residential	Residential districts with four to ten du/acre. A residential lot within this category will range from 10,890 sf to 4,360 sf.
High Density Residential	Residential districts with greater than 10 du/acre. Typically, residential units with this land designation are non-traditional detached and attached homes such as townhouses, mobile home parks, and multi-family apartment complexes.
<b>Commercial Land Uses</b>	
Community Commercial	Marketplaces that serve a geographic area from 3 to 5 miles. Typical sites range from 10 to 40 acres, and may include retail space of 100,000 to 500,000 square feet. These marketplaces may feature an anchor tenant such as a high-volume grocery or retail “superstore” outlet. Other businesses within the community commercial designation include, but are not limited to, adult businesses, night clubs, restaurants, dining and entertainment services, mixed single retail services, strip mall retail services, personal services, and mortuaries.
Neighborhood Commercial	Neighborhood-based commercial uses typically serve a neighborhood market area of up to two miles. Typical sites range from 2.5 to ten acres, and overall retail floor space of 50,000 to 100,000 square feet. These sites may feature tenants such as grocery stores, clustered commercial, personal services, and restaurant uses. Other businesses within the neighborhood commercial designation include, but are not limited to, banks and financial services, convenience retail, beauty and barber services, gas stations and liquor stores.
Regional Commercial	Regional Commercial serves a regional area. Typical sites range from 50 to 125 acres and contain between 500,000 to 1,000,000 square feet.
Hotel/Motel	A site with one or more buildings containing guest rooms or dwelling units. Tourist and visitor accommodations consisting of hotels, motels and resorts.
General Office	A site or building(s) where business activities such as administrative, clerical, professional, or service sales are conducted. Businesses within the general office designation include, but are not limited to, insurance companies, real estate sales offices, professional offices, medical offices, and multi-office complexes.
Business Park	Includes enclosed industrial, office or retail in a planned environment. Businesses within the business park designation include, but are not limited to, administrative, professional and supportive retail sales. Grouped businesses are designed to be compatible with each other and feature common traffic circulation, parking, walkways, utilities, landscaped areas and signage.

## Exhibit 2.1 Existing Land Use Definitions (cont.)

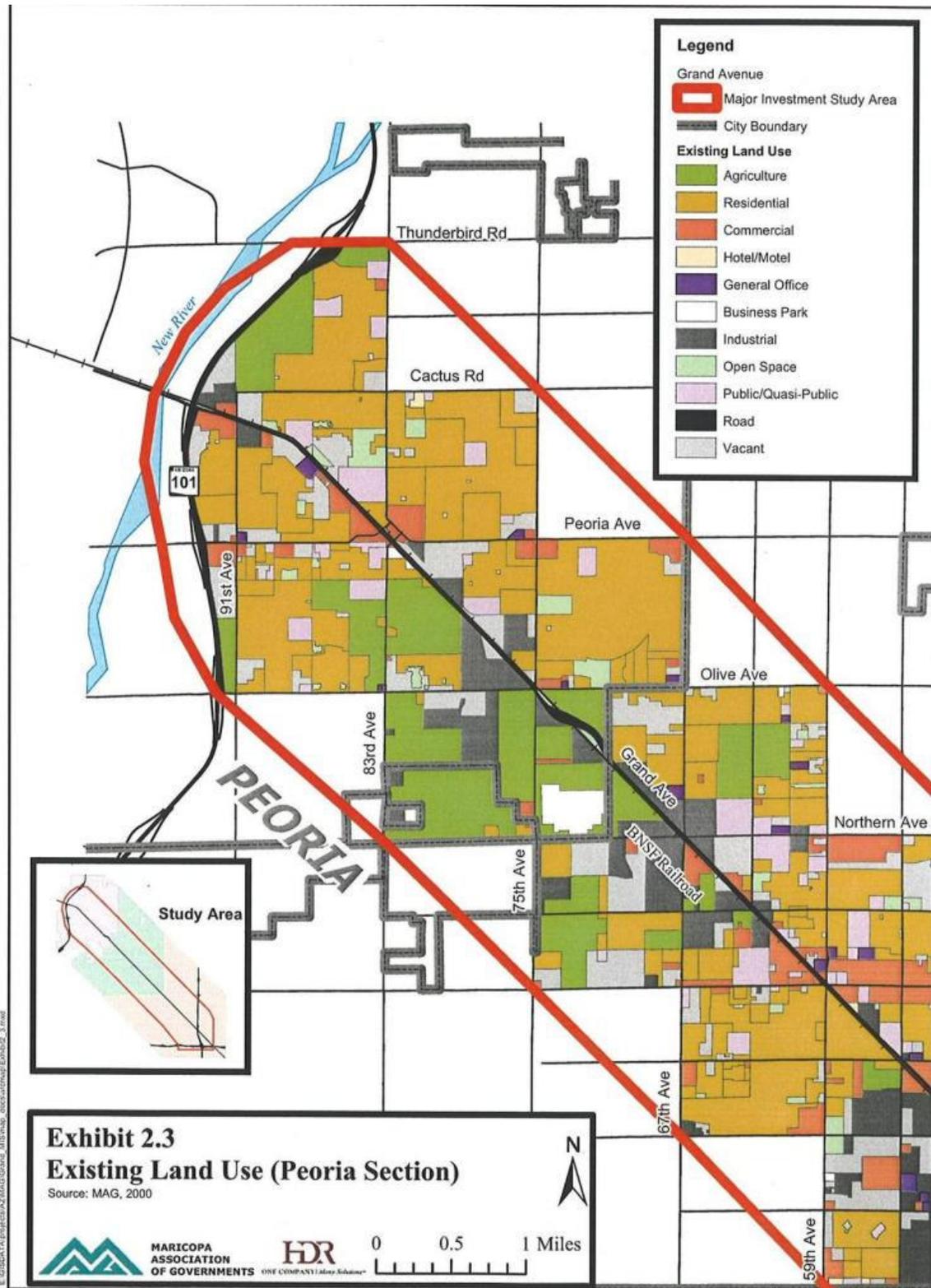
Category	Description
<b>Industrial Land Uses</b>	
Light Industrial	A land use where activities are of a production, warehousing, distribution or manufacturing nature that do not contribute excessive impacts such as noxious fumes, noise, semi-truck traffic, sewer, or water contaminants into the environment. Businesses found within the light industrial land use designation include, but are not limited to, mobile home sales, warehouse, office complexes and self-storage facilities.
Heavy Industrial	A land use where business activities are of a production, warehousing, distribution or manufacturing nature that may contribute impacts (unless mitigated), such as noxious fumes, noise, heavy semi-truck traffic, and heavy sewer or water contaminants into the environment. Businesses found within the light industrial land use designation include, but are not limited to, major distribution warehouses, heavy equipment storage yards and service facilities, mobile home manufacturing and solid waste material recycling centers.
Public/Quasi-Public	These are land uses where access is open to the general public. Admission may or may not require an entrance fee. Public facilities include, but are not limited to, city halls, government facilities, libraries, public transit depots, public transit storage and service areas, and educational services (schools). Quasi-public uses include, but are not limited to, facilities such as churches, cemeteries, hospitals and trade schools. This designation may also include community centers, and power sub-stations.
Parks and Recreation	A land use where landscaped, open air activities and facilities are open to the general public for the purpose of recreation. Recreation facilities may include, but are not limited to, ball fields, hiking trails and swimming pools.
Open Space	Land set aside for the public's enjoyment, or otherwise enhances the quality of the environment. These areas may include landscaped areas, natural areas, plazas with grass and trees, fountains, and public sitting areas.
Agriculture	Land that is privately owned for the purpose of farm production
Vacant	Land that is not presently in use, but may be zoned for a particular use. This land may or may not be privately held or available for sale or purchase.
Road	Includes railroads, railyards, transit centers and freeways

## Exhibit 2.2 Existing Land Use Summary

Land Use Category	Peoria		Glendale		Phoenix		Total	
	Study Area Acres	Percent						
Residential								
Low Density	36.9	0.7%	120.8	2.0%	0	0%	157.8	0.9%
Medium Density	2,142.7	42.3%	1,890.6	31.3%	2,346.2	38.6%	6,379.5	37.1%
High Density	141.5	2.8%	534.6	8.9%	321.0	5.3%	997.1	5.8%
<i>Subtotal Residential</i>	<i>2,321.1</i>	<i>45.8%</i>	<i>2,546.0</i>	<i>42.2%</i>	<i>2,667.2</i>	<i>43.9%</i>	<i>7,534.3</i>	<i>43.9%</i>
Commercial								
Community	41.7	0.8%	368.9	6.1%	201.8	3.3%	612.4	3.6%
Neighborhood	195.6	3.9%	337.0	5.6%	182.3	3.0%	714.9	4.2%
Regional	37.0	0.7%	0	0%	0	0%	37.0	0.2%
Hotel/Motel	6.2	0.1%	10.2	0.2%	14.3	0.2%	30.7	0.2%
General Office	25.2	0.5%	57.8	1.0%	34.5	0.6%	117.5	0.7%
Business Park	91.8	1.8%	7.6	0.1%	359.2	5.9%	458.6	2.7%
<i>Subtotal Commercial</i>	<i>397.5</i>	<i>7.8%</i>	<i>781.5</i>	<i>13.0%</i>	<i>792.1</i>	<i>13.0%</i>	<i>1,971.1</i>	<i>11.5%</i>
Light Industrial	65.3	1.3%	330.1	5.5%	3.6	0.1%	399.0	2.3%
Heavy Industrial	189.4	3.7%	724.5	12.0%	1,602.8	26.4%	2,516.7	14.7%
<i>Subtotal Industrial</i>	<i>254.7</i>	<i>5.0%</i>	<i>1,054.6</i>	<i>17.5%</i>	<i>1,606.3</i>	<i>26.4%</i>	<i>2,915.6</i>	<i>17.0%</i>
Public/Quasi-Public	231.8	4.6%	318.9	5.3%	322.9	5.3%	873.6	5.1%
Open Space	137.4	2.7%	108.9	1.8%	68.5	1.1%	314.8	1.8%
Agriculture	1,097.9	21.7%	402.0	6.7%	0	0%	1,499.9	8.7%
Vacant	468.1	9.2%	766.9	12.7%	421.4	6.9%	1,656.4	9.6%
Road	157.0	3.1%	52.4	0.9%	203.3	3.3%	412.7	2.4%
<b>Total</b>	<b>5,065.5</b>	<b>100.0%</b>	<b>6,031.1</b>	<b>100.0%</b>	<b>6,081.8</b>	<b>100.0%</b>	<b>17,178.4</b>	<b>100.0%</b>

Sources: Maricopa Association of Government's Existing Land Use (Year 2000), HDR.

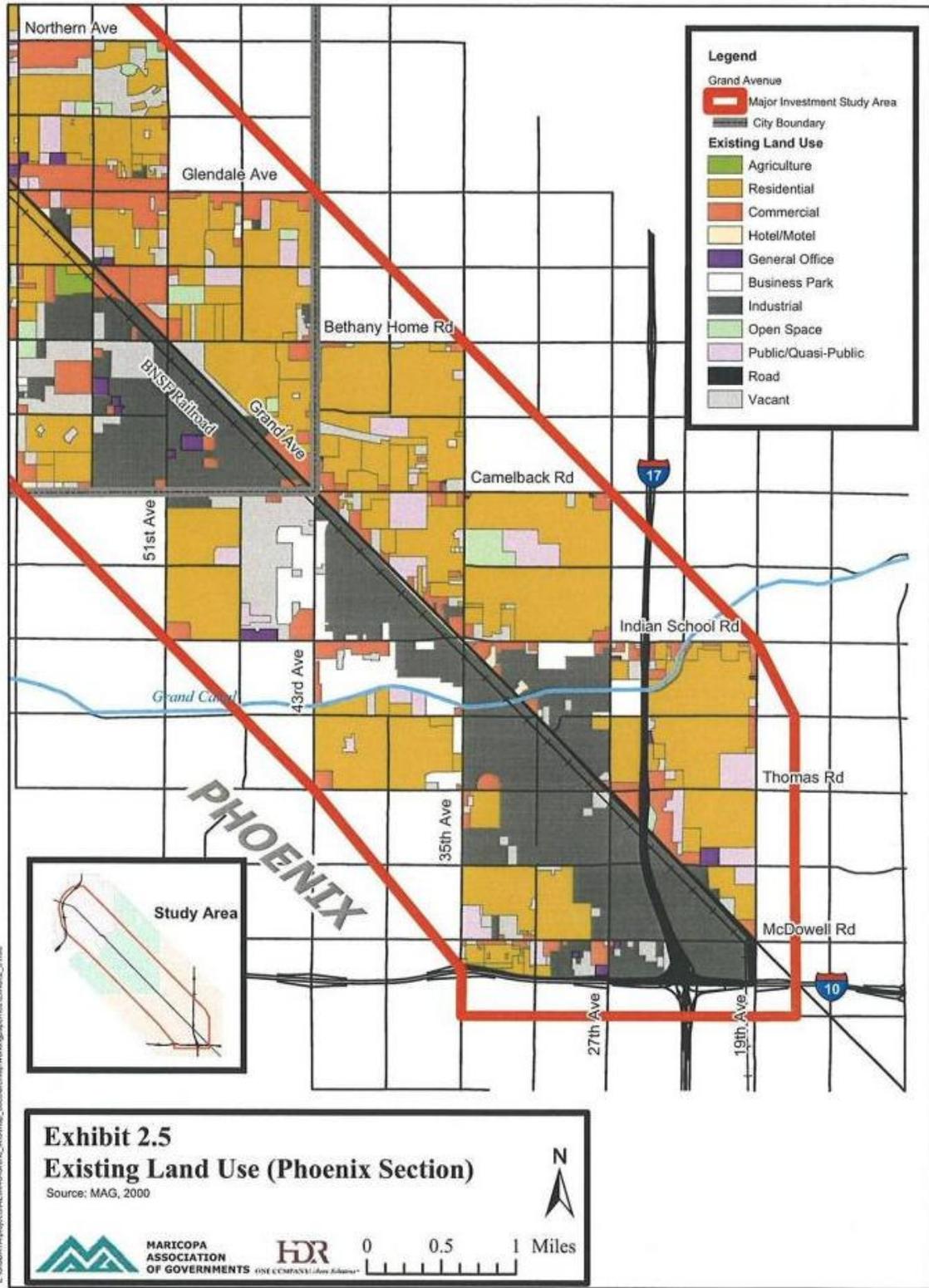
### Exhibit 2.3 Existing Land Use (Peoria Section)



## Exhibit 2.4 Existing Land Use (Glendale Section)



## Exhibit 2.5 Existing Land Use (Phoenix Section)



## 2.3 Future Land Use

Future land uses are from MAG's Future Land Use coverage. This coverage is comprised of currently existing land use with the vacant and build-able agricultural lands replaced with the jurisdiction plans (either the general plan or development plans, if available). Future land uses were analyzed for the Study Area, an area approximately one mile to each side of Grand Avenue. For this Study, the MAG data was further consolidated into eight land use categories. The future land use for the Study Area is summarized in Exhibit 2.6. Future land uses are illustrated in Exhibit 2.7.

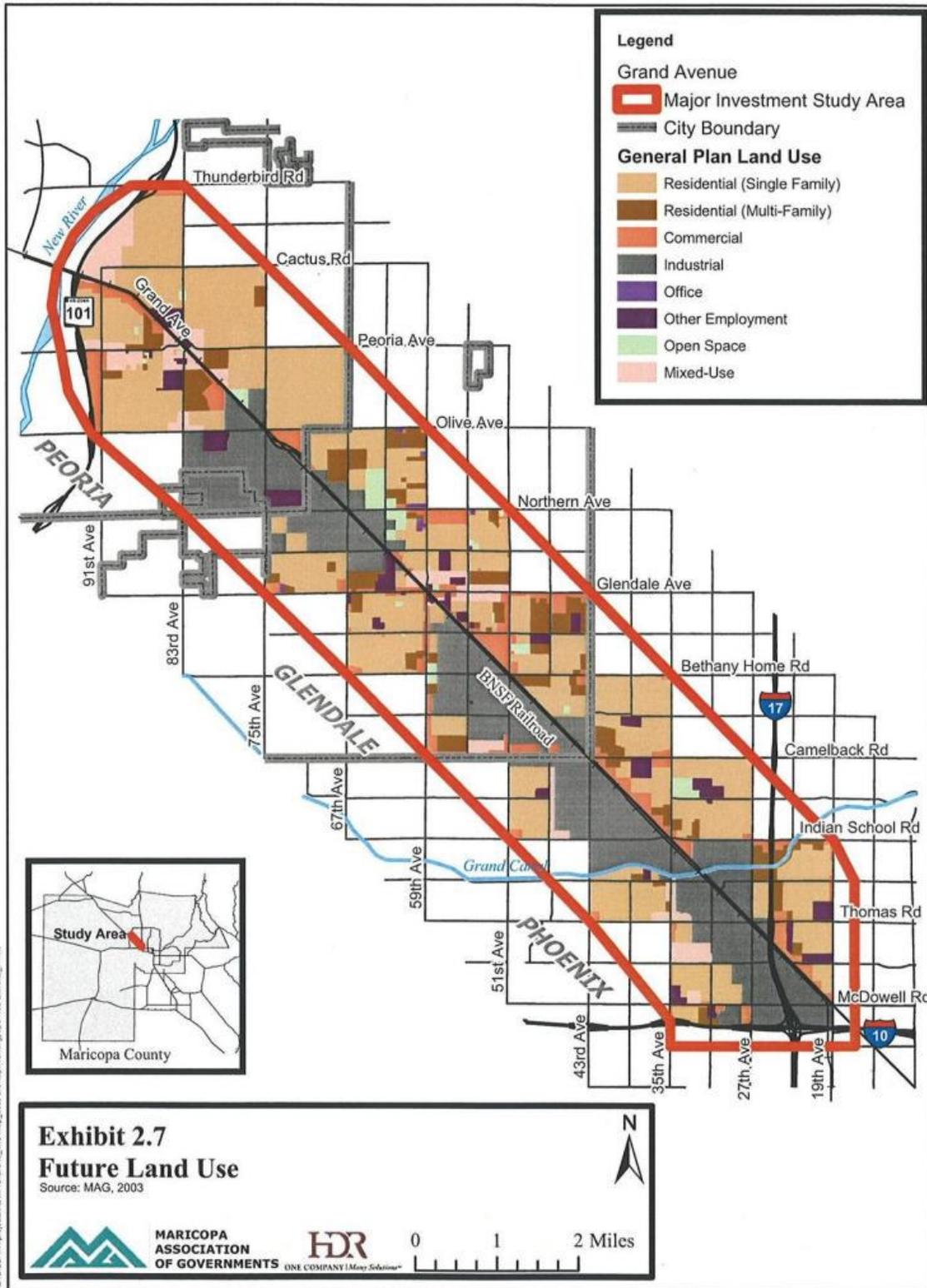
The Study Area encompasses about 17,180 acres of land. Within the Study Area the cities of Peoria, Glendale, and Phoenix combined have designated 52 percent of the land to residential land uses. Residential land use in Peoria represents 59 percent of the planned land use in the Study Area, followed by Glendale with 52 percent, and Phoenix with 47 percent. The next largest planned land use is industrial with 23 percent of the land designated for this use. Phoenix has designated the greatest percentage of land to industrial with 38 percent, followed by Glendale with 27 percent, and Peoria with less than one percent. Mixed-use represents 11 percent of the Study Area land use. Peoria contains the greatest percentage of mixed-use with 28 percent, while both Glendale and Phoenix have 4 percent each designated to the mixed-use category. The remaining planned land uses are commercial with 8 percent, other employment land uses comprising 4 percent and open space with 2 percent.

### Exhibit 2.6 Future Land Use Summary

Land Use	Peoria	%	Glendale	%	Phoenix	%	Total	%
Residential -- Multi-Family	238.8	5%	764.4	13%	355.0	6%	1,358.2	8%
Residential --Single Family	2,740.6	54%	2,356.9	39%	2,504.8	41%	7,602.3	44%
<i>Subtotal Residential</i>	<i>2,979.5</i>	<i>59%</i>	<i>3,121.3</i>	<i>52%</i>	<i>2,859.7</i>	<i>47%</i>	<i>8,960.5</i>	<i>52%</i>
Commercial	374.6	7%	628.4	10%	424.1	7%	1,427.1	8%
Industrial	<1	<1%	1,650.8	27%	2,285.3	38%	3,936.2	23%
Mixed Use	1,418.5	28%	208.3	3%	212.0	3%	1,838.8	11%
Office	0	0%	38.8	1%	0	0%	38.8	<1%
Other Employment	240.1	5%	186.2	3%	255.2	4%	681.5	4%
Open Space	52.0	1%	197.3	3%	45.4	1%	294.7	2%
<b>Grand Total</b>	<b>5,064.7</b>	<b>100%</b>	<b>6,031.1</b>	<b>100%</b>	<b>6,081.8</b>	<b>100%</b>	<b>17,177.6</b>	<b>100%</b>

Source: Maricopa Association of Governments Future Land Use (2003).

## Exhibit 2.7 Future Land Use



Future land uses for the affected communities reveal several changes from the existing land use pattern in the Study Area:

- Agricultural land is projected to be converted to residential/non-residential uses.
- The amount of single-family and multi-family residential is anticipated to increase.
- Industrial land use is anticipated to increase in Glendale and Phoenix, while Peoria anticipates less industrial.

## 2.4 Existing and Projected Population

The population numbers used in this report are based on MAG's Interim Socioeconomic Projections (July 2003). These projections use a July 1, 2000 base population, derived from the 2000 US Census. The interim projections have been prepared for July 1 of the following years: 2010, 2020, 2025 and 2030. The 2006 base year projections are derived from a linear interpolation of the interim projections. Numbers reported for municipalities are based on Municipal Planning Areas (MPAs) which include the corporate limits of a municipality and adjacent areas anticipated to become part of those corporate limits in the future.

The unit of analysis for the population projections is the Socioeconomic Analysis Zones (SAZ). The Study Area is comprised of 39 SAZs. The SAZs are shown in Exhibit 2.8. The existing and projected population by SAZ for the Study Area is shown in Exhibit 2.9. Existing population densities are shown in Exhibit 2.10.

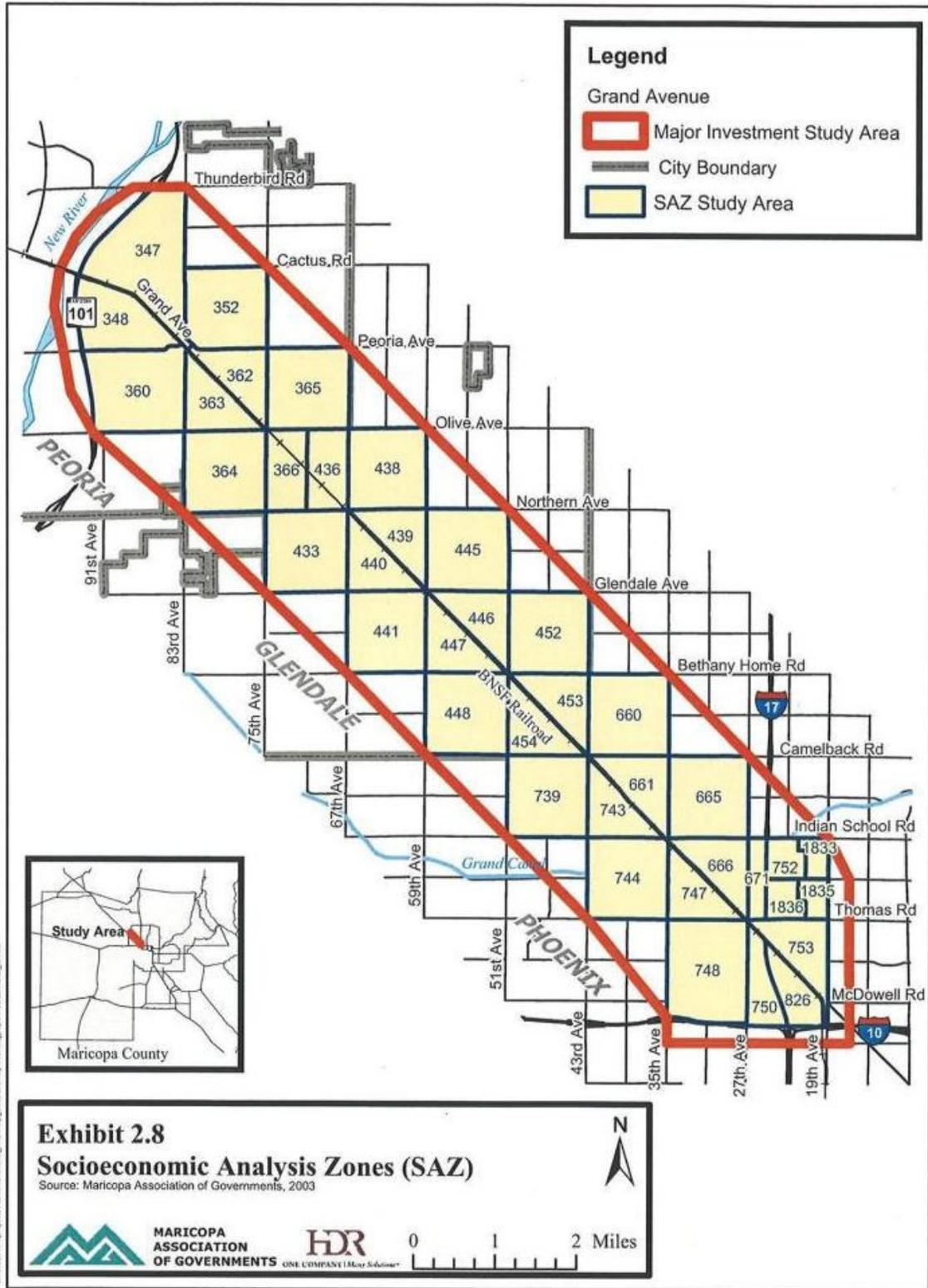
The 2006 projected Maricopa County population is 3,719,300. By 2030, the Maricopa County population is projected to be nearly 6,140,000. During the same period Peoria's population is projected to increase nearly 80 percent, followed by Phoenix with 40 percent growth, and then Glendale which is anticipated to experience 17 percent growth.

The 2006 population projection for the Study Area is 147,832 people. The Study Area is projected to have a compounded annual growth rate of approximately 1.2 percent between 2000 and 2006. During this same period the Peoria, Glendale, and Phoenix MPAs are all projected to have greater compounded annual growth rates of 6.0 percent, 3.5 percent, and 2.8 percent, respectively.

The Study Area is expected to grow seven percent in population to 158,464 people by the year 2030. Within the Study Area, absolute population growth will be greatest in Glendale with an additional 5,502 people (9 percent increase), followed by Peoria with an additional 2,593 people (7 percent increase), and Phoenix with an additional 2,537 people (5 percent increase).

The Study Area population density is approximately 8.6 people per acre (refer to Exhibit 2.9). The Peoria portion had a density of 7.2 people per acre, Glendale's population density is 9.8 people per acre, and Phoenix's portion of the Study Area has 8.6 people per acre. These densities are higher than the overall population densities for Peoria, Glendale, and Phoenix MPAs (1.1, 4.5, and 3.7 people per acre, respectively).

## Exhibit 2.8 Socioeconomic Analysis Zones (SAZ) Within Study Area

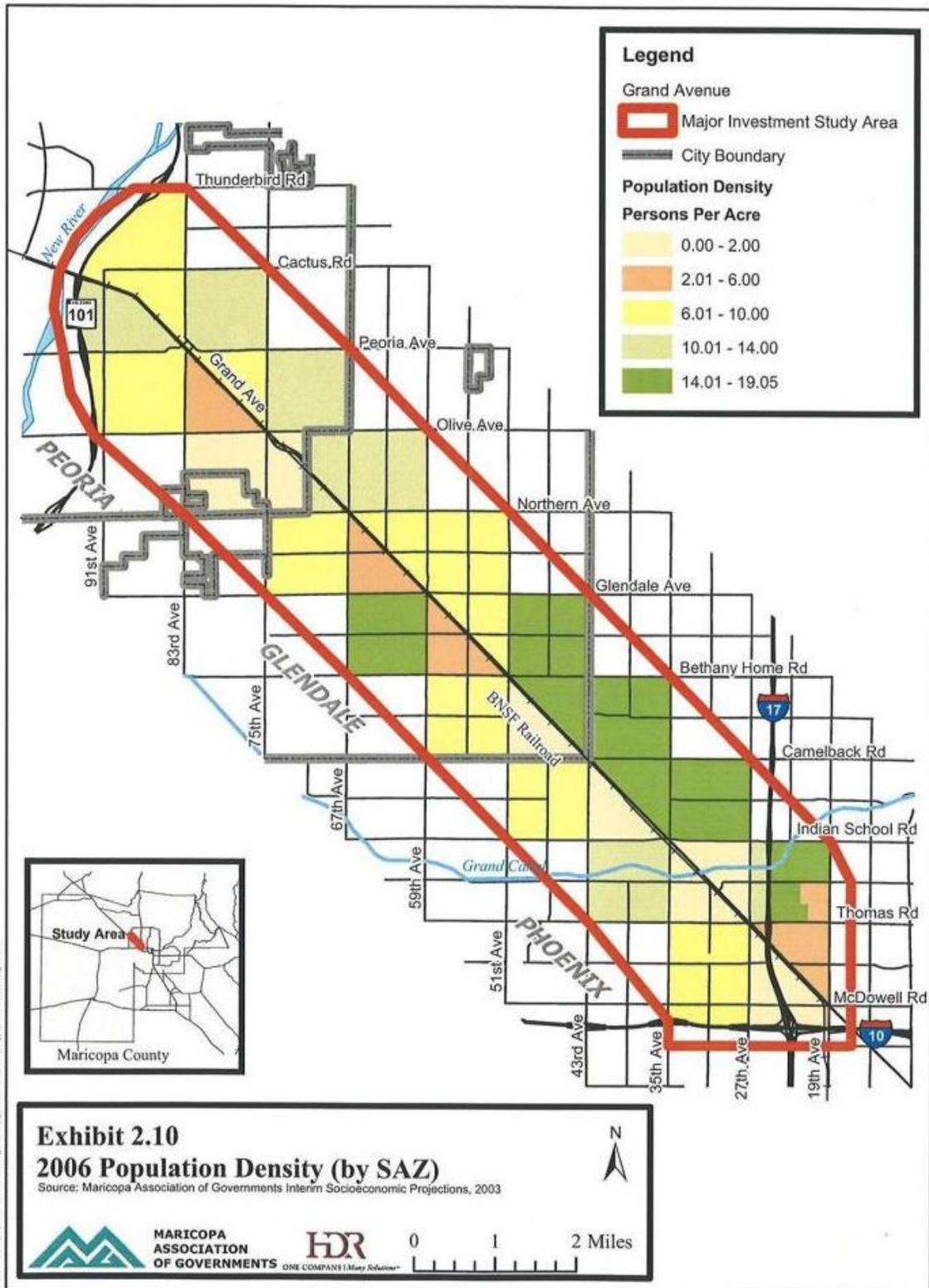


## Exhibit 2.9 Base Year and Projected Population

SAZ	Acres	2006		2030		Absolute Change	Percent Change
		Resident Population	Population Density	Resident Population	Population Density		
<b>Peoria</b>							
347	920.0	6,224	6.77	6,579	7.15	355	6%
348	494.9	5,418	10.95	5,877	11.87	459	8%
352	636.9	7,070	11.10	7,262	11.4	192	3%
360	766.9	5,960	7.77	6,082	7.93	122	2%
362	318.0	2,544	8.00	3,004	9.45	460	18%
363	325.1	1,782	5.48	2,571	7.91	789	44%
364	642.1	119	0.19	120	0.19	1	1%
365	642.8	7,433	11.56	7,648	11.9	215	3%
366	318.7	31	0.10	31	0.1	0	0%
<i>Peoria Subtotal</i>	5,065.5	36,581	7.22	39,174	7.73	2,593	7%
<b>Glendale</b>							
433	639.4	4,090	6.40	5,323	8.32	1,233	30%
436	320.4	3,522	10.99	3,926	12.25	404	11%
438	611.0	8,128	13.30	9,678	15.84	1,550	19%
439	309.5	1,947	6.29	1,994	6.44	47	2%
440	311.1	1,728	5.55	1,837	5.91	109	6%
441	621.5	11,834	19.04	12,329	19.84	495	4%
445	649.7	5,302	8.16	6,056	9.32	754	14%
446	323.4	2,179	6.74	2,218	6.86	39	2%
447	326.3	1,320	4.05	1,345	4.12	25	2%
448	650.0	4,274	6.58	4,510	6.94	236	6%
452	633.9	9,858	15.55	10,156	16.02	298	3%
453	319.9	4,694	14.67	5,006	15.65	312	7%
454	314.9	2	0.01	2	0.01	0	0%
<i>Glendale Subtotal</i>	6,031.1	58,878	9.76	64,380	10.67	5,502	9%
<b>Phoenix</b>							
660	639.0	10038	15.71	10,292	16.11	254	3%
661	339.9	4790	14.09	5,379	15.83	589	12%
665	636.2	9252	14.54	9,562	15.03	310	3%
666	336.5	354	1.05	507	1.51	153	43%
671	143.8	1448	10.07	1,729	12.02	281	19%
739	636.4	4707	7.40	4,754	7.47	47	1%
743	302.2	10	0.03	11	0.04	1	10%
744	639.5	7592	11.87	7,780	12.17	188	2%
747	301.2	175	0.58	210	0.7	35	20%
748	794.5	5199	6.54	5,342	6.72	143	3%
750	242.2	0	0.00	0	0	0	0%
752	146.4	2259	15.43	2,395	16.36	136	6%
753	350.2	1885	5.38	1,972	5.63	87	5%
826	236.4	2	0.01	2	0.01	0	0%
1833	97.6	1510	15.47	1,583	16.22	73	5%
1835	102.6	579	5.64	598	5.83	19	3%
1836	137.3	2573	18.74	2,794	20.35	221	9%
<i>Phoenix Subtotal</i>	6,081.8	52,373	8.61	54,910	9.03	2,537	5%
<b>Total Study Area</b>	17,178.4	147,832	8.61	158,464	9.22	10,632	7%
<b>Peoria MPA</b>	130,242	142,100	1.09	253,395	1.95	111,295	78%
<b>Glendale MPA</b>	58,810	266,400	4.53	312,182	5.31	45,782	17%
<b>Phoenix MPA</b>	423,341	1,560,400	3.69	2,187,506	5.17	627,106	40%
<b>Maricopa County</b>	5,902,937	3,719,300	0.63	6,139,971	1.04	2,420,671	65%

Source: Maricopa Association of Governments Interim Socioeconomic Projections (July 2003)

## Exhibit 2.10 2006 Population Density



The projected increase in population for the Study Area will result in the population density increasing by approximately 7 percent. The Study Area population density increase is less than the projected population density increase for each of the constituent cities.

## 2.5 Employment

Employment is an important factor in considering travel behavior in the Study Area. Existing and projected employment were obtained from the MAG Interim Socioeconomic Projections (July 2003). As with the population projections, the 2006 base year employment projections are derived from a linear interpolation of the interim projections. The existing and projected employment for the Study Area is summarized in Exhibit 2.11. Employment densities are illustrated in Exhibit 2.12.

For the period 2006 to 2030, job growth in Maricopa County is anticipated to increase at a greater rate than the population. Employment numbers for the County are anticipated to grow from 1,893,100 in the year 2006 to 3,377,000 in the year 2030. This increase in County-wide jobs increases the employment ratio of jobs to population from 0.51 to 0.55.

In the year 2006, there are projected to be 71,097 jobs in the Study Area. The Phoenix portion of the Study Area contained 35,120 jobs (49 percent); the Glendale portion contributed 22,361 jobs (31 percent); and Peoria's portion contributed the remaining 13,616 jobs (19 percent).

Employment within the Study Area is expected to grow to 98,003 jobs by the year 2030. Employment density within the Study Area is expected to increase from the year 2006 density of 4.1 to the year 2030 density of 5.7. The Peoria portion of the Study Area is anticipated to experience the greatest absolute increase in employment with 12,045 new jobs; Glendale is second with 9,151 new jobs; followed by Phoenix with an increase of 5,710 new jobs.

Within the Study Area, Peoria is anticipated to experience the greatest employment density increase of the three cities, from the year 2006 density of 2.7 employees per acre to a year 2030 density of 5.1 employees per acre; Glendale is next with an increase from 3.7 employees per acre to 5.2; followed by Phoenix with an increase from the year 2000 employment density of 5.8 to a year 2030 estimated employment density of 6.7 employees per acre (densities are based on gross acreage).

Two of the conclusions drawn from the analysis of employment in the Study Area are:

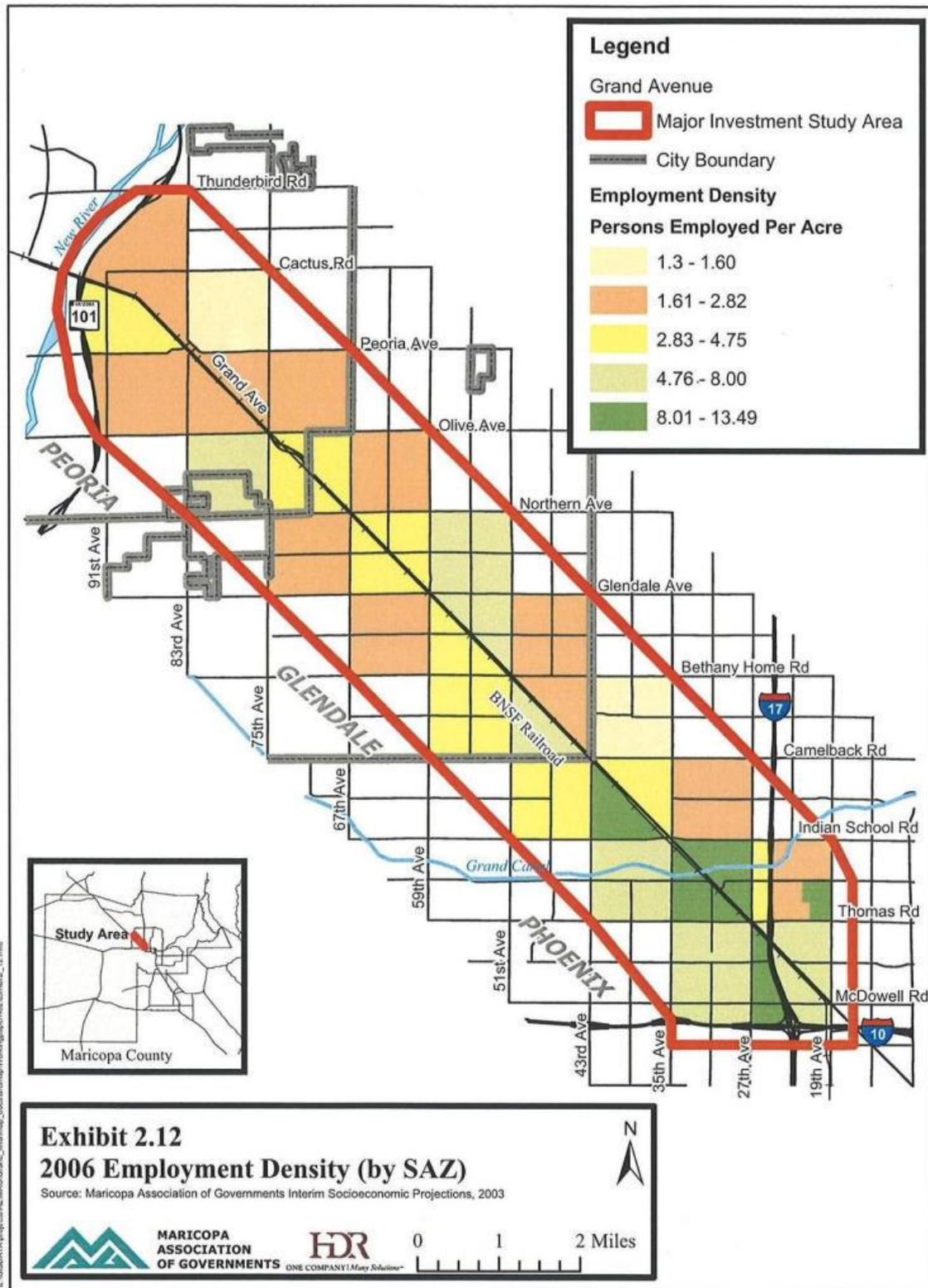
- The Phoenix portion of the Study Area contains nearly one-half of the Study Area employment.
- Although Peoria contributes only 19 percent to the Study Area employment, these jobs represent 32 percent of Peoria's overall employment.

## Exhibit 2.11 Base Year and Projected Employment

SAZ	2006			2030		Absolute Change	Percent Change
	Acres	Employment	Employment Density	Employment	Employment Density		
<b>Peoria</b>							
347	920.0	1,842	2.00	4,474	4.86	2,632	143%
348	494.9	1,838	3.71	2,337	4.72	499	27%
352	636.9	835	1.31	829	1.30	-6	-1%
360	766.9	1,967	2.56	2,705	3.53	738	38%
362	318.0	662	2.08	868	2.73	206	31%
363	325.1	628	1.93	1,159	3.56	531	85%
364	642.1	3,511	5.47	9,424	14.68	5,913	168%
365	642.8	1,151	1.79	1,148	1.79	-3	0%
366	318.7	1,182	3.71	2,717	8.53	1,535	130%
<i>Peoria Subtotal</i>	<i>5,065.5</i>	<i>13,616</i>	<i>2.69</i>	<i>25,661</i>	<i>5.07</i>	<i>12,045</i>	<i>88%</i>
<b>Glendale</b>							
433	639.4	1,410	2.21	3,784	5.92	2,374	168%
436	320.4	953	2.97	1,959	6.11	1,006	106%
438	611.0	1,630	2.67	1,768	2.89	138	8%
439	309.5	1,287	4.16	2,417	7.81	1,130	88%
440	311.1	1,426	4.58	2,138	6.87	712	50%
441	621.5	1,368	2.20	1,470	2.37	102	7%
445	649.7	3,190	4.91	3,194	4.92	4	0%
446	323.4	2,311	7.15	2,373	7.34	62	3%
447	326.3	1,444	4.42	2,207	6.76	763	53%
448	650.0	2,982	4.59	5,787	8.90	2,805	94%
452	633.9	1,652	2.61	1,718	2.71	66	4%
453	319.9	618	1.93	607	1.90	-11	-2%
454	314.9	2,090	6.64	2,090	6.64	0	0%
<i>Glendale Subtotal</i>	<i>6,031.1</i>	<i>22,361</i>	<i>3.71</i>	<i>31,512</i>	<i>5.22</i>	<i>9,151</i>	<i>41%</i>
<b>Phoenix</b>							
660	639.0	804	1.26	812	1.27	8	1%
661	339.9	1496	4.40	1,605	4.72	109	7%
665	636.2	1147	1.80	1,156	1.82	9	1%
666	336.5	3222	9.58	3,495	10.39	273	8%
671	143.8	660	4.59	684	4.76	24	4%
739	636.4	1842	2.89	5,651	8.88	3,809	207%
743	302.2	3321	10.99	3,370	11.15	49	1%
744	639.5	4140	6.47	4,346	6.80	206	5%
747	301.2	4061	13.48	4,061	13.48	0	0%
748	794.5	6126	7.71	7,013	8.83	887	14%
750	242.2	2505	10.34	2,816	11.63	311	12%
752	146.4	280	1.91	283	1.93	3	1%
753	350.2	2105	6.01	2,121	6.06	16	1%
826	236.4	1891	8.00	1,891	8.00	0	0%
1833	97.6	221	2.26	221	2.26	0	0%
1835	102.6	956	9.32	956	9.32	0	0%
1836	137.3	343	2.50	349	2.54	6	2%
<i>Phoenix Subtotal</i>	<i>6,081.8</i>	<i>35,120</i>	<i>5.77</i>	<i>40,830</i>	<i>6.71</i>	<i>5,710</i>	<i>16%</i>
<b>Total Study Area</b>	<b>17,178.4</b>	<b>71,097</b>	<b>4.14</b>	<b>98,003</b>	<b>5.71</b>	<b>26,906</b>	<b>38%</b>
<b>Peoria MPA</b>	58,810	112,100	1.91	190,225	3.23	78,125	70%
<b>Glendale MPA</b>	130,242	42,100	0.32	141,492	1.09	99,392	236%
<b>Phoenix MPA</b>	423,341	836,500	1.98	1,264,062	2.99	427,562	51%
<b>Maricopa County</b>	5,902,937	1,893,100	0.32	3,377,000	0.57	1,483,900	78%

Source: Maricopa Association of Governments Interim Socioeconomic Projections (July 2003)

## Exhibit 2.12 2006 Employment Density



## 2.6 Environmental Justice

### 2.6.1 Introduction

Environmental justice is a planning consideration based on Title VI of the 1964 Civil Rights Act and Executive Order 12898 of 1994 titled *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. It is MAG's intent to recognize the significance of transportation planning in the continued quality of life of all residents of the Metropolitan Area.

Title VI of the 1964 Civil Rights Act and related statutes require that individuals not be excluded from participating in, denied the benefit of, or subject to discrimination under any program or activity receiving federal funding on the basis or race, color, national origin, age, sex, or disability. Executive Order 12898 further directs federal programs, policies and activities not have a disproportionately high and adverse human health and environmental effect on low-income populations.

These documents provide guidance on environmental justice populations but stop short of prescribing the specific methods and processes for ensuring environmental justice in decision making. The following sections will identify the environmental justice populations within the Grand Avenue Study Area. This understanding will provide the basis for identifying socioeconomic concerns of the area and addressing them through the proposed actions.

The intent of environmental justice is to ensure that minority and low-income communities (and others specified below) are included in the transportation planning process, and to ensure that these populations benefit equally from the transportation network without shouldering a disproportionate share of its burdens.

Environmental justice principles that relate to the development of the Grand Avenue MIS include: ensuring the full and fair participation by potentially all affected communities in the transportation decision making process, including those of low-income or minority populations; prevent the denial of, reduction in, or significant delay in the receipt of benefits by low income and minority populations; avoid, minimize or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority and low-income populations.

### 2.6.2 Defining Environmental Justice Communities

The 2000 U.S. Census is the source of data used for determining the environmental justice populations. The 2000 Census data reflects information current as of April 1, 2000 (population data reported in this section may differ from the data presented Section 2.4, Existing and Projected Population, due to the fact that the data used in that section is derived from the Census data which has a April 1, 2000 base and may contain different geography). The unit of analysis is the Census Tract. In all instances the defined group was compared to the Maricopa County mean. *Environmental justice populations are those Tracts where the identified group represents a percentage of the population greater than that of the County mean.*

Environmental justice populations include the specific groups called out by the Federal Highway Administration's "Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" memorandum dated December 2, 1998, and Presidential Executive Order 12898. In addition to the groups identified in the above referenced documents, information on educational attainment and the availability of vehicles at households was also included in this analysis. A lack of educational attainment may be a hindrance for these residents to become involved in the process. The availability of vehicles, or lack thereof, would indicate a greater need for alternative modes.

### *Minority Populations*

For this Study the minority populations include the following groups (as defined in the 2000 US Census): Black or African American alone not Hispanic or Latino, American Indian and Alaska Native alone not Hispanic or Latino, Asian alone not Hispanic or Latino, Native Hawaiian and Other Pacific Islander alone not Hispanic or Latino, some other race alone not Hispanic or Latino, persons two more races not Hispanic or Latino, and Hispanic or Latino.

As of the year 2000, minorities represented 33.8 percent of the Maricopa County population. The largest component of the minority population is "Hispanic" or "Latino" classification, which comprise approximately three-quarters of the minority population in the County. "Hispanics" or "Latinos" may be of any race and classify themselves in one of the specific Hispanic or Latino categories -- "Mexican," "Puerto Rican," or "Cuban" -- as well as those who indicate that they are "other Spanish, Hispanic, or Latino." Origin can be viewed as the heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. Exhibit 2.13 summarizes the population of those individuals, within the Study Area, who are minority. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale, and Phoenix. Exhibit 2.14 graphically depicts the percentage of population within the Study Area by Census Tract that is minority.

The percent reported minority population for the Study Area is 56.7 percent. The percent minority populations for the Study Area portions of the cities Glendale, Peoria and Phoenix were 58.2 percent, 34.1 percent and 72.2 percent, respectively. For all three cities, the percent minority population in the Study Area portion of each city is greater than that for the respective city as a whole.

### *Aged Populations*

Aged Populations are defined as people 60 years of age and older. Exhibit 2.15 summarizes the Study Area population of people 60 years of age and older, as well as a number of the other environmental justice factors described below. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale, and Phoenix. Exhibit 2.16 illustrates the percentage of population within the Study Area by Census Tract that are 60 years of age and older. Aged populations are a community of concern because many seniors do not drive or have below average household incomes and rely heavily on transit services. Also, the wide intersections resulting from the diagonal orientation of Grand Avenue make it harder for slower walking pedestrians to cross safely.

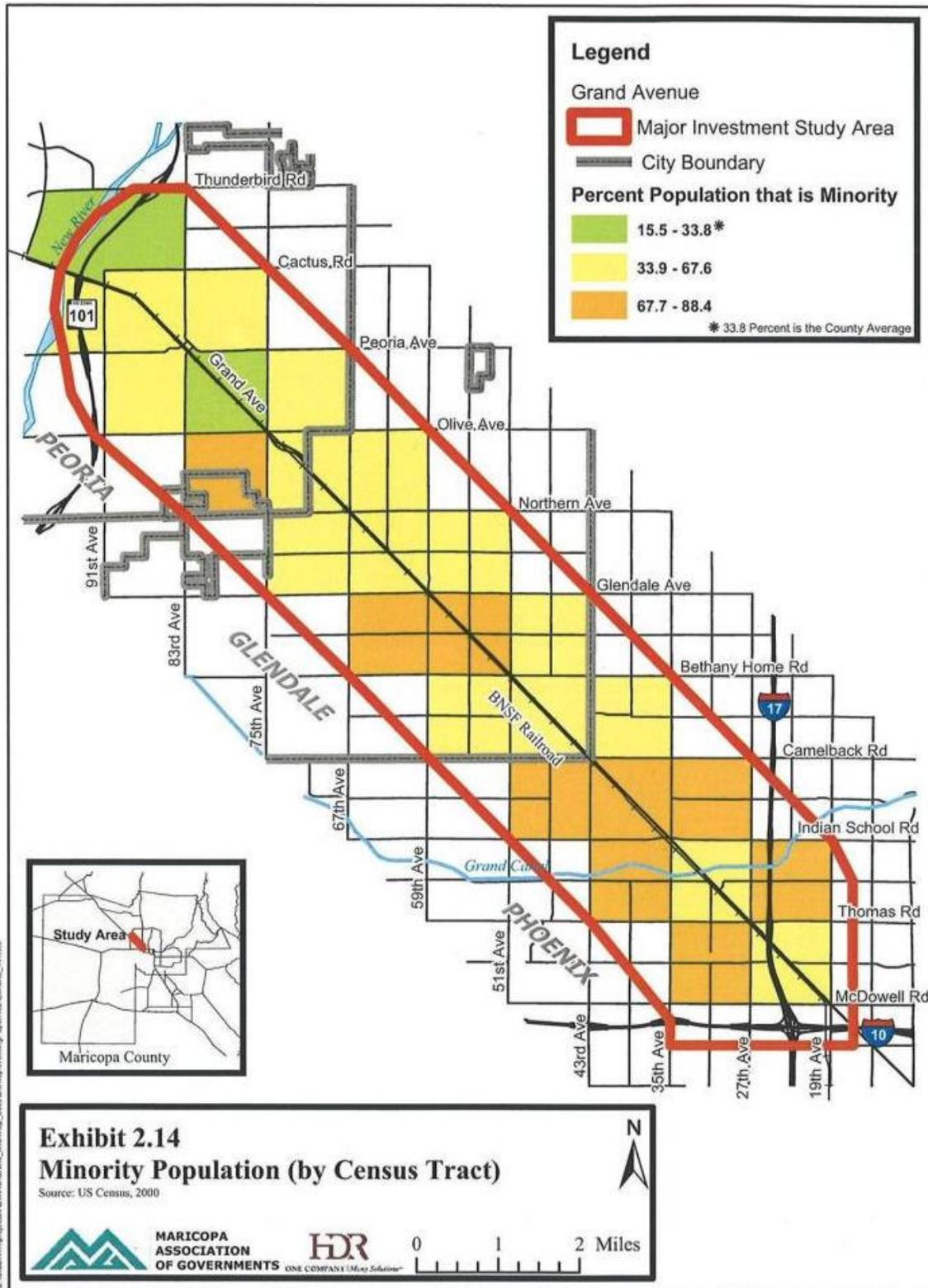
## Exhibit 2.13 Minority Populations Summary

	Tract	Total Population	White	Black/ African American	American Indian/ Alaska Native	Asian/Pacific Islander	Other Race	Hispanic or Latino	Total Minority Population	Percent Minority
<b>Peoria</b>	071507	5,482	4,634	160	17	93	60	518	848	15.5%
	071906	5,204	3,149	172	29	145	128	1,581	2,055	39.5%
	071904	7,275	4,688	243	71	81	110	2,082	2,587	35.6%
	071908	6,964	4,514	342	89	122	116	1,781	2,450	35.2%
	071910	6,878	4,225	277	69	88	159	2,060	2,653	38.6%
	071911	2,526	1,715	75	22	64	55	595	811	32.1%
	092704	120	20	0	0	0	1	99	100	83.3%
	092310	3,084	1,799	245	85	48	111	796	1,285	41.7%
Subtotal		37,533	24,744	1,514	382	641	740	9,512	12,789	34.1%
<b>Glendale</b>	092705	2,471	913	139	52	53	59	1,255	1,558	63.1%
	092304	7,399	4,830	377	167	198	181	1,646	2,569	34.7%
	092600	3,608	1,547	129	43	21	38	1,830	2,061	57.1%
	092800	11,269	2,865	662	184	43	257	7,258	8,404	74.6%
	092500	4,258	1,725	91	47	126	59	2,210	2,533	59.5%
	092900	3,464	554	147	31	21	53	2,658	2,910	84.0%
	093104	3,885	1,732	439	189	45	129	1,351	2,153	55.4%
	093000	9,614	4,756	700	240	120	287	3,511	4,858	50.5%
	093101	4,332	2,124	487	68	99	100	1,454	2,208	51.0%
Subtotal		50,300	21,046	3,171	1,021	726	1,163	23,173	29,254	58.2%
<b>Phoenix</b>	107101	4,214	1,990	262	74	195	93	1,600	2,224	52.8%
	107102	5,289	1,880	534	195	239	144	2,297	3,409	64.5%
	109200	4,724	1,153	278	101	140	99	2,953	3,571	75.6%
	109100	9,085	2,593	290	115	369	214	5,504	6,492	71.5%
	110200	469	170	6	6	0	15	272	299	63.8%
	110300	8,170	2,421	367	276	320	173	4,613	5,749	70.4%
	109300	4,707	1,196	171	49	49	89	3,153	3,511	74.6%
	110100	7,592	1,067	190	109	165	61	6,000	6,525	85.9%
	112100	4,204	488	42	26	20	39	3,589	3,716	88.4%
	112000	1,856	1,053	42	22	12	20	707	803	43.3%
Subtotal		50,310	14,011	2,182	973	1,509	947	30,688	36,299	72.2%
<b>Study Area Total</b>		138,143	59,801	6,867	2,376	2,876	2,850	63,373	78,342	56.7%
Percent		100%	43%	5%	2%	2%	2%	46%	56.7%	
City of Peoria		108,364	84,370	2,887	579	2,103	1,726	16,699	23,994	22.1%
City of Glendale		218,812	141,462	9,818	2,460	6,090	4,639	54,343	77,350	35.3%
City of Phoenix		1,321,045	736,844	63,756	21,472	26,806	22,195	449,972	584,201	44.2%
Maricopa County		3,072,149	2,034,530	108,521	45,703	68,287	51,767	763,341	1,037,619	33.8%

Note: Population totals differ somewhat from that reported in Exhibit 2.9 due to different data sources.

Source: US Census (2000)

## Exhibit 2.14 Minority Population

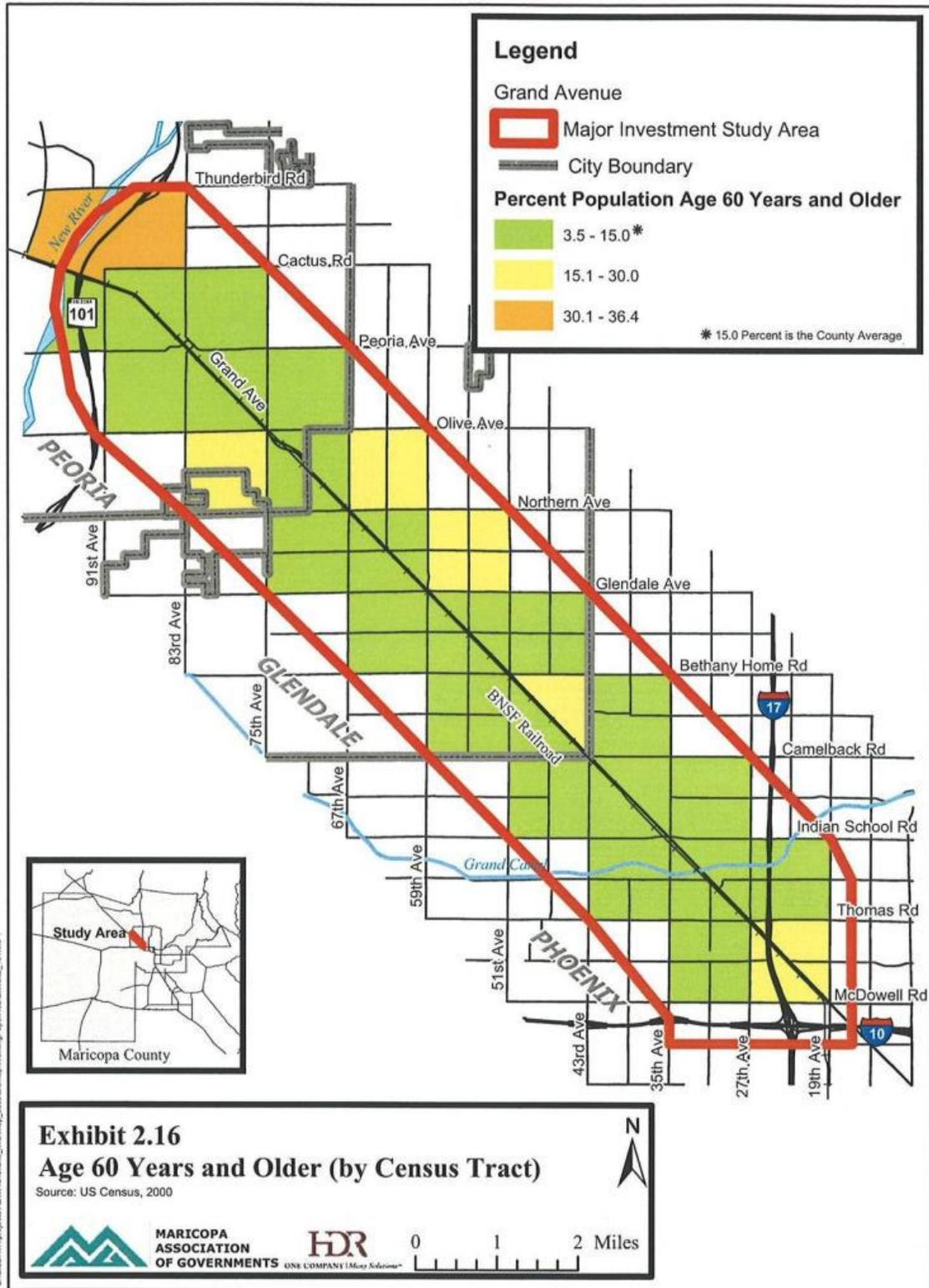


## Exhibit 2.15 Environmental Justice Communities

SAZs	Tract	Total Population	Age 60+ Percent	Mobility Disability Percent	Female Head of Household Percent	Poverty Percent
<b>Peoria</b>						
	071507	5,482	36.4%	18.1%	4.8%	3.0%
	071906	5,204	10.0%	16.3%	12.4%	5.8%
	071904	7,275	8.8%	11.4%	17.5%	8.4%
	071908	6,964	12.0%	14.3%	15.3%	9.0%
	071910	6,878	9.1%	12.7%	11.3%	6.0%
	071911	2,526	5.7%	9.2%	8.7%	5.7%
	092704	120	16.7%	47.5%	0.0%	45.0%
	092310	3,084	6.0%	18.1%	24.2%	19.6%
<i>Peoria Subtotal</i>		<i>37,533</i>	<i>13.2%</i>	<i>14.4%</i>	<i>13.3%</i>	<i>7.8%</i>
<b>Glendale</b>						
	092705	2,471	3.5%	15.7%	18.3%	32.3%
	092304	7,399	18.5%	18.3%	17.2%	12.7%
	092600	3,608	10.0%	9.2%	16.4%	31.9%
	092800	11,269	7.2%	11.8%	16.5%	31.5%
	092500	4,258	19.8%	15.2%	12.1%	22.2%
	092900	3,464	11.8%	13.2%	15.4%	34.1%
	093104	3,885	14.4%	12.2%	28.8%	23.7%
	093000	9,614	12.3%	15.4%	21.7%	18.3%
	093101	4,332	15.7%	12.7%	14.7%	14.6%
<i>Glendale Subtotal</i>		<i>50,300</i>	<i>12.5%</i>	<i>13.9%</i>	<i>18.0%</i>	<i>23.6%</i>
<b>Phoenix</b>						
	107101	4,214	14.1%	12.6%	6.6%	9.1%
	107102	5,289	7.6%	14.0%	15.9%	28.1%
	109200	4,724	6.6%	14.4%	13.9%	27.6%
	109100	9,085	9.7%	11.4%	10.3%	25.6%
	110200	469	11.1%	29.6%	0.0%	43.3%
	110300	8,170	9.9%	15.9%	14.0%	29.7%
	109300	4,707	9.7%	13.6%	10.1%	21.6%
	110100	7,592	6.9%	15.5%	13.5%	28.0%
	112100	4,204	7.0%	18.3%	17.6%	32.9%
	112000	1,856	20.0%	16.8%	7.7%	17.2%
<i>Phoenix Subtotal</i>		<i>50,310</i>	<i>9.3%</i>	<i>14.6%</i>	<i>12.4%</i>	<i>25.8%</i>
<b>Total</b>		<b>138,143</b>	<b>11.6%</b>	<b>14.3%</b>	<b>14.7%</b>	<b>20.1%</b>
<b>City of Peoria</b>		<b>108,364</b>	<b>18%</b>	<b>13.1%</b>	<b>7.6%</b>	<b>5.2%</b>
<b>City of Glendale</b>		<b>218,812</b>	<b>10%</b>	<b>11.9%</b>	<b>10.9%</b>	<b>11.7%</b>
<b>City of Phoenix</b>		<b>1,321,045</b>	<b>11%</b>	<b>12.7%</b>	<b>11.6%</b>	<b>15.5%</b>
<b>Maricopa County</b>		<b>3,072,149</b>	<b>15%</b>	<b>12.1%</b>	<b>9.3%</b>	<b>11.6%</b>

Source: US Census (2000)

Exhibit 2.16 Age 60 Years and Older



Approximately 15 percent of the population of Maricopa County is 60 years of age or older. The percentage of people in the Study Area 60 years of age and older is 11.6 percent.

### *Poverty*

The poverty status of households is defined as those whose median household income is at or below the Department of Health and Human Services poverty guideline. The poverty thresholds are revised annually to allow for changes in the cost of living. It is important to note that the poverty thresholds are the same for all parts of the country -- they are not adjusted for regional, state or local variations in the cost of living. Exhibit 2.17 graphically depicts the percentage of population within the Study Area by Census Tract that is considered in poverty.

Low-income households typically have limited car availability and are therefore more transit dependent. Lack of affordable and convenient transportation connections to jobs remains one of the major causes of unemployment and therefore poverty. Public transit can play an important role in the improvement of job accessibility for people from low-income households.

Within Maricopa County, 11.6 percent of the households are considered in poverty. The percent of households within the Study Area in poverty is 20.1 percent. The poverty level for the Study Area portions of each of the cities is greater than that of the respective cities. Both the Glendale and Phoenix portions of the Study Area had percentages of the population in poverty greater than that of the County, with 23.6 percent and 25.8 respectively, while the Peoria portion of the Study Area had a lower percentage of people in poverty with 7.8 percent.

### *Mobility Disability*

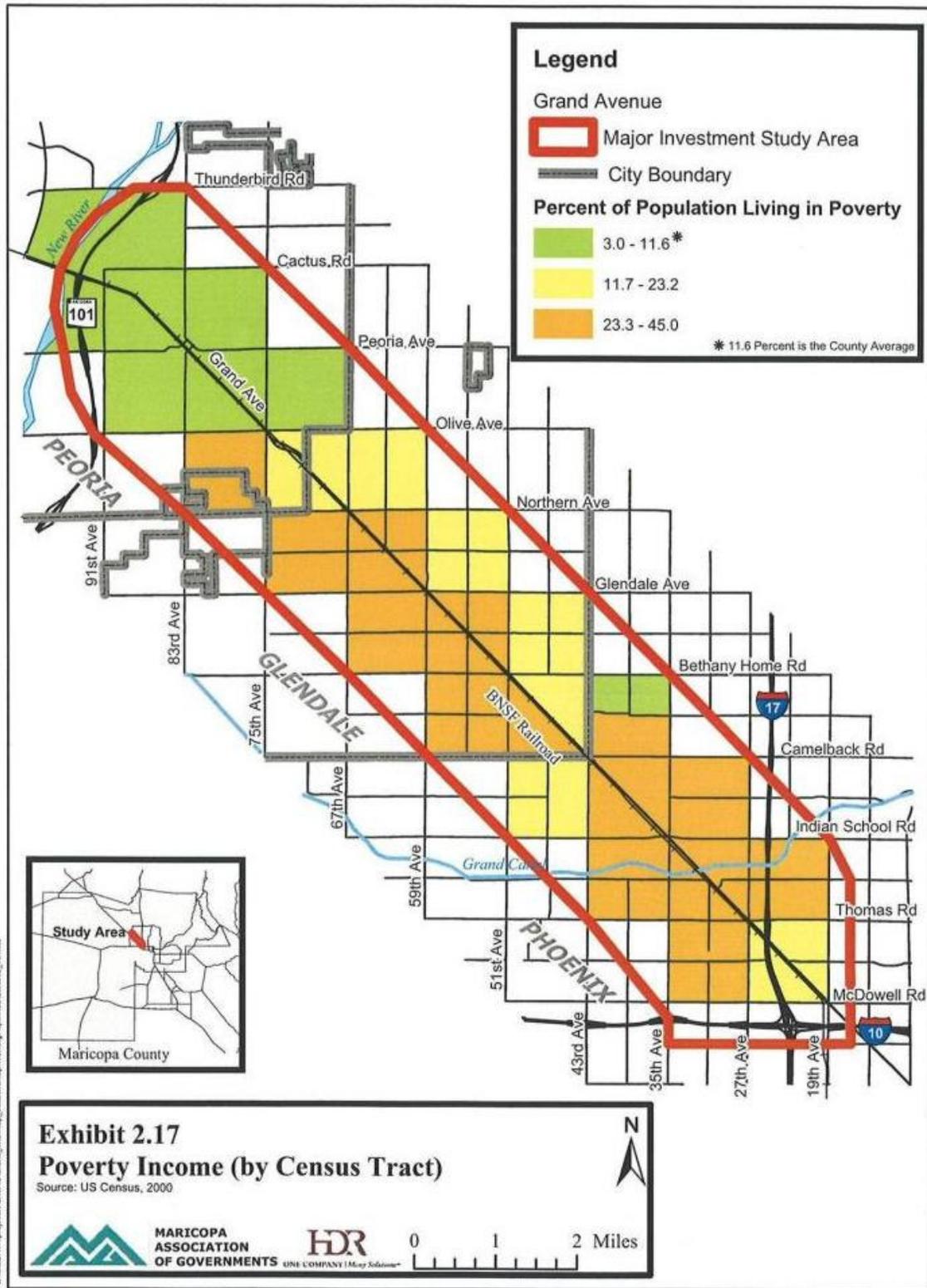
For this Study mobility limitations are derived from the physical and going-outside-of-home categories for those age five and over (information for those under five years of age is not collected). Exhibit 2.18 graphically depicts the percentage of population within the Study Area by Census Tract that have mobility disabilities as defined above.

Within Maricopa County, the percentage of people reporting disabilities as described above is 12.1 percent. Within the Study Area, the percentage of people with mobility or outside of home limitations is 14.3 percent. The percent of people with mobility disabilities for the Study Area portions of the cities Glendale, Peoria and Phoenix were 13.9 percent, 14.4 percent and 14.6 percent, respectively. For all three cities, the percent of people with mobility or going outside of home limitations is greater in the Study Area portion of each city than for the respective city as a whole.

### *Female Head of Household*

The Female Head of Household category represents those households with a female householder and no husband present with (her) own children less than 18 years of age. Exhibit 2.19 graphically depicts the percentage of households within the Study Area by Census Tract that are headed by a female with children under 18 years of age.

## Exhibit 2.17 Poverty Income



## Exhibit 2.18 Mobility Disability

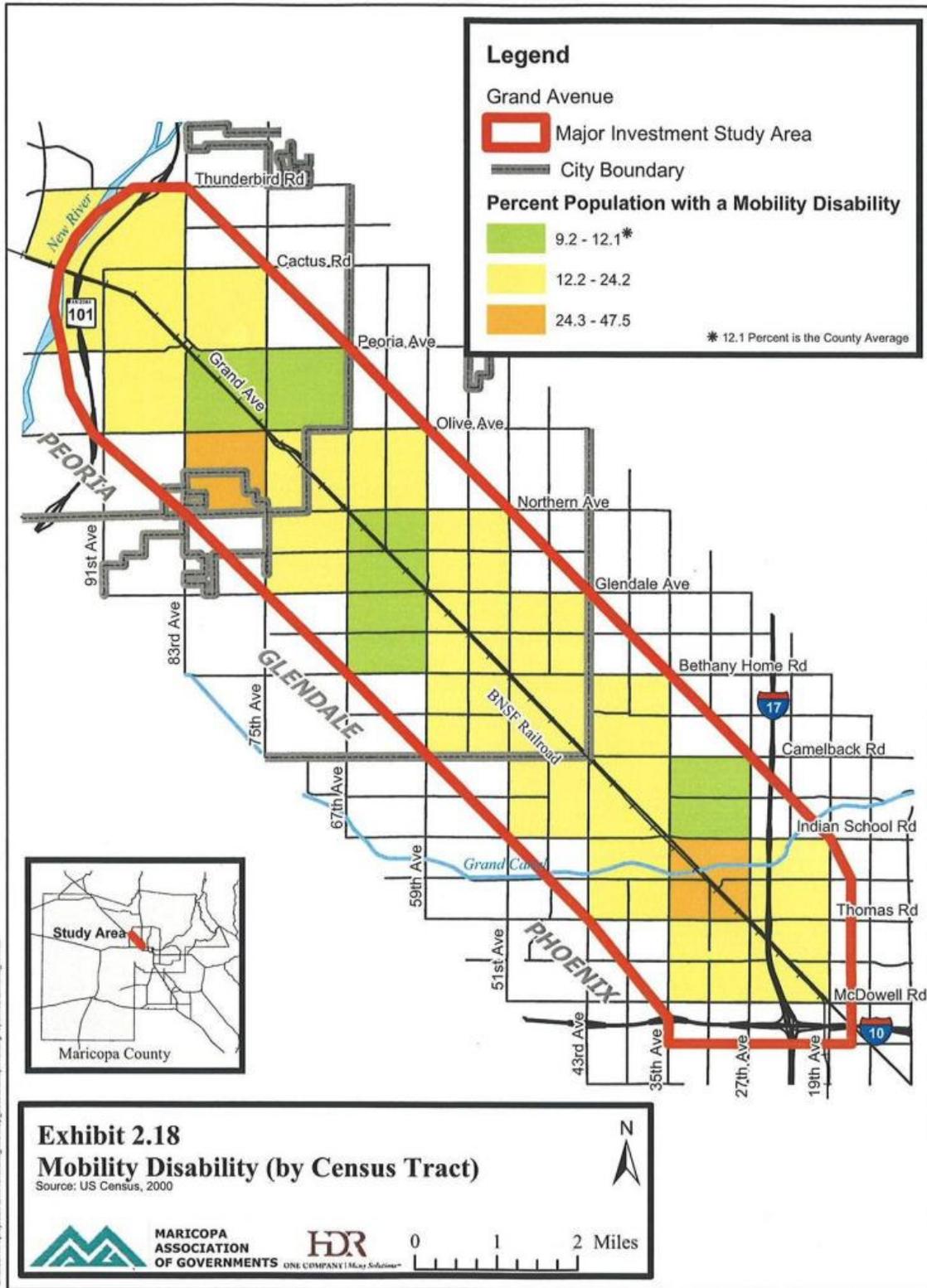
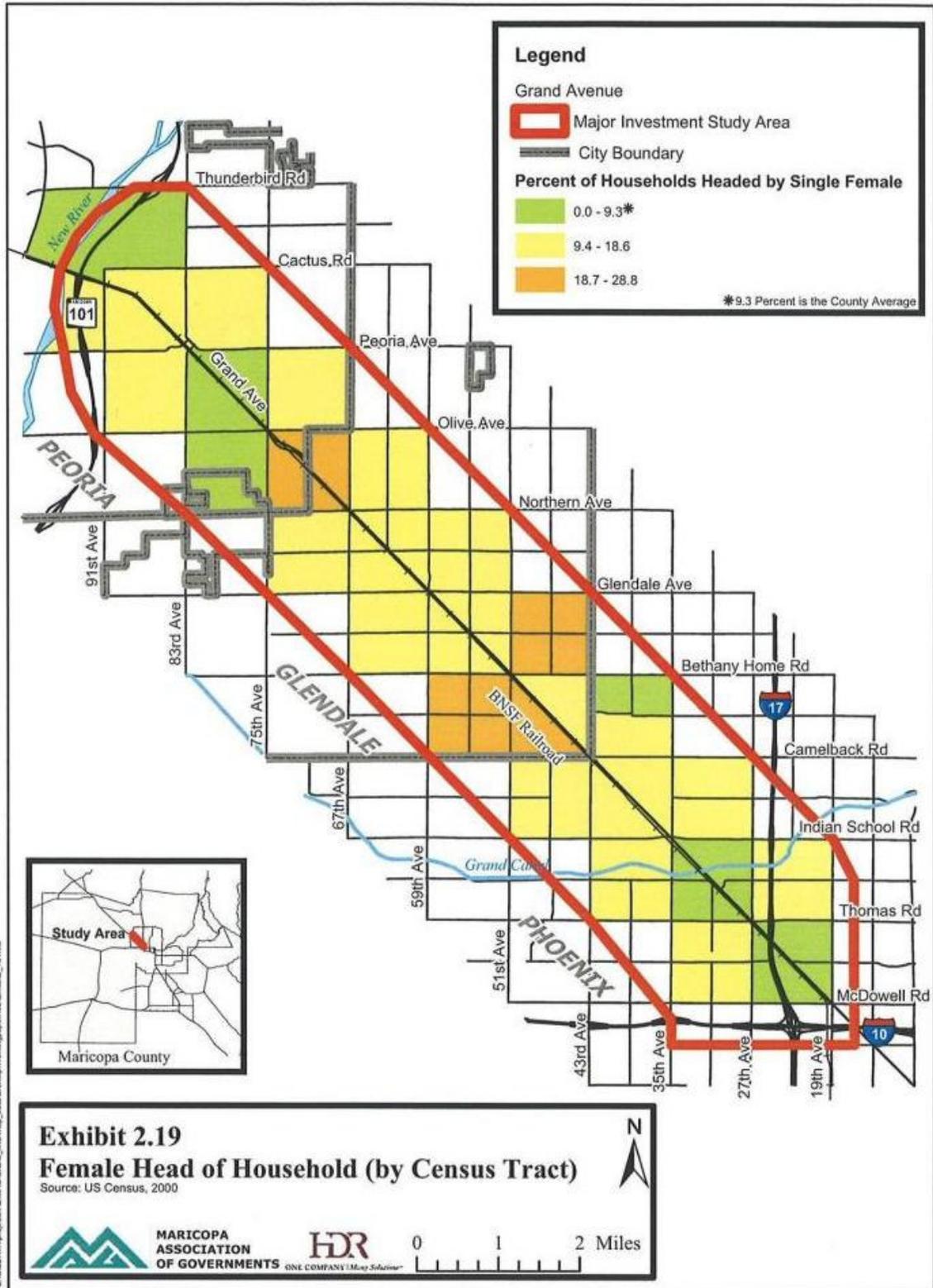


Exhibit 2.19 Female Head of Household



The Study Area percentage of female heads of household is 14.7, compared to Maricopa County where female heads of household represent 9.3 percent of the households.

Glendale's portion of the Study Area contains the highest percentage of female heads of households with 18 percent, followed by Peoria with 13.3 percent, and Phoenix with 12.4 percent.

### *Educational Attainment*

Educational attainment includes the populations of people, over 25 years of age, having attained various levels of education. Three levels were identified for this Study, namely: persons without a high school diploma, persons with a high school education, and, persons with higher education. Exhibit 2.20 summarizes the percentage of population over twenty-five years of age within the Study Area by Census Tract that do not have a high school diploma. Exhibit 2.21 graphically depicts the percent of the population over twenty-five years of age without a high school diploma.

For Maricopa County as a whole, 17.5 percent of the population is without a high school diploma. Within the Study Area the number without a high school diploma is nearly double the County percentage at 32.1 percent. The Phoenix portion of the Study Area has the greatest percentage of the population without a high school diploma at 42 percent, followed by Glendale with 34.7 percent. Peoria's percentage of the population without a high school diploma is 17.2 percent, slightly below that of Maricopa County.

### *Automobile Availability*

The 2000 Census reported the number of zero car households. Exhibit 2.22 summarizes the percentage of households that have vehicles available. Exhibit 2.23 graphically depicts the percentage of households where there are no vehicles available.

Within the Study Area the number of zero car households is 12.5 percent. In Maricopa County, zero car households represent seven percent of all households. The Glendale portion of the Study Area reported 16.2 percent of the households with no vehicle present, followed by Phoenix with 12.5 percent and Peoria at 7.3 percent. For all three cities, the percent of households without vehicles is greater for the Study Area portion of each city than for the respective city as a whole.

## **2.6.3 Socioeconomic Factors**

Exhibit 2.24 presents a summary of the socioeconomic factors for the Study Area that exceed the Maricopa County average.

The following points highlight the environmental justice populations identified within the Study Area:

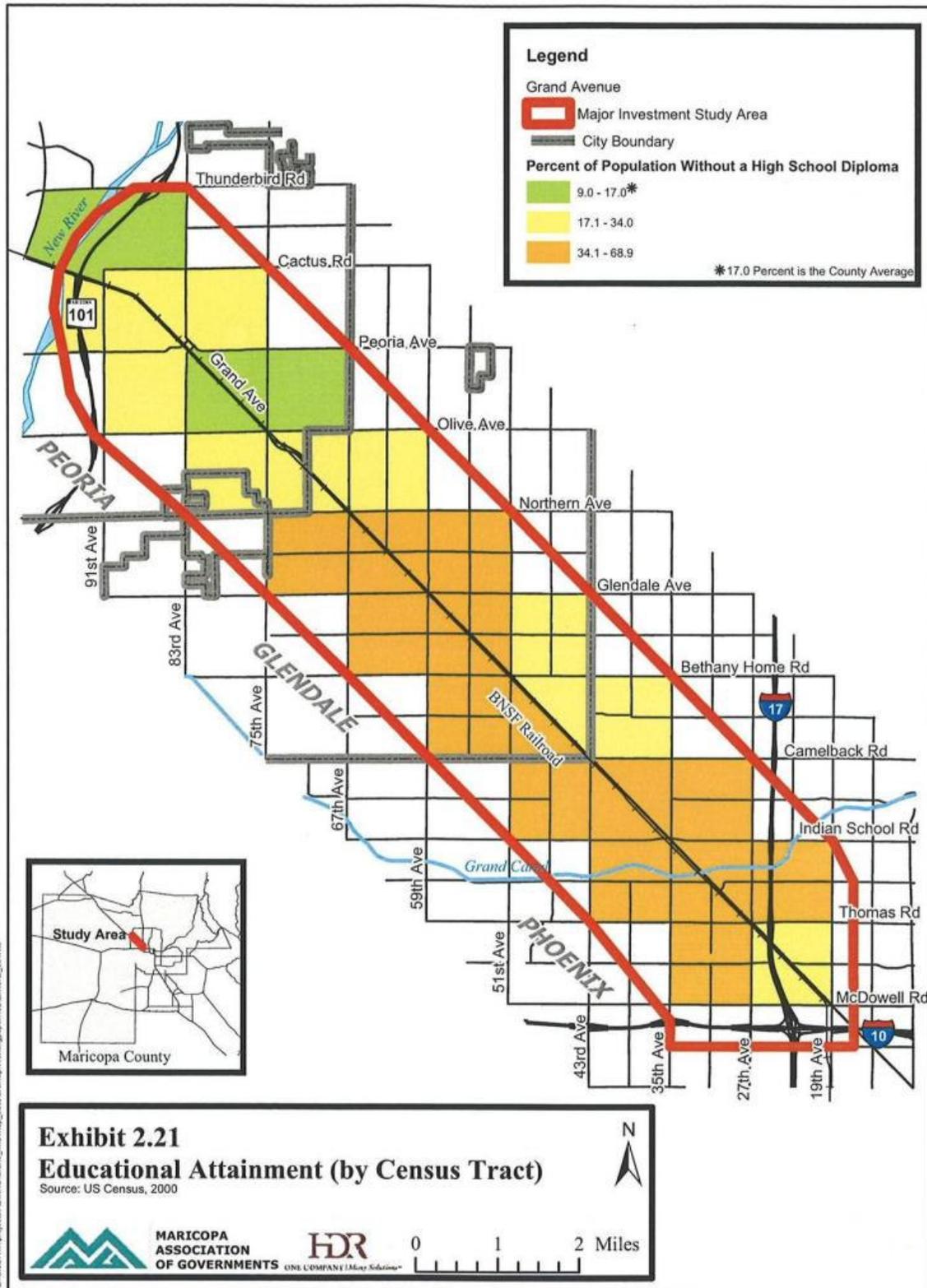
- The minority population in the Study Area is 56 percent, compared to Maricopa County which has a minority population of 34 percent.
- Hispanics comprise 80 percent of the minority population in the Study Area.

## Exhibit 2.20 Educational Attainment Summary

SAZs	Tract	Population 25 years and over: Total	Persons without a High School Diploma	Percent without a High School Diploma	Persons with High School Education	Percent with High School Education	Persons with Higher Education	Percent with Higher Education
<b>Peoria</b>								
	071507	3,958	355	9%	1,231	31%	2,372	60%
	071906	3,111	640	21%	915	29%	1,556	50%
	071904	4,220	684	16%	1,498	35%	2,038	48%
	071908	4,183	753	18%	1,352	32%	2,078	50%
	071910	3,987	835	21%	1,278	32%	1,874	47%
	071911	1,423	168	12%	403	28%	852	60%
	092704	58	13	22%	15	26%	30	52%
	092310	1,620	422	26%	441	27%	757	47%
<i>Peoria Subtotal</i>		<i>22,560</i>	<i>3,870</i>	<i>17%</i>	<i>7,133</i>	<i>32%</i>	<i>11,557</i>	<i>51%</i>
<b>Glendale</b>								
	092705	1,149	453	39%	271	24%	425	37%
	092304	4,562	957	21%	1,270	28%	2,335	51%
	092600	1,984	692	35%	621	31%	671	34%
	092800	5,543	2,819	51%	1,291	23%	1,433	26%
	092500	2,537	895	35%	751	30%	891	35%
	092900	1,853	911	49%	485	26%	457	25%
	093104	2,201	841	38%	664	30%	696	32%
	093000	5,399	1,533	28%	1,683	31%	2,183	40%
	093101	2,662	582	22%	942	35%	1,138	43%
<i>Glendale Subtotal</i>		<i>27,890</i>	<i>9,683</i>	<i>35%</i>	<i>7,978</i>	<i>29%</i>	<i>10,229</i>	<i>37%</i>
<b>Phoenix</b>								
	107101	2,341	570	24%	765	33%	1,006	43%
	107102	2,738	853	31%	904	33%	981	36%
	109200	2,405	1,005	42%	720	30%	680	28%
	109100	4,730	1,960	41%	1,393	29%	1,377	29%
	110200	319	173	54%	55	17%	91	29%
	110300	4,727	1,754	37%	1,131	24%	1,842	39%
	109300	2,392	1,090	46%	638	27%	664	28%
	110100	3,737	2,133	57%	808	22%	796	21%
	112100	2,025	1,395	69%	410	20%	220	11%
	112000	1,240	255	21%	380	31%	605	49%
<i>Phoenix Subtotal</i>		<i>26,654</i>	<i>11,188</i>	<i>42%</i>	<i>7,204</i>	<i>27%</i>	<i>8,262</i>	<i>31%</i>
<b>Total Study Area</b>		<b>77,104</b>	<b>24,741</b>	<b>32%</b>	<b>22,315</b>	<b>29%</b>	<b>30,048</b>	<b>39%</b>
<b>City of Peoria</b>		<b>70,583</b>	<b>8,244</b>	<b>12%</b>	<b>19,771</b>	<b>28%</b>	<b>42,568</b>	<b>60%</b>
<b>City of Glendale</b>		<b>129,927</b>	<b>22,909</b>	<b>18%</b>	<b>33,278</b>	<b>26%</b>	<b>73,740</b>	<b>57%</b>
<b>City of Phoenix</b>		<b>795,297</b>	<b>185,968</b>	<b>23%</b>	<b>181,850</b>	<b>23%</b>	<b>427,479</b>	<b>54%</b>
<b>Maricopa County</b>		<b>1,934,957</b>	<b>338,591</b>	<b>17%</b>	<b>446,445</b>	<b>23%</b>	<b>1,149,921</b>	<b>59%</b>

Source: US Census (2000)

## Exhibit 2.21 Educational Attainment

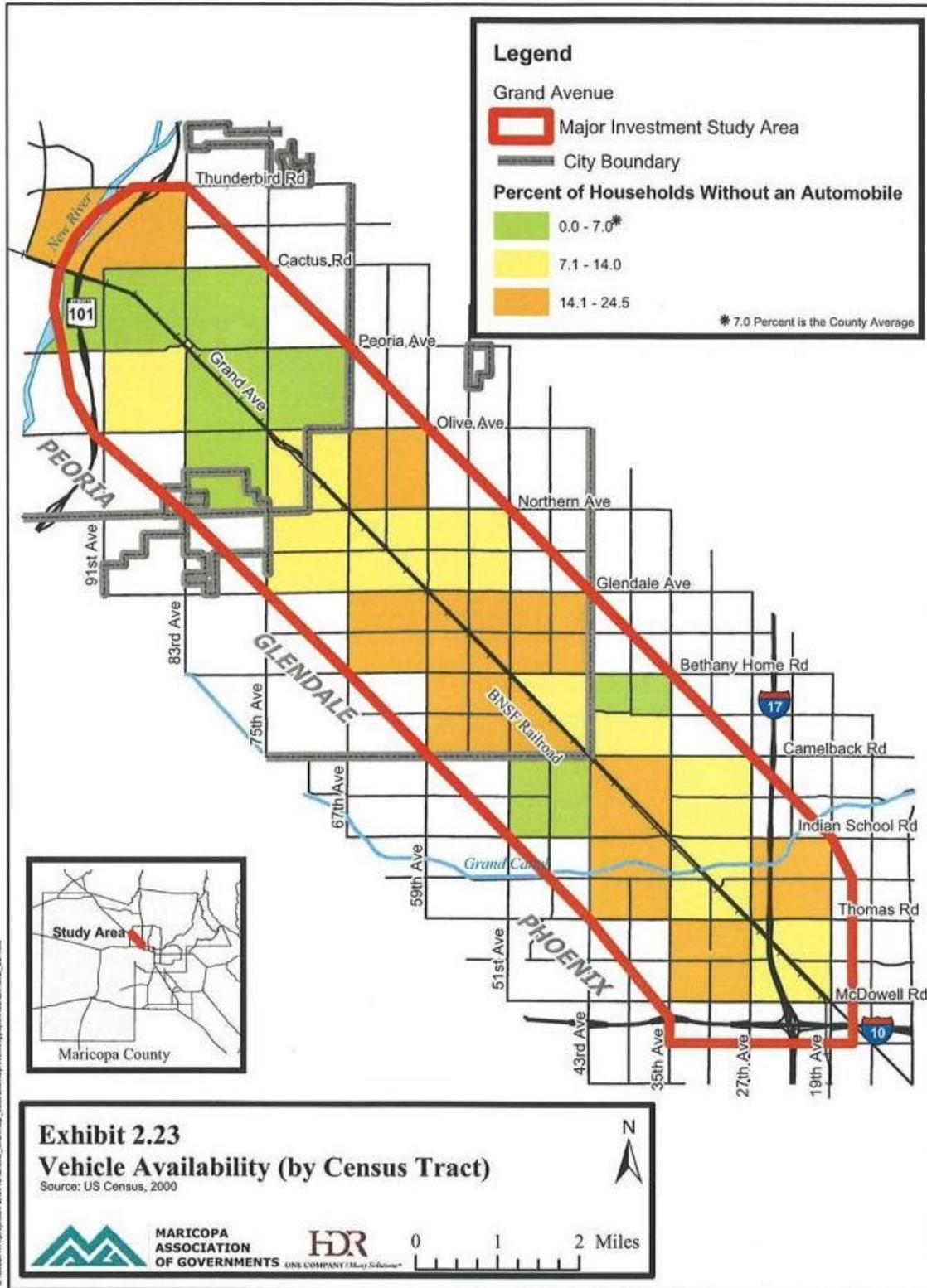


## Exhibit 2.22 Vehicle Availability Summary

Geography Id	Tract	Households	Percent Households with No Vehicle	Percent Households with 1 Vehicle	Percent Households with 2 Vehicles	Percent Households with 3+ Vehicles
<b>Peoria</b>						
	71507	2,313	14.9%	40.5%	34.2%	10.3%
	71906	1,759	8.2%	33.8%	38.5%	19.5%
	71904	2,347	4.0%	35.9%	40.2%	19.9%
	71908	2,394	5.5%	38.6%	39.5%	16.4%
	71910	2,224	3.6%	34.3%	39.3%	22.8%
	71911	784	6.1%	17.3%	53.4%	23.1%
	92704	35	0.0%	37.1%	62.9%	0.0%
	92310	1,258	8.7%	52.2%	35.3%	3.8%
<i>Peoria Subtotal</i>		13,114	7.3%	37.1%	39.0%	16.6%
<b>Glendale</b>						
	92705	824	10.9%	54.4%	29.6%	5.1%
	92304	3,515	17.6%	55.1%	23.5%	3.8%
	92600	1,229	13.3%	56.3%	25.5%	4.9%
	92800	3,188	20.1%	46.2%	23.0%	10.7%
	92500	1,495	13.1%	50.2%	24.8%	11.9%
	92900	1,113	24.5%	40.1%	23.8%	11.6%
	93104	1,415	16.7%	56.3%	22.8%	4.2%
	93000	3,380	15.6%	45.4%	32.5%	6.4%
	93101	1,663	8.7%	47.8%	32.0%	11.5%
<i>Glendale Subtotal</i>		17,822	16.2%	49.8%	26.4%	7.6%
<b>Phoenix</b>						
	107101	1,222	6.2%	37.6%	42.6%	13.7%
	107102	1,654	12.9%	50.7%	23.3%	13.1%
	109200	1,565	18.5%	48.8%	26.4%	6.3%
	109100	2,526	7.3%	47.5%	30.1%	15.0%
	110200	171	12.3%	62.0%	25.7%	0.0%
	110300	2,770	17.9%	42.7%	30.5%	8.9%
	109300	1,122	3.6%	27.4%	51.5%	17.6%
	110100	1,903	15.7%	42.2%	28.0%	14.1%
	112100	958	17.4%	27.3%	37.4%	17.8%
	112000	765	10.3%	47.5%	34.8%	7.5%
<i>Phoenix Subtotal</i>		14,656	12.7%	42.9%	32.1%	12.3%
<b>Total Study Area</b>		45,592	12.5%	43.9%	31.9%	11.7%
<b>City of Peoria</b>		39,245	5.2%	32.5%	46.2%	16.1%
<b>City of Glendale</b>		75,671	7.5%	35.7%	40.5%	16.3%
<b>City of Phoenix</b>		465,864	8.9%	39.5%	37.9%	13.7%
<b>Maricopa County</b>		1,132,886	7.0%	38.7%	40.1%	14.3%

Source: US Census (2000)

## Exhibit 2.23 Vehicle Availability



## Exhibit 2.24 Summary of Socioeconomic Factors Exceeding County Average

		Census Tracts with Percent Population Greater than that of Maricopa County for:							Total of
		TITLE VI/ENVIRONMENTAL JUSTICE CRITERIA					Households	Without a	
		Age 60	Mobility Disability	Female	Poverty	Minority			
Maricopa County		15%	12%	9%	12%	34%	7%	17%	0
<b>Peoria</b>									
	071507	36%	18%				15%		3
	071906		16%	12%		39%	8%	21%	5
	071904			18%		36%			2
	071908		14%	15%		35%		18%	4
	071910		13%	11%		39%		21%	4
	071911								0
	092704	17%	48%		45%	83%		22%	5
	092310		18%	24%	20%	42%	9%	26%	6
Peoria portion of Study Area			14%	13%		34%	7%		4
<b>Glendale</b>									
	092705		16%	18%	32%	63%	11%	39%	6
	092304	19%	18%	17%	13%	35%	18%	21%	7
	092600			16%	32%	57%	13%	35%	5
	092800			16%	32%	75%	20%	51%	5
	092500	20%	15%	12%	22%	59%	13%	35%	7
	092900		13%	15%	34%	84%	25%	49%	6
	093104		12%	29%	24%	55%	17%	38%	6
	093000		15%	22%	18%	51%	16%	28%	6
	093101	16%	13%	15%	15%	51%	9%	22%	7
Glendale portion of Study Area			14%	18%	24%	58%	16%	35%	6
<b>Phoenix</b>									
	107101		13%			53%		24%	3
	107102		14%	16%	28%	64%	13%	31%	6
	109200		14%	14%	28%	76%	18%	42%	6
	109100			10%	26%	71%	7%	41%	5
	110200		30%		43%	64%	12%	54%	5
	110300		16%	14%	30%	70%	18%	37%	6
	109300		14%	10%	22%	75%		46%	5
	110100		15%	13%	28%	86%	16%	57%	6
	112100		18%	18%	33%	88%	17%	69%	6
	112000	20%	17%		17%	43%	10%	21%	6
Phoenix portion of Study Area			15%	12%	26%	72%	13%	42%	6
<b>Study Area</b>			14%	15%	20%	57%	13%	32%	6
<b>City of Peoria</b>		18%	13%						2
<b>City of Glendale</b>				11%	12%	35%	8%	18%	5
<b>City of Phoenix</b>			13%	12%	16%	44%	9%	23%	6

Note: Shaded cells indicate that the value is at or below the County average.

Source: US Census (2000)

- Three-quarters of the Census Tracts that make up the Study Area exceed the County average for households in poverty.
- Three-quarters of the Census Tracts that make up the Study Area exceed the County average for female heads of households with own children under 18 years of age.
- The percent of the Study Area population without a high school diploma (32 percent) is nearly double that of Maricopa County overall.
- Vehicle availability for households is a problem throughout the Study Area; with the percentage of households with no vehicle available (13 percent) nearly double that of Maricopa County.
- Twenty-two of the twenty-seven Census Tracts that comprise the Study Area have five or more environmental justice populations above the County average. It is anticipated that transportation improvement projects within the corridor will serve and benefit the residents regardless of their census population classification. Further evaluation will be conducted as part of ADOT's project-level design concept report process.

## 2.7 Potential Environmental Issues

Hazardous materials are regulated under the authority of the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund; and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

Hazardous waste is a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources and may come in many forms, including liquids, solids, gases, and sludges. Sites listed within the Study Area corridor are at various levels of federal and/or state remedial concern.

The environmental concerns associated with hazardous materials necessitate that sites where they are handled, stored, transported and or used be documented. A search of over forty environmental databases was conducted by Environmental Data Resources, Inc. in April, 2004 (Appendix B includes a list of the specific databases consulted). A summary of the findings of this database search is shown in Exhibit 2.25. Exhibit 2.26 shows the location of the listed sites within the Study Area.

Due to the number of listed hazardous sites, an initial site assessment (ISA) should be conducted when future projects are identified that may affect a listed hazardous sites. The ISA would confirm or deny the presence of hazardous materials at specific locations.

## 2.8 Cultural Resources

Several state and federal laws have been enacted to provide protection for historic and archaeological resources that are associated with important past events, themes, and people; and that are representative of periods and types of architecture, possess high artistic value; or that are likely to yield valuable information about the past. Specifically, potential cultural resources must

## Exhibit 2.25 Hazardous Material Sites Summary

<b>FEDERAL ASTM STANDARD</b>	<b>Number of Sites</b>	<b>Search Radius (miles)</b>
CERCLIS	13	0.50
CERC-NFRAP	46	0.25
CORRACTS	1	1.00
RCRIS-TSD	6	0.50
RCRIS Large Quantity Generator	2	0.25
RCRIS Small Quantity Generator	178	0.25
ERNS	1	TP*
The following Federal ASTM Standard databases were searched and no records returned: NPL and Proposed NPL		
<b>STATE ASTM STANDARD</b>		
SPL	3	1.00
State Haz. Waste	111	-
LUST	168	0.25
UST	254	0.25
AZ WQARF	5	1.00
The following State ASTM Standard databases were searched and no records returned: State Landfill, Indian UST, Indian LUST		
<b>FEDERAL ASTM SUPPLEMENTAL</b>		
FINDS	170	TP*
PADS	3	TP*
TRIS	1	TP*
FTTS	1	TP*
The following Federal ASTM Supplemental databases were searched and no records returned: CONSENT, ROD, Delisted NPL, HMIRS, MLTS, MINES, NPL Liens, US Brownfields, Indian Reservations, DOD, RAATS, TSCA, SSTS		
<b>STATE OR LOCAL ASTM SUPPLEMENTAL</b>		
AZ Spills	12	TP*
The following State or Local ASTM Supplemental databases were searched and no records returned: AST, AZ DOD		
*TP – Target Property		

**Exhibit 2.26 Hazardous Material Sites**



be evaluated under the National Historic Preservation Act of 1966, the Archaeological Resources Protection Act of 1979, and the Arizona Historic Preservation Act of 1990 to ensure the protection of our cultural heritage.

A preliminary inventory was performed that identified previously recorded cultural resources. Cultural resource surveys were reviewed from a variety of sources, including: Arizona Department of Transportation (ADOT), the Arizona State Museum, Arizona State University, the State Historic Preservation Office (SHPO), and the Pueblo Grande Museum. Based on these sources previous surveys and known archaeological sites within the Study Area were identified. The number and type of resources are summarized in Exhibit 2.27. A detailed inventory of resources identified is included in Appendix C.

### Exhibit 2.27 Types, Frequencies, and NRHP Status of Previously Recorded Cultural Resources

Site Type	Total	NRHP Status					State Eligible
		Listed	Eligible	Potentially Eligible	Not Eligible	Not Evaluated/unknown	
Prehistoric Habitation	2		1			1	
Prehistoric Canal Segments	14					14	
Historic Canal Segments	2					2	
Historic Structures/Foundations	225	8	19	2	56	139	1
Historic Transportation (Structures/Routes)	5		1		3	1	
Historic District	4	1	1	2			
<b>TOTAL</b>	<b>252</b>	<b>9</b>	<b>22</b>	<b>4</b>	<b>59</b>	<b>157</b>	<b>1</b>

When future projects are identified that may affect historic properties that are National Register of Historic Places (NRHP) eligible avoidance may be recommended. Mitigation of construction impacts through testing and data recovery may be considered as necessary.

## 2.9 Redevelopment Opportunities and Constraints

The 1999 Grand Avenue Major Investment Study Environmental Overview (Logan Simpson Design, 1999) characterized the majority of the visual landscape of the Grand Avenue Corridor as “urban industrial/commercial”. This visual landscape unit is characterized by built features, a lack of vegetation, and an abundance of structures and warehouses, and is further described as being extremely visually cluttered. Traveling west along Grand Avenue, where the railroad overpass occurs between Glendale and Peoria, the visual landscape changes to a “rural industrial/commercial” unit. Here the landscape of agricultural fields, undeveloped, and/or vacant lots becomes more common, and overhead utilities and signage are more scattered providing a more rural character.

## 2.9.1 Billboards

The number of commercial outdoor advertising signs contributes to the visual clutter along Grand Avenue. Billboards can also represent an impediment to redevelopment, as they are costly for a municipality to acquire and remove. A total of 98 billboards were identified in the Grand Avenue Study Area, with 17 of these located in Peoria, 30 located in Glendale and the remaining 51 found in Phoenix. Exhibit 2.28 shows the approximate location of billboards along Grand Avenue in the Study Area.



*An example of a billboard found along Grand Avenue.*

This section of the report specifically addresses billboards that are intended to advertise a business, commodity, service, entertainment, product, or attraction sold, offered, or existing elsewhere than on the property where the sign is located.

Billboards are constitutionally protected under the First Amendment (453 U.S. 490, *Metromedia Inc. v. City of San Diego*). Arizona Revised Statutes allows a municipality to acquire by purchase or condemnation private property for the removal of nonconforming uses and structures. A municipality may not discontinue a non-conforming billboard without paying just compensation, or allowing the billboard to be relocated to a comparable site (with removal, relocation and construction at the municipality's expense (ARS 9-462.02. Nonconformance to regulations; outdoor advertising change; enforcement).

Each of the Study Area jurisdictions regulates the use of billboards through their respective zoning ordinances. The City of Peoria and Glendale allow the existing billboards, when properly maintained, as non-conforming uses. Phoenix permits billboards in the City as both conforming and non-conforming uses.

Nonconforming uses are land uses or an activity that existed legally prior to an ordinance change that no longer permits the use, and typically result from amendments to city code or rezoning. According to state law, the purpose for allowing nonconforming uses is to prevent the injustice of forcing retroactive compliance. State law also specifies that the right to continue a nonconforming use ceases once the use is utilized for a different purpose, regardless of whether a municipality offers compensation.

Peoria no longer allows billboards to be placed in the City. Existing billboards are allowed to continue as a non-conforming use, provided that they are maintained in reasonable shape. Billboards that are greater than 50 percent destroyed must be razed and cannot be replaced.

Glendale's zoning ordinance does not allow the construction of new billboards within the City, unless the person desiring placement of the new billboard submits evidence that a billboard has been removed.



Phoenix allows billboards, but only in zoning districts A-1, A-2, and C-3. As of 1999 there were over 2,250 billboards in Phoenix; of which 1,073 are nonconforming<sup>1</sup>.

## 2.9.2 Overhead Utilities

Also contributing to the visual clutter discussed in the 1999 Environmental Overview are overhead utilities found in the corridor. The 1999 Grand Avenue Major Investment Study identified the location of major utilities throughout the Grand Avenue corridor. This section discusses the impact of overhead utilities along Grand Avenue.

Undergrounding (i.e. removing utility poles and burying wires and equipment in conduits or pipes) is the most comprehensive and effective method of reducing the visual impact of utility wires. Improving the aesthetic image of the Grand Avenue corridor may also result in attracting new businesses and stimulating economic development, assisting ongoing redevelopment efforts.



*Utility poles and wires along the north side of Grand Avenue at Northern Avenue.*

Major utility providers in the corridor identified in the 1999 Grand Avenue Major Investment Study include the following:

- Arizona Public Service: 230 kV overhead power and smaller
- Salt River Project: 69 kV and smaller
- Salt River Project Water and Salt River Valley Users Association: irrigation lines and gates
- MCI-WorldCom fiber optic
- Burlington Northern Santa Fe Railroad
- Qwest Telephone
- City of Peoria, Glendale, and Phoenix: water, sewer, and storm drain
- Southwest Gas: natural gas lines
- Flood Control District of Maricopa County

Undergrounding of long sections of overhead utilities would have a positive visual affect on the Grand Avenue corridor. This is evidenced with the several grade separation projects that have been completed, such as Thomas Road, where the utilities have been relocated and/or undergrounded.

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<sup>1</sup> Arizona State Senate, 44th Legislature, First Regular Session. Minutes Of Committee On Government & Environmental Stewardship, March 22, 1999.

Various methods for funding utility relocation exist. The Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) provides transportation enhancement funds for utility burial or relocation under the categories of landscaping and scenic beautification. Other options related to the undergrounding of utilities may include identifying business/employment districts where assessment districts might be considered to fund such utilities. The development of these options must be responsive to legal issues related to the collection, holding and use of any such funds.

East of 31<sup>st</sup> Avenue the corridor is largely free of overhead utilities other than strung streetlights. Streetlights which are strung with a single cable between poles impose less clutter on the visual landscape than power lines and other utilities strung with multiple cables between poles. This is evidenced along the eastern portion of the corridor where there are few overhead utilities and the power for streetlights is underground. Grand Avenue grade separation improvements have included underground streetlight power, resulting in a less cluttered, and more visually attractive landscape.

230 kV overhead power runs along the southern side of Grand Avenue from 31<sup>st</sup> Avenue where it enters from the south, to the municipal border of Peoria where it turns west and out of the Study Area. Where Grand Avenue grade separation improvements have been completed this power is elevated above the separations.

Opportunities for undergrounding and consolidating service primarily exist along the north side of Grand Avenue. As alternatives are identified, opportunities for consolidating and undergrounding utilities will be further explored.

### **Redevelopment Opportunities**

Numerous efforts have been made to revitalize the Grand Avenue corridor over the past several decades, however, numerous vacant parcels continue to exist. In addition to reducing tax income for the cities in which they exist, vacant and abandoned parcels impose other economic and social costs on localities and neighborhoods by reducing property values, creating blight, and becoming targets for vandalism and criminal activity.

The State of Arizona, through Growing Smarter legislation first adopted in 1998, and Growing Smarter Plus in 2000, promotes infill development. Both versions promote infill development by identifying infill locations and special incentives, such as expediting zoning and processing, waiving municipal fees, and providing relief from development standards (Arizona Department of Commerce, 2003).

Within the Grand Avenue Study Area, there are over 120 acres of vacant parcels with frontage along Grand Avenue.

As Grand Avenue improvement alternatives are considered, parcels within 500 feet of Grand Avenue will be more thoroughly investigated to identify redevelopment opportunities.

## 3.0 EXISTING, PROGRAMMED AND PLANNED FACILITIES

### 3.1 Introduction

Originally constructed in the late 1800's, Grand Avenue served as a major connection between the agricultural communities of the West Valley and the business community in downtown Phoenix. With the introduction of rail activity parallel to Grand Avenue, the West Valley continued to develop and began to transform from an agriculture-centered region to an industrial/agriculture-centered region. This change in land use and economic generators, along with the population growth that the West Valley began to experience, has led to increased congestion along Grand Avenue, both in terms of motorized and non-motorized transportation.

Over the years, Grand Avenue has ceased to produce the benefits it was originally intended to provide. The diagonal orientation of Grand Avenue and the associated skewed and six-legged intersections it produces have resulted in excessive signal timing cycle delays at north-south and east-west arterials. In addition, delays and congestion are magnified by delays due to train activity (at-grade railroad crossings) with respect to the BNSF Railway. These delays often result in heightened driver irritation and potential blockage of emergency vehicle routes.

This chapter seeks to provide a review of existing roadway and traffic conditions as well as documentation pertaining to transit, bicycle, and pedestrian facilities and usage within the Study Area (See Exhibits 3.1 and 3.2). (The Study Area parallels Grand Avenue from 19<sup>th</sup> Avenue in the southeast to SR 101L in the northwest.) For purposes of this Study, "existing" information is based on data from December 2004. Future traffic conditions are also documented.

Below is a summary of the existing roadway, railroad and traffic conditions within the Study Area and the interrelationships of existing multi-modal elements.

#### Existing Roadway and Railroad Conditions

##### **Grand Avenue**

- Three travel lanes in each direction east of 83<sup>rd</sup> Avenue with raised median
- Two travel lanes in each direction west of 83<sup>rd</sup> Avenue with raised median
- Right-of-way width of 90 to 100 feet
- Access control at grade-separations and on railroad side only
- 18 traffic signals along Grand Avenue

##### **BNSF**

- Railway parallels Grand Avenue within Study Area
- Spur tracks cross Grand Avenue south of Northern Avenue

##### **Six-Legged Intersections**

- 19<sup>th</sup> Avenue / McDowell Road/ Grand Avenue
- 35<sup>th</sup> Avenue / Indian School Road / Grand Avenue (still operates as six-legged)

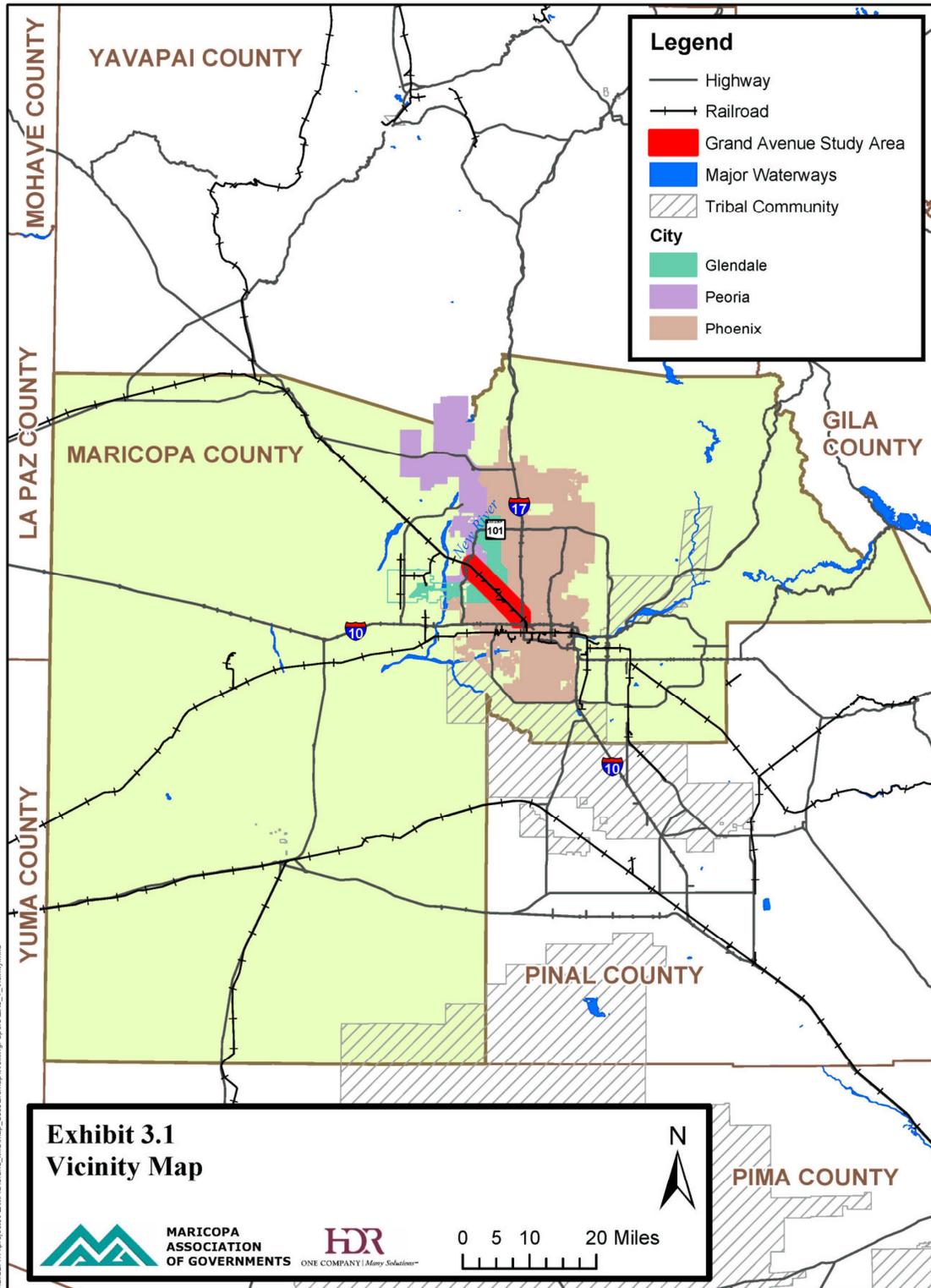
##### **Grade Separations**

- Grand Ave over 27<sup>th</sup> Avenue / Thomas Road
- Indian School Road over 35<sup>th</sup> Avenue/ Grand Avenue
- Grand Ave over 43<sup>rd</sup> Avenue / Camelback Road
- Olive Avenue over 75<sup>th</sup> Avenue / Grand Avenue
- Maryland Avenue over 55<sup>th</sup> Avenue / Grand Avenue
- 51<sup>st</sup> Avenue over Bethany Home Road / Grand Avenue
- Grand Avenue under 59<sup>th</sup> Avenue / Glendale Avenue (Under Construction as of March 2006)
- 67<sup>th</sup> Avenue over Northern Avenue / Grand Avenue

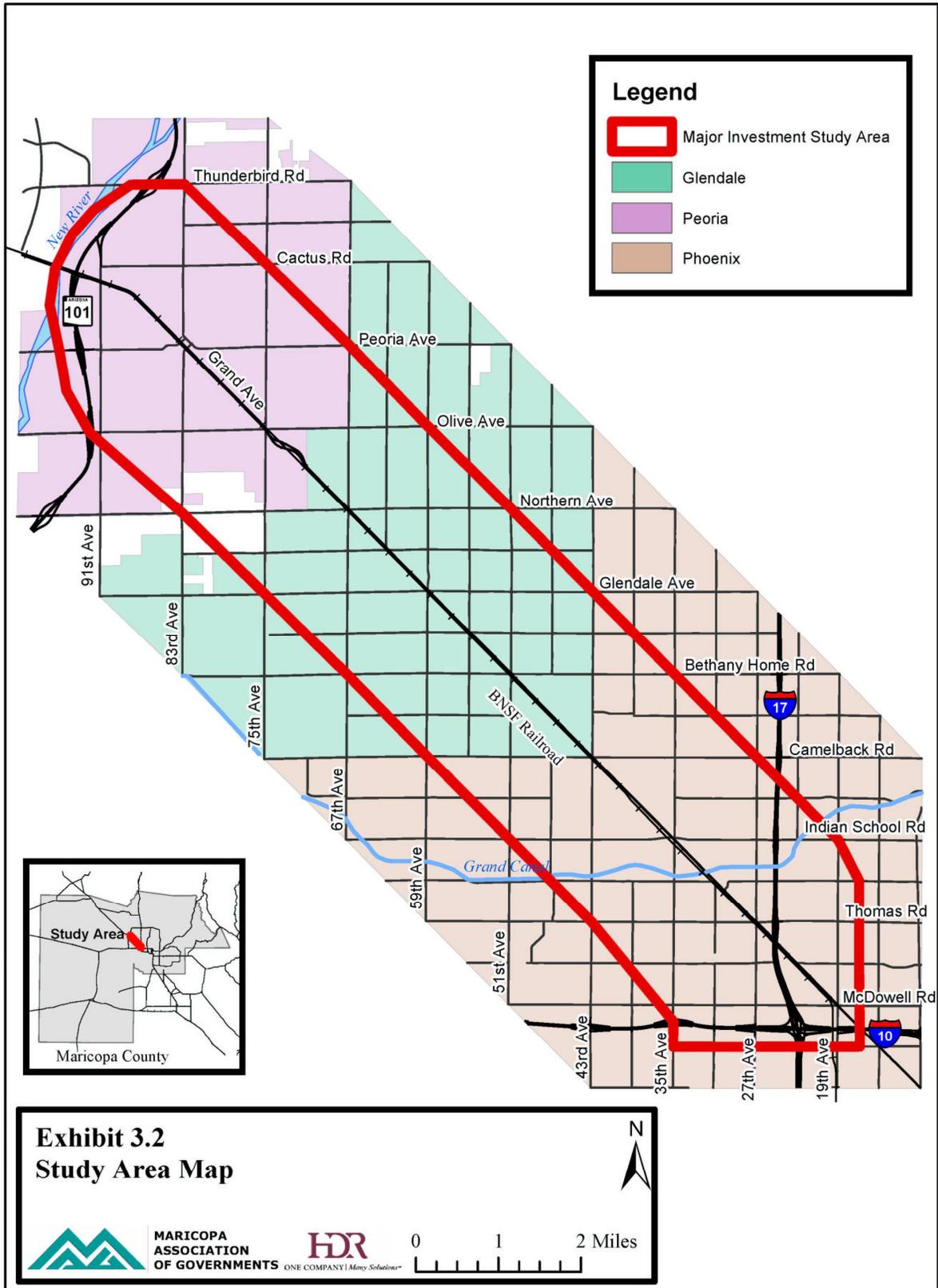
##### **Arterial Cross-Streets**

- Typically three travel lanes northbound and westbound
- Typically two travel lanes southbound and eastbound
- Center two-way left-turn lane

### Exhibit 3.1 Vicinity Map



## Exhibit 3.2 Study Area Map



### Existing Traffic Conditions

#### **Traffic Volumes**

- 2002 volumes on Grand Avenue: 21,000 - 32,900 vehicles per day

#### **Arterial Cross-Streets**

- Limited capacity due to at-grade crossings with Railroad

#### **Congestion and Delay**

- Six-legged intersections operate at LOS E or F during peak hours
- Train activity increases delay at some approaches by up to three minutes

#### **Crashes**

- Over 1,300 crashes on Grand Avenue within Study Area in last three years

### Existing Multi-Modal Elements

#### **Transit Service**

- Grand Avenue Limited serves 138 passengers per day and provides local bus service along Grand Avenue; its passenger per mile ratio is below the metropolitan average
- Transfer points at six-legged intersections are difficult for pedestrians; particularly those with disabilities
- Paratransit / vanpool service exist -
- Three park-and-ride lots exist

#### **Planned Improvements**

- Increased local / express bus service
- Additional bike facilities

#### **Other Facilities**

- Existing bike facilities include bike lanes, bike routes and multi-use paths
- Six-legged intersections are difficult for pedestrians to cross because of long cross distances
- Sidewalks are not continuous within the Study Area

#### **Intelligent Transportation Systems**

- Grand Avenue and Northern Avenue are AZTech "SMART Corridors"
- Enhanced traffic detection, data collection and signal coordination will be implemented

## 3.2 Existing Roadway Infrastructure

Grand Avenue exists as a four- to six-lane major arterial street that runs diagonally across the one-mile grid system of arterial streets that make up the roadway network in Phoenix's greater metropolitan area. On its diagonal route through Maricopa County, US 60 (Grand Avenue) begins near the Town of Wickenburg and travels southeast through the communities of Sun City West, Surprise, El Mirage, Sun City, Peoria, Glendale and Phoenix. As a result of its diagonal orientation, Grand Avenue creates six-legged intersections where it crosses the one-mile grid of arterial streets. Three major six-legged arterial intersections existed within the Study Area (19<sup>th</sup> Ave / McDowell Rd / Grand Ave, 59<sup>th</sup> Ave / Glendale Ave / Grand Ave, and 67<sup>th</sup> Ave / Northern Ave / Grand Ave), of which the latter two have now been reconstructed to provide a grade separation for one of the movements (two of the legs). There are also numerous four- or five-legged intersections created where Grand Avenue crosses collector streets.

Within the Study Area, the BNSF Railroad has track parallel to Grand Avenue. The track is located north of Grand Avenue between SR 101L and 75<sup>th</sup> Avenue. To the east of 75<sup>th</sup> Avenue, the track crosses over westbound Grand Avenue and under eastbound Grand Avenue. The track then travels along the southern side of Grand Avenue until 19<sup>th</sup> Avenue, where it turns south and enters Mobest Yard. At each of the multi-legged intersections, the track crosses at least one approach to the intersection. The railroad crossings are at-grade and are typically controlled by

flashing warning signals; automatic gates are not located at a majority of the crossings. There is one at-grade crossing of Grand Avenue by spur tracks located south of Northern Avenue. Along Grand Avenue, access is generally prohibited along the railroad side with the exception of mile and half-mile arterial streets. The side opposite the railroad track generally does not limit access.

Throughout the Study Area, raised median typically separates eastbound and westbound traffic. Exclusive left-turn lanes are provided at most median breaks and intersections. Recently, the Arizona Department of Transportation (ADOT) completed and opened grade-separations at seven of the six-legged intersection locations, including: Grand Avenue over 27<sup>th</sup> Avenue / Thomas Road, Grand Avenue over 43<sup>rd</sup> Avenue / Camelback Road, 51<sup>st</sup> Avenue over Bethany Home Road / Grand Avenue, Maryland Avenue over 55<sup>th</sup> Avenue / Grand Avenue, Grand Avenue under 59<sup>th</sup> Avenue / Glendale Avenue, 67<sup>th</sup> Avenue over Northern Avenue / Grand Avenue, and Olive Avenue over 75<sup>th</sup> Avenue / Grand Avenue. Indian School Road is also grade-separated over the 35<sup>th</sup> Avenue / Grand Avenue intersection though the intersection still operates as a six-legged intersection

There are a total of 18 traffic signals (including the pair of signals at the SR 101L / Grand Avenue interchange) on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue. Traffic signal spacing varies from less than one-quarter mile to over one mile. The right-of-way for Grand Avenue is generally 90 to 100 feet wide within the Study Area, but ranges from a minimum of 85 feet to a maximum of 166 feet.

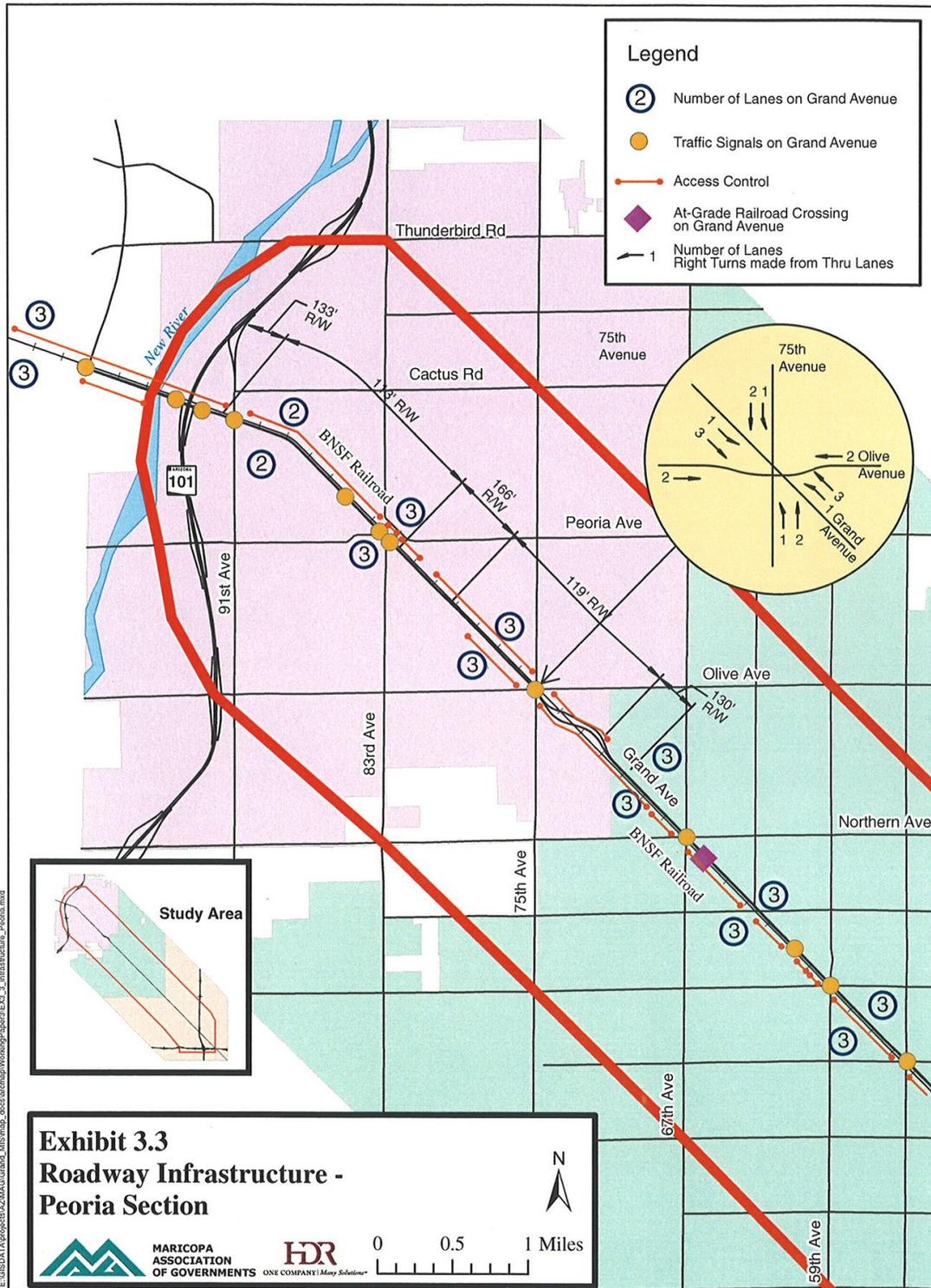
Exhibits 3.3, 3.4, and 3.5 show the existing roadway infrastructure along Grand Avenue within the cities of Peoria, Glendale, and Phoenix, respectively. Roadway infrastructure shown includes right-of-way width, number of lanes, number of turn lanes at major six-legged intersections, traffic signal locations, railroad track locations, at-grade railroad crossings, and access control. Access control lines designate areas where access to and from Grand Avenue is prohibited due to jurisdictional or physical constraints.

Exhibit 3.6 shows the existing number of lanes for the major arterial streets that intersect Grand Avenue within the Study Area. Within Phoenix, arterial streets generally have five travel lanes with an additional center lane functioning as a two-way left-turn lane. North-south arterial streets typically have three northbound lanes and two southbound lanes. East-west arterial streets typically have three westbound lanes and two eastbound lanes. Many of the major arterial streets in Glendale and Peoria have four travel lanes (two in each direction) with a center lane functioning as a two-way left-turn lane. In Peoria, there are some two-lane arterial streets within the Study Area.

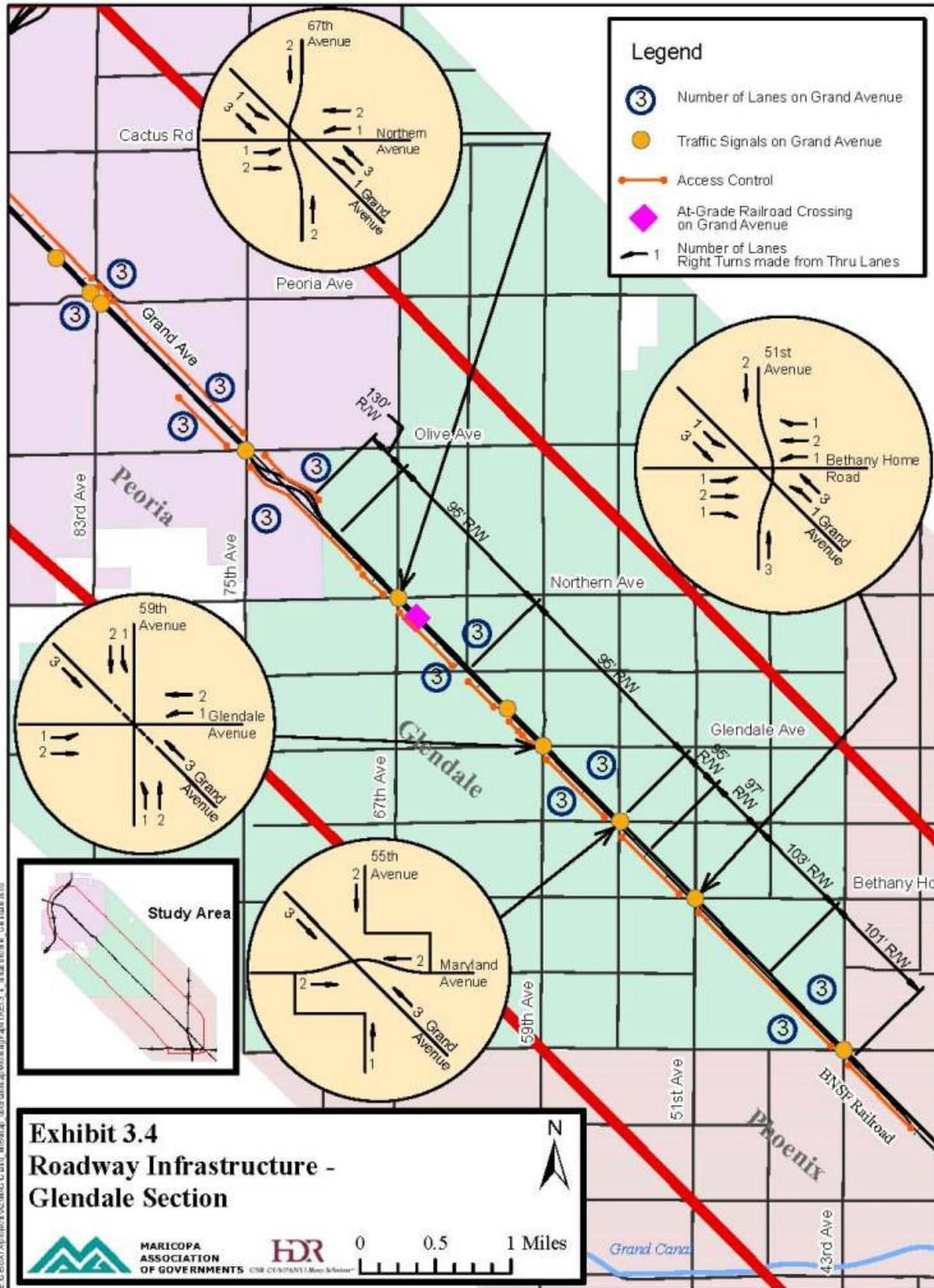
As noted, there are 18 traffic signals along Grand Avenue within the Study Area. Additionally, there are over 140 traffic signals on arterials and collectors within the Study Area. Exhibit 3.7 illustrates the location of these signals.

Prior to the initiation of grade-separated structures along the Grand Avenue corridor, most modifications to Grand Avenue have been modest over the past 25 years. The eight new grade-separations that are currently open to traffic represent a major investment in Grand Avenue. In

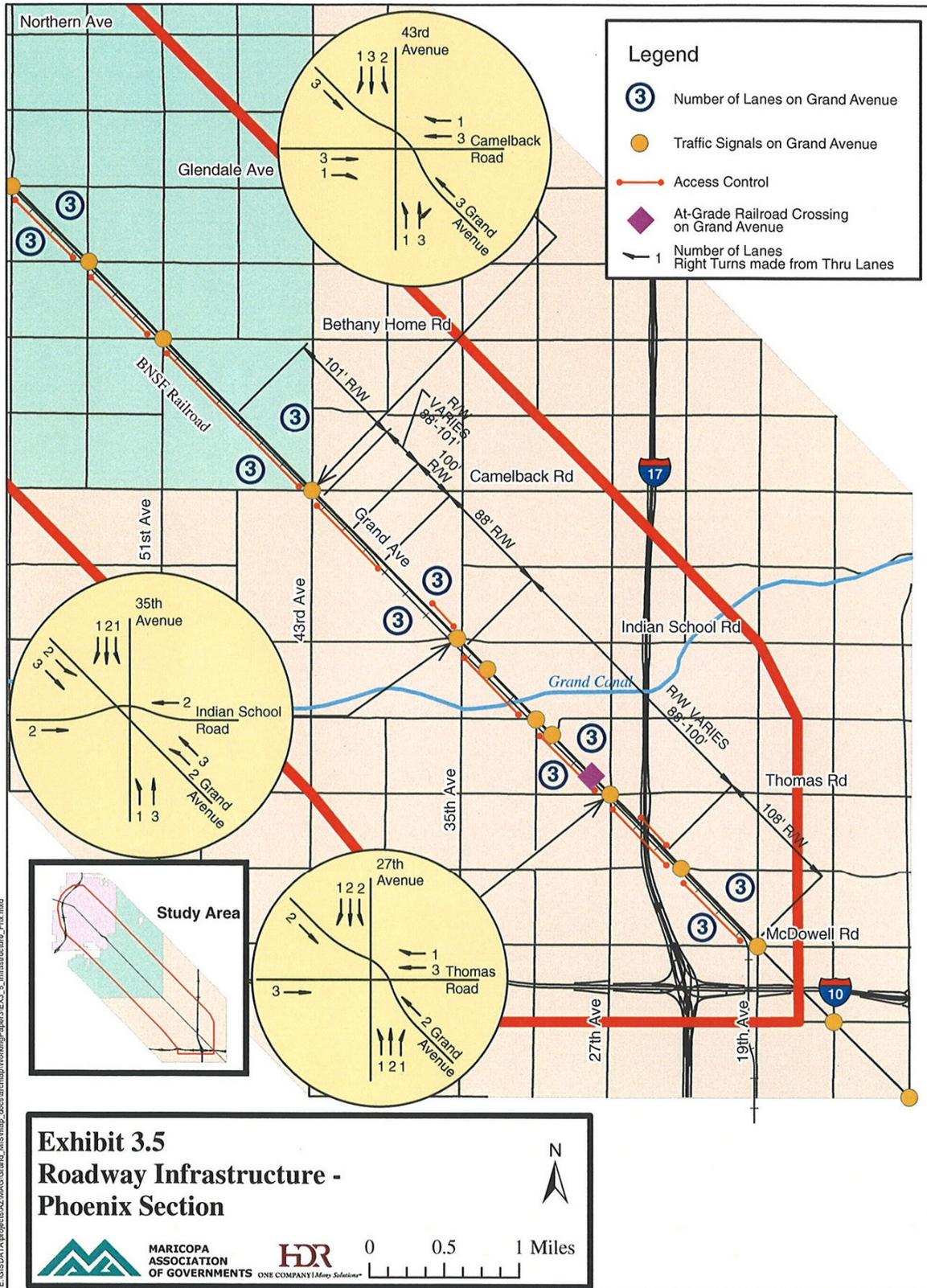
### Exhibit 3.3 Roadway Infrastructure - Peoria Section



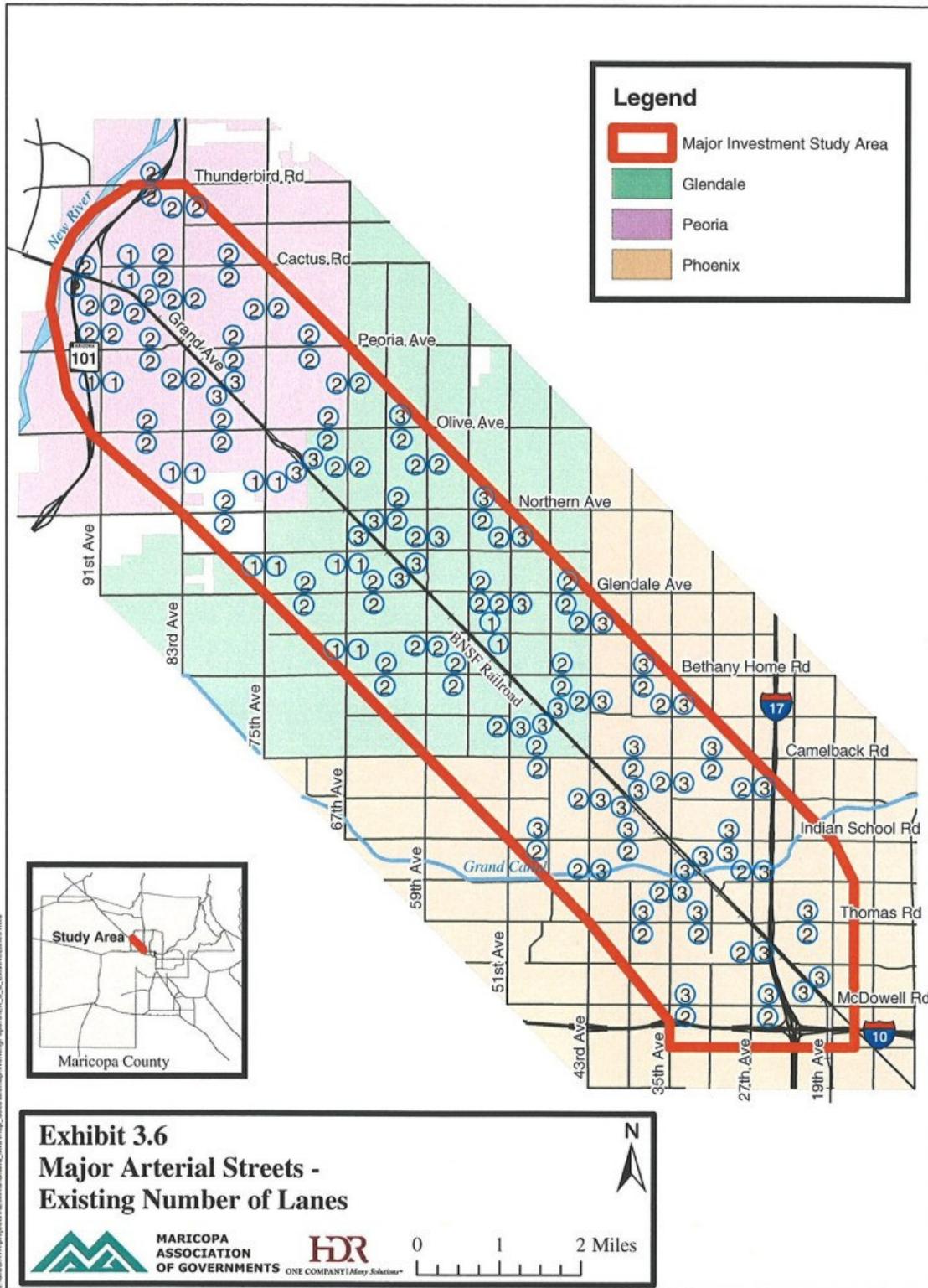
### Exhibit 3.4 Roadway Infrastructure - Glendale Section



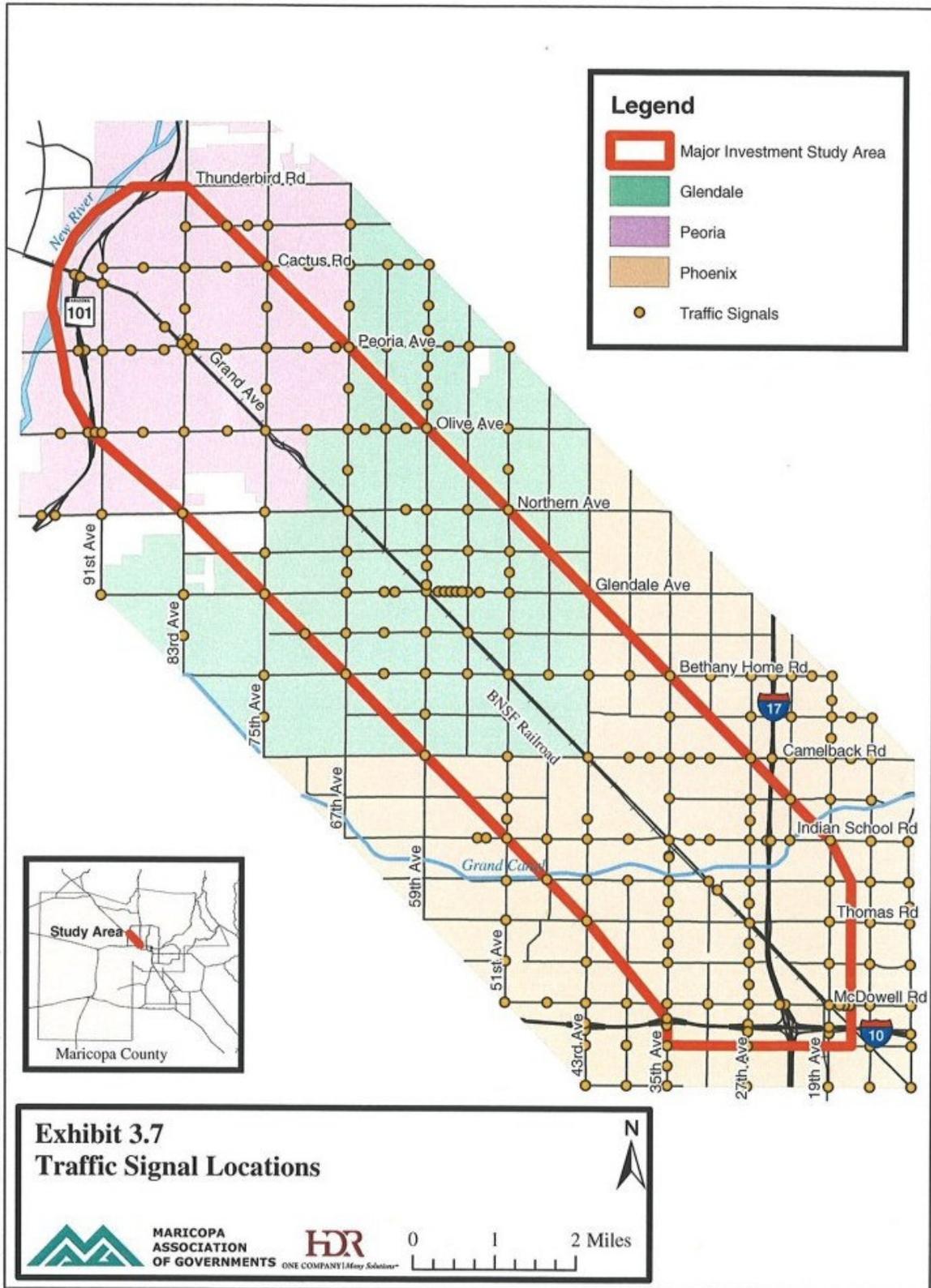
### Exhibit 3.5 Roadway Infrastructure - Phoenix Section



**Exhibit 3.6 Major Arterial Streets - Existing Number of Lanes**



### Exhibit 3.7 Traffic Signal Locations



addition, major improvements have been made to the regional transportation network during this time period. A summary of the improvements and changes to the regional transportation network that affect travel on Grand Avenue is provided below:

- Eight grade separations along or across Grand Avenue.
- Grand Avenue has been widened to a four-lane divided highway (from two-lanes, undivided) from the Agua Fria River north to the RH Johnson Boulevard intersection through the cities of El Mirage, Surprise and Sun City West.
- New traffic signal bridges have been constructed at six-legged intersections along with operational improvements.
- The Agua Fria Freeway (SR 101L) has been completed from the Black Canyon Freeway (I-17) to the Papago Freeway (I-10). Ramps exiting northbound SR 101L and entering southbound SR 101L are provided for along Grand Avenue and are controlled by traffic signals. Ramps exiting southbound SR 101L and entering northbound SR 101L are provided for along 91<sup>st</sup> Avenue and operate as direct connection ramps.
- High Occupancy Vehicle (HOV) lanes and auxiliary lanes have been constructed along I-17 between Thomas Road and Peoria Avenue. The traffic interchanges along this stretch have also been reconstructed.
- Grand Avenue southeast of McDowell Road / 19<sup>th</sup> Avenue has been refurbished with new curb, gutter, sidewalk and landscaping and has been turned over to the City of Phoenix.
- ADOT has installed new traffic signal controllers along Grand Avenue with plans to coordinate the signals.

In November 2004, the voters of Maricopa County passed Proposition 400, which extended for the next 20-years the one-half cent sales tax that has funded regional transportation improvements over the past two decades. The Regional Transportation Plan (RTP), which provides guidance for the funds generated from the one-half cent sales tax, includes \$147 million for improvements to Grand Avenue within the Study Area. The purpose of this MIS is to provide recommendations for how best to utilize this money.

Three field reviews have occurred thus far in the Study process to inventory the existing infrastructure on and adjacent to Grand Avenue. The first field review, on January 20, 2004, focused on the signalized and unsignalized intersections along the entire corridor. Special attention was given to the six-legged intersections. The second field review, on March 16, 2004, focused on the existing infrastructure along Grand Avenue, including sidewalks, lighting, railroad facilities, lane configurations and intersection control. The third field review was conducted in late December 2004 to document changes that have occurred within the Study Area over the past year. Findings from these field reviews are summarized in the following sections.

### 3.1.1 Right-of-Way

The original Grand Avenue Major Investment Study (MIS) (ADOT, 1999) indicated that ROW for Grand Avenue is typically 90 to 100 feet wide within its Study Area. As-built plans were acquired from ADOT Engineering Records to confirm information contained in previous reports. In addition to the as-built plans, parcel information was obtained from the Maricopa County Assessor that delineates property boundaries along the corridor.

The existing right-of-way along Grand Avenue varies within the Study Area as listed below in Exhibit 3.8. This information is shown graphically in Exhibits 3.3, 3.4 and 3.5.

#### Exhibit 3.8 Existing Right-of-Way along Grand Avenue within Study Area

Arterial Limits	Existing Grand Avenue ROW
SR 101L – 91 <sup>st</sup> Avenue	133 feet
91 <sup>st</sup> Avenue – 83 <sup>rd</sup> Avenue	113 feet
83 <sup>rd</sup> Avenue – Monroe Street	166 feet
Monroe Street – Peoria/Glendale Boundary	119 feet
Peoria/Glendale Boundary – 71 <sup>st</sup> Avenue	130 feet
71 <sup>st</sup> Avenue – 63 <sup>rd</sup> Avenue	95 feet
63 <sup>rd</sup> Avenue – 55 <sup>th</sup> Avenue	93 feet
55 <sup>th</sup> Avenue – 54 <sup>th</sup> Avenue	95 feet
54 <sup>th</sup> Avenue – 51 <sup>st</sup> Avenue	97 feet
51 <sup>st</sup> Avenue – Missouri Avenue	103 feet
Missouri Avenue – 43 <sup>rd</sup> Avenue	101 feet
43 <sup>rd</sup> Avenue – 41 <sup>st</sup> Avenue	88 feet – 101 feet
41 <sup>st</sup> Avenue – 39 <sup>th</sup> Avenue	100 feet
39 <sup>th</sup> Avenue – 33 <sup>rd</sup> Avenue	88 feet
33 <sup>rd</sup> Avenue – 24 <sup>th</sup> Drive	88 feet – 100 feet
24 <sup>th</sup> Drive – 19 <sup>th</sup> Avenue	108 feet

Based on information contained in their Capital Improvement Plans/Programs (CIP) the cities of Glendale and Peoria have roadway widening or right-of-way acquisition improvements planned for the near future on or near Grand Avenue:

- The City of Glendale’s 2003 – 2012 Capital Improvement Plan includes funding for right-of-way protection along Northern Avenue between Grand Avenue and SR 303L for the Superstreet and selected widening along 59<sup>th</sup> Avenue that may or may not require additional right-of-way. 67<sup>th</sup> Avenue between Grand Avenue and Camelback Road is also identified for widening that may or may not require additional right-of-way.
- The City of Peoria’s FY 2004 Capital Improvement Program includes funding for the widening of Peoria Avenue near the Grand Avenue intersection that may or may not require additional right-of-way as well as the acquisition of right-of-way for the total reconstruction of 81<sup>st</sup> Avenue from Grand Avenue to Olive Avenue.

The ADOT Current Five-Year Transportation Facilities Construction Program (2005 – 2009) includes \$2 million for widening Grand Avenue between 101L and 83<sup>rd</sup> Avenue, \$26 million for constructing a structure at 59<sup>th</sup> Avenue / Glendale Avenue, and \$11 million for right-of-way acquisition along Grand Avenue.

### 3.1.2 Number of Lanes

As noted previously, Grand Avenue has six through lanes (three in each direction) for its entire length through the Study Area except from 83<sup>rd</sup> Avenue to SR 101L. Where left turns are permitted, all signalized intersection locations provide dedicated left-turn lanes along Grand Avenue. Refer to Exhibits 3.3, 3.4 and 3.5 for lane movement details at the major six-legged signalized intersections.

Exhibit 3.6 identifies the number of through lanes along each roadway within the Study Area.

Based on information contained in their CIPs the cities of Phoenix, Glendale and Peoria have roadway widening and/or lane addition improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding to construct improvements at Camelback Road / 43<sup>rd</sup> Avenue that may or may not result in additional lanes.
- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for intersection improvements such as lane extensions and turning lanes at the thirty most congested intersections as well as the elimination of drop lanes in congested areas (specifically noted along 59<sup>th</sup> Avenue).
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for improvements to the Peoria Avenue / 83<sup>rd</sup> Avenue / Grand Avenue intersections including street widening that may or may not result in additional lanes.

The ADOT Current Five-Year Transportation Facilities Construction Program (2005 – 2009) includes \$5 million for roadway widening projects along Grand Avenue from 83<sup>rd</sup> Avenue to 99<sup>th</sup> Avenue.

### 3.1.3 Signalized and Unsignalized Intersections

Within the Study Area, Grand Avenue is host to over 60 three-, four-, five- and six-legged intersections that are either stop controlled or signal controlled. A majority of these intersections are stop controlled along the minor roadway, allowing Grand Avenue traffic to flow freely.

The original Grand Avenue MIS (ADOT, 1999) identified a total of 148 traffic signals in its Study Area. Of these, 18 were located on Grand Avenue between SR 101L and McDowell Road. The remainder were located within one mile of Grand Avenue along city arterials and collectors.

Exhibit 3.7 illustrates the locations of traffic signals based on field reviews and previous documentation.

A field review was conducted on January 20, 2004 to confirm the location of previously identified traffic signals as well as document any changes in traffic control within the Study Area. Refer to Exhibit 3.9 for intersection information pertaining to location, type and traffic control.

Exhibits 3.10, 3.11 and 3.12 illustrate the location of each intersection along Grand Avenue within the Study Area.

All signalized intersections present during the writing of the 1999 MIS remain in their previously identified location. No new signalized intersections exist along Grand Avenue within the Study Area.

Based on information contained in their capital improvement plans (CIP) the cities of Phoenix, Glendale and Peoria have traffic signal and/or intersection improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding for the installation of a new traffic signal at the intersection of 27<sup>th</sup> Avenue / Thomas Road, signal modernization including left-turn arrows and the installation of loop detectors, and the installation of warranted traffic signals at eight locations per year.
- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for the implementation of "Smart Traffic Signals" that include more left-turn arrows and the installation of traffic signals at various locations (two intersections in 2004 and four intersections per year thereafter).
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for a new traffic signal 85<sup>th</sup> Avenue / Monroe Street.

Based on information contained in the RTP, and studied in several of the documents included in Appendix A, Northern Avenue is programmed to be upgraded to a controlled access facility with grade-separations and a direct connection to Grand Avenue (Northern Avenue crosses Grand Avenue at 67<sup>th</sup> Avenue).

#### **3.1.4 Median Dividers**

Along its length through the Study Area, Grand Avenue exists as a divided highway with a raised median separating opposing traffic. In certain portions of the Study Area, the median is landscaped, while in other portions it exists as barren earth. Where median landscaping exists, it consists of sporadic, mature vegetation.

Median breaks along Grand Avenue are common. At each minor roadway connection median breaks occur, preceded by a dedicated left-turn lane. There are approximately 50 median breaks for minor roadway connections within the Study Area.

### Exhibit 3.9 Intersections along Grand Avenue within Study Area

Number <sup>1</sup>	Cross-street Names	Skewed / Perpendicular / Offset / Grade-separated <sup>2</sup>	Traffic Control	Exhibit Number
1	15 <sup>th</sup> Avenue / Roosevelt Road / Grand Avenue	Skewed	Signalized	3.12
2	Laurel Avenue / Linden Street / Grand Avenue	Skewed	Unsignalized	3.12
3	Latham Street / 16 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
4	Moreland Street / Grand Avenue	Skewed	Unsignalized	3.12
5	17 <sup>th</sup> Avenue / Spruce Street / Grand Avenue	Skewed	Unsignalized	3.12
6	17 <sup>th</sup> Drive / Culver Street / Grand Avenue	Skewed	Unsignalized	3.12
7	18 <sup>th</sup> Avenue / Willetta Street / Grand Avenue	Skewed	Unsignalized	3.12
8	19 <sup>th</sup> Avenue / McDowell Road / Grand Avenue	Skewed	Signalized	3.12
9	20 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
10	21 <sup>st</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
11	22 <sup>nd</sup> Avenue / Monte Vista Road / Grand Avenue	Skewed	Unsignalized	3.12
12	23 <sup>rd</sup> Avenue / Encanto Boulevard / Grand Avenue	Skewed	Signalized	3.12
13	24 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
14	24 <sup>th</sup> Drive / Grand Avenue	Skewed	Unsignalized	3.12
15	27 <sup>th</sup> Avenue / Thomas Road (Grand Avenue over)	Grade-separated	Free-flow	3.12
16	29 <sup>th</sup> Drive / Grand Avenue	Closed	Unsignalized	3.12
17	Cherry Lynn / Grand Avenue	Closed	Unsignalized	3.12
18	Osborn Road / Grand Avenue	Perpendicular	Signalized	3.12
19	31 <sup>st</sup> Avenue / Osborn Road / Grand Avenue	Skewed	Signalized	3.12
20	Weldon Avenue / Grand Avenue	Perpendicular	Unsignalized	3.12
21	33 <sup>rd</sup> Avenue / Grand Avenue	Skewed	Signalized	3.12
22	35 <sup>th</sup> Avenue / Grand Avenue (Indian School Road over)	Skewed	Signalized	3.12
23	37 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
24	39 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
25	42 <sup>nd</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.12
26	43 <sup>rd</sup> Avenue / Camelback Road (Grand Avenue over)	Grade-separated	Free-flow	3.11
27	Missouri Avenue / Grand Avenue	Skewed	Unsignalized	3.11
28	Bethany Home Road / Grand Avenue (51 <sup>st</sup> Avenue over)	Skewed	Signalized	3.11
29	53 <sup>rd</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.11
30	55 <sup>th</sup> Avenue / Grand Avenue (Maryland Avenue over)	Grade-separated	Free-flow	3.11
31	56 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.11
32	57 <sup>th</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.11
33	Ocotillo Road / Grand Avenue	Skewed	Unsignalized	3.11
34	57 <sup>th</sup> Drive / Grand Avenue	Future Perpendicular	Future Signal	3.11
35	Lamar Road / 58 <sup>th</sup> Avenue / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11

**Exhibit 3.9 Intersections along Grand Avenue within Study Area (cont.)**

Number <sup>1</sup>	Cross-street Names	Skewed / Perpendicular / Offset / Grade-separated <sup>2</sup>	Traffic Control	Exhibit Number
36	58 <sup>th</sup> Drive / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11
37	59 <sup>th</sup> Avenue / Glendale Avenue (Grand Avenue under) <sup>3</sup>	Future Grade Separated	Future Free-flow	3.11
38	59 <sup>th</sup> Drive / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11
39	Glenn Drive / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11
40	60 <sup>th</sup> Avenue / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11
41	Palmaire Avenue / Grand Avenue <sup>4</sup>	Skewed	Unsignalized	3.11
42	Myrtle Avenue / Grand Avenue	Skewed	Signalized	3.11
43	Orangewood Avenue / Grand Avenue	Skewed	Unsignalized	3.11
44	63 <sup>rd</sup> Avenue / Grand Avenue	Skewed	Unsignalized	3.11
45	Northern Avenue / Grand Avenue (67 <sup>th</sup> Avenue over) <sup>3</sup>	Skewed	Signalized	3.11
46	Royal Palm Lane / Grand Avenue	Perpendicular	Signalized	3.11
47	Butler Drive / Grand Avenue	Skewed	Unsignalized	3.11
48	71 <sup>st</sup> Avenue / Grand Avenue	Perpendicular	Unsignalized	3.10
49	75 <sup>th</sup> Avenue / Grand Avenue (Olive Avenue over)	Skewed	Signalized	3.10
50	Monroe Street / 81 <sup>st</sup> Avenue / Grand Avenue	Perpendicular	Unsignalized	3.10
51	82 <sup>nd</sup> Avenue / Jefferson Street / Grand Avenue	Skewed	Unsignalized	3.10
52	83 <sup>rd</sup> Avenue / Grand Avenue	Perpendicular	Signalized	3.10
53	Peoria Avenue / Grand Avenue	Perpendicular	Signalized	3.10
54	84 <sup>th</sup> Avenue / Grand Avenue	Perpendicular	Unsignalized	3.10
55	85 <sup>th</sup> Avenue / Grand Avenue	Perpendicular	Signalized	3.10
56	87 <sup>th</sup> Avenue / Grand Avenue	Perpendicular	Unsignalized	3.10
57	88 <sup>th</sup> Drive / Grand Avenue	Perpendicular	Unsignalized	3.10
58	91 <sup>st</sup> Avenue / Grand Avenue	Skewed	Signalized	3.10
59	92 <sup>nd</sup> Drive / Grand Avenue	Perpendicular	Unsignalized	3.10
60	SR 101L Exit Ramp / Grand Avenue	Perpendicular	Signalized	3.10
61	SR 101L Entrance Ramp / Grand Avenue	Perpendicular	Signalized	3.10
62	99 <sup>th</sup> Avenue / Grand Avenue	Perpendicular	Signalized	3.10

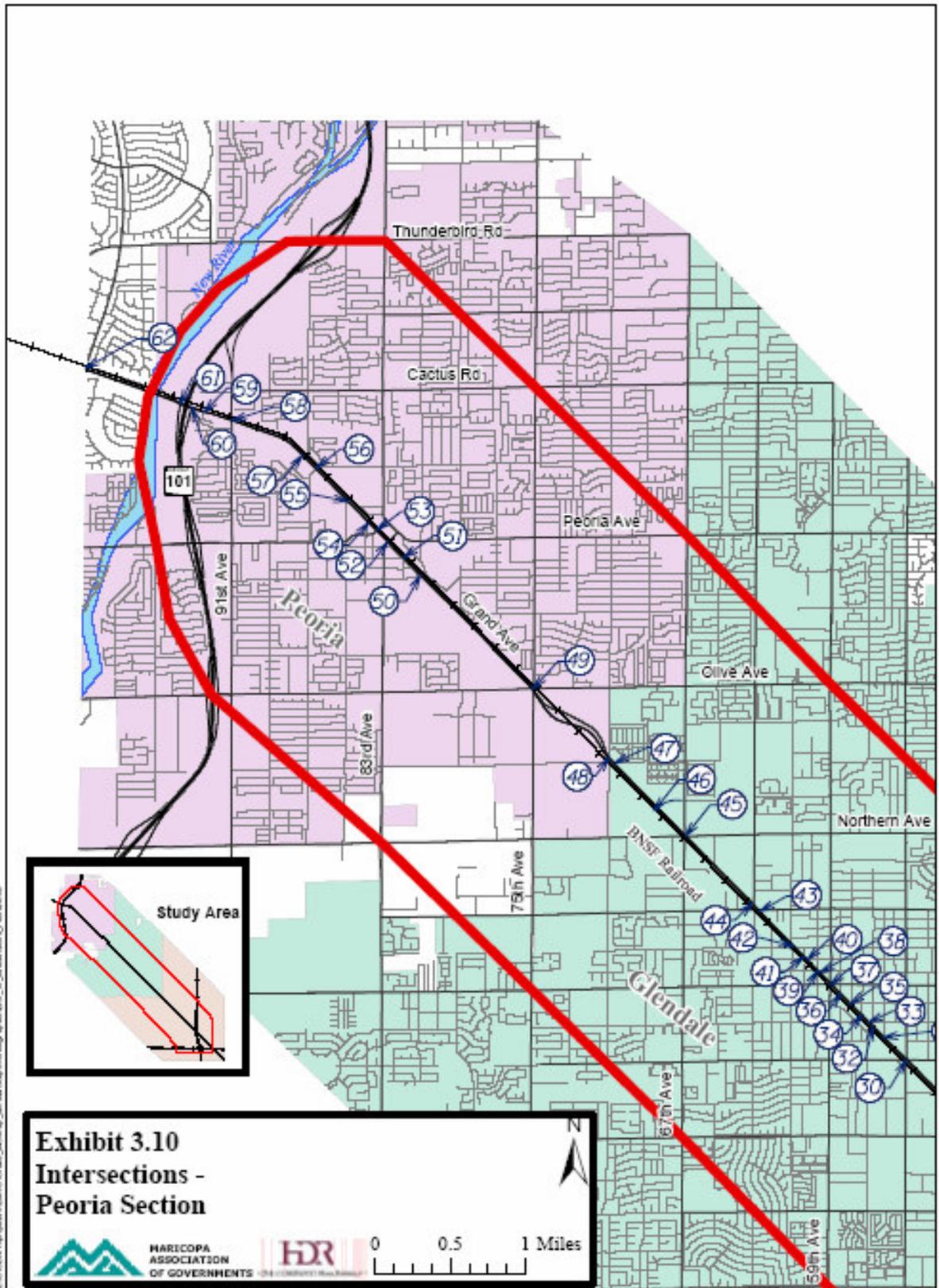
<sup>1</sup>Number refers to the intersection number in Exhibits 3.10, 3.11, and 3.12.

<sup>2</sup>Refers to the orientation of the cross-street intersections to Grand Avenue.

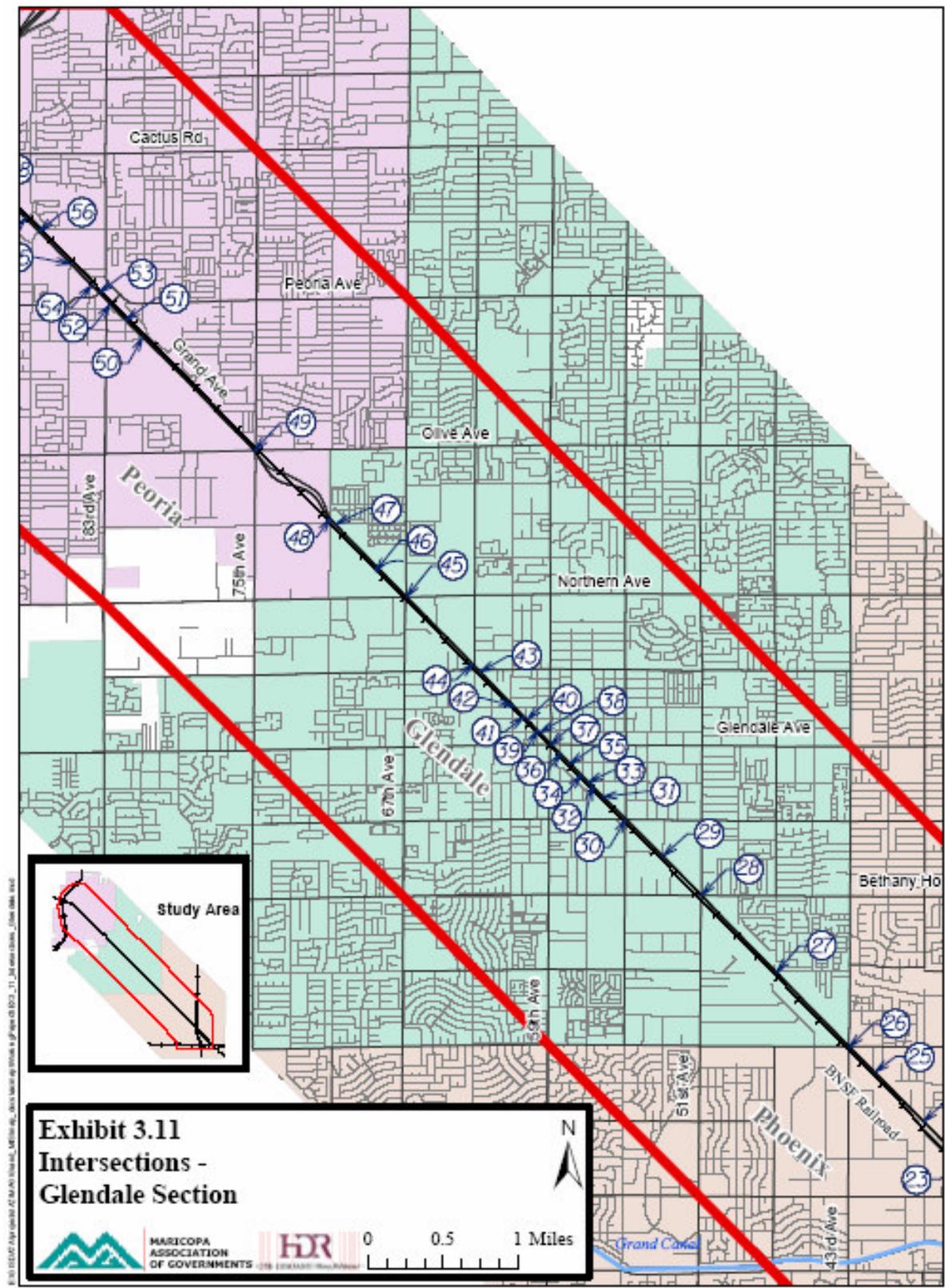
<sup>3</sup>Indicates grade-separations that are currently under construction as of July 2005.

<sup>4</sup>Indicates intersections that will be cut-off as a result of the Grand Avenue underpass at 59<sup>th</sup> Avenue/Glendale Avenue.

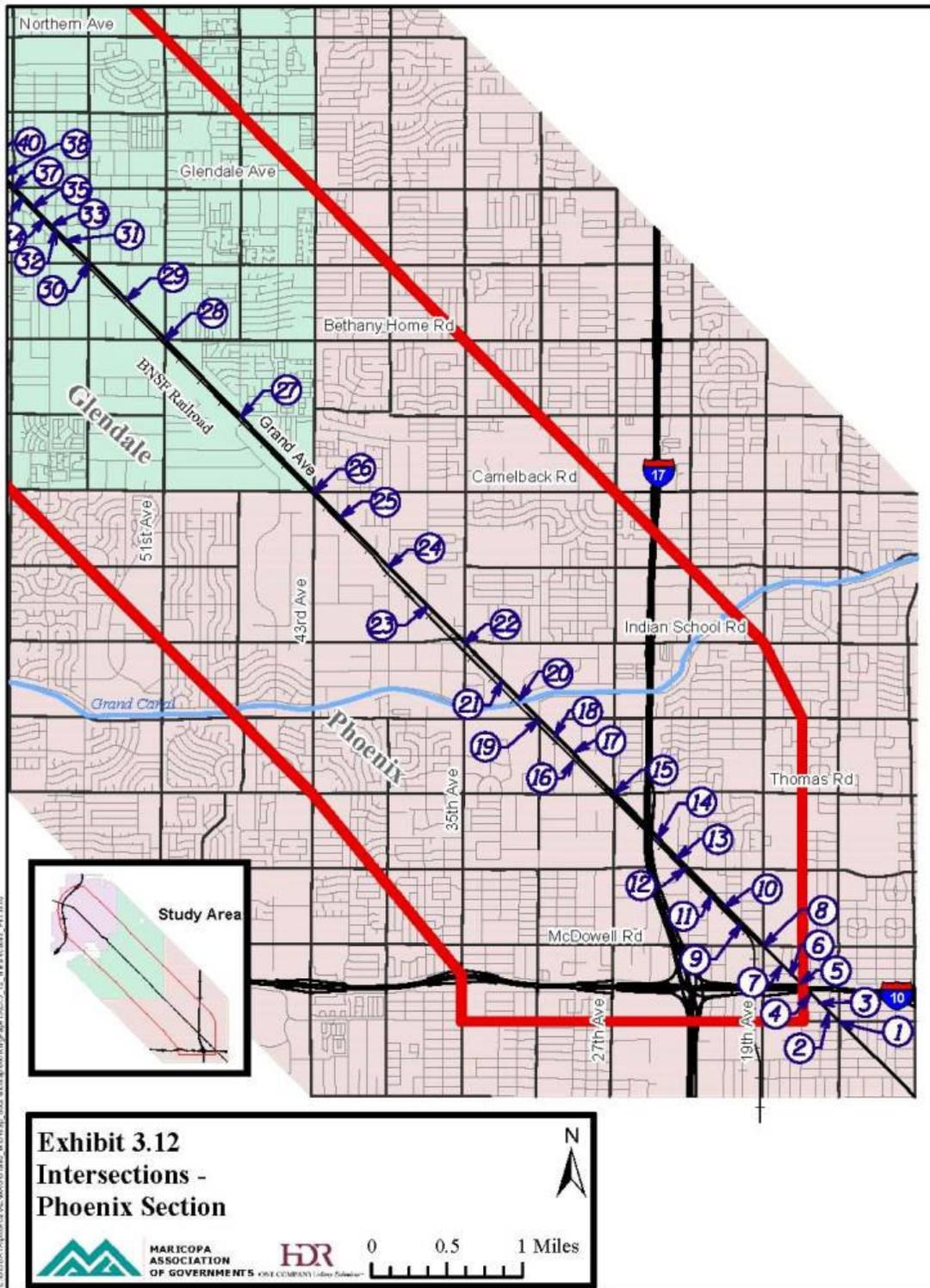
Exhibit 3.10 Intersections - Peoria Section



### Exhibit 3.11 Intersections - Glendale Section



### Exhibit 3.12 Intersections - Phoenix Section



Refer to Exhibits 3.13, 3.14 and 3.15 for locations of existing median breaks.

Based on information contained in its CIPs the City of Glendale has median improvements planned for the near future on or near Grand Avenue:

- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for median improvements along 59<sup>th</sup> Avenue in conjunction with other spot improvements as well as the potential for median barriers at the thirty most congested intersections.

### **3.1.5 Grade Separations**

As previously discussed, ADOT has recently completed construction at seven major six-legged intersections by grade-separating one of the movements from the other two.

The seven grade-separations include:

- Grand Avenue grade-separated over 27<sup>th</sup> Avenue / Thomas Road
- Grand Avenue grade-separated over 43<sup>rd</sup> Avenue / Camelback Road
- 51<sup>st</sup> Avenue grade-separated over Bethany Home Road / Grand Avenue
- Maryland Avenue grade-separated over 55<sup>th</sup> Avenue / Grand Avenue
- Grand Avenue grade-separated under 59<sup>th</sup> Avenue / Glendale Avenue
- 67<sup>th</sup> Avenue grade-separated over Northern Avenue / Grand Avenue
- Olive Avenue grade-separated over 75<sup>th</sup> Avenue / Grand Avenue

The only major six-legged intersection in the Study Area that has not been grade-separated is 19<sup>th</sup> Avenue / McDowell Road / Grand Avenue in the City of Phoenix.

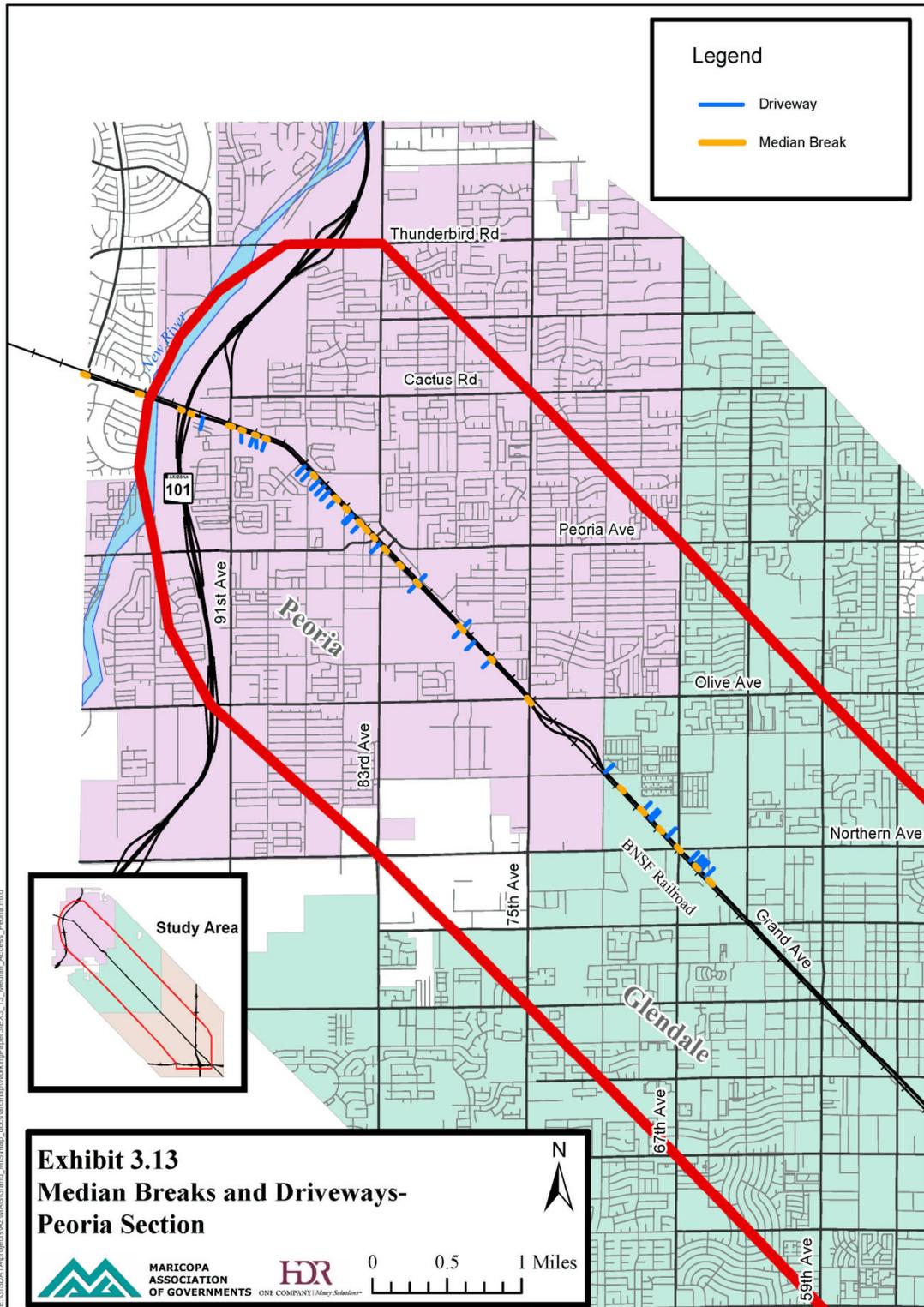
### **3.1.6 Access Control**

Within the Study Area, Grand Avenue exists as a limited access-controlled facility. The presence of the BNSF Railway track parallel to Grand Avenue provides access control (with the exception of railroad maintenance / yard driveways) to and from Grand Avenue in many areas. This access control is typically only broken at major arterial street intersections with Grand Avenue, although a few minor roadways in all three cities do cross the tracks. There is one segment along Grand Avenue where commercial / industrial development exists between the BNSF track and Grand Avenue located south of Indian School Road. Along the Grand Avenue corridor, the BNSF track moves from the south side of Grand Avenue to the north side south of Olive Avenue (east of 75<sup>th</sup> Avenue). The access control the railroad provides moves with it.

On the side opposite the railroad tracks, access is largely permitted and has resulted in the installation of hundreds of access points (collector / local street connections, alleys, driveways, etc.).

Refer to Exhibits 3.3, 3.4 and 3.5 for the limits of access control along Grand Avenue within the Study Area. Refer to Exhibits 3.13, 3.14 and 3.15 for locations of existing driveways.

### Exhibit 3.13 Median Breaks and Driveways - Peoria Section



### Exhibit 3.14 Median Breaks and Driveways - Glendale Section

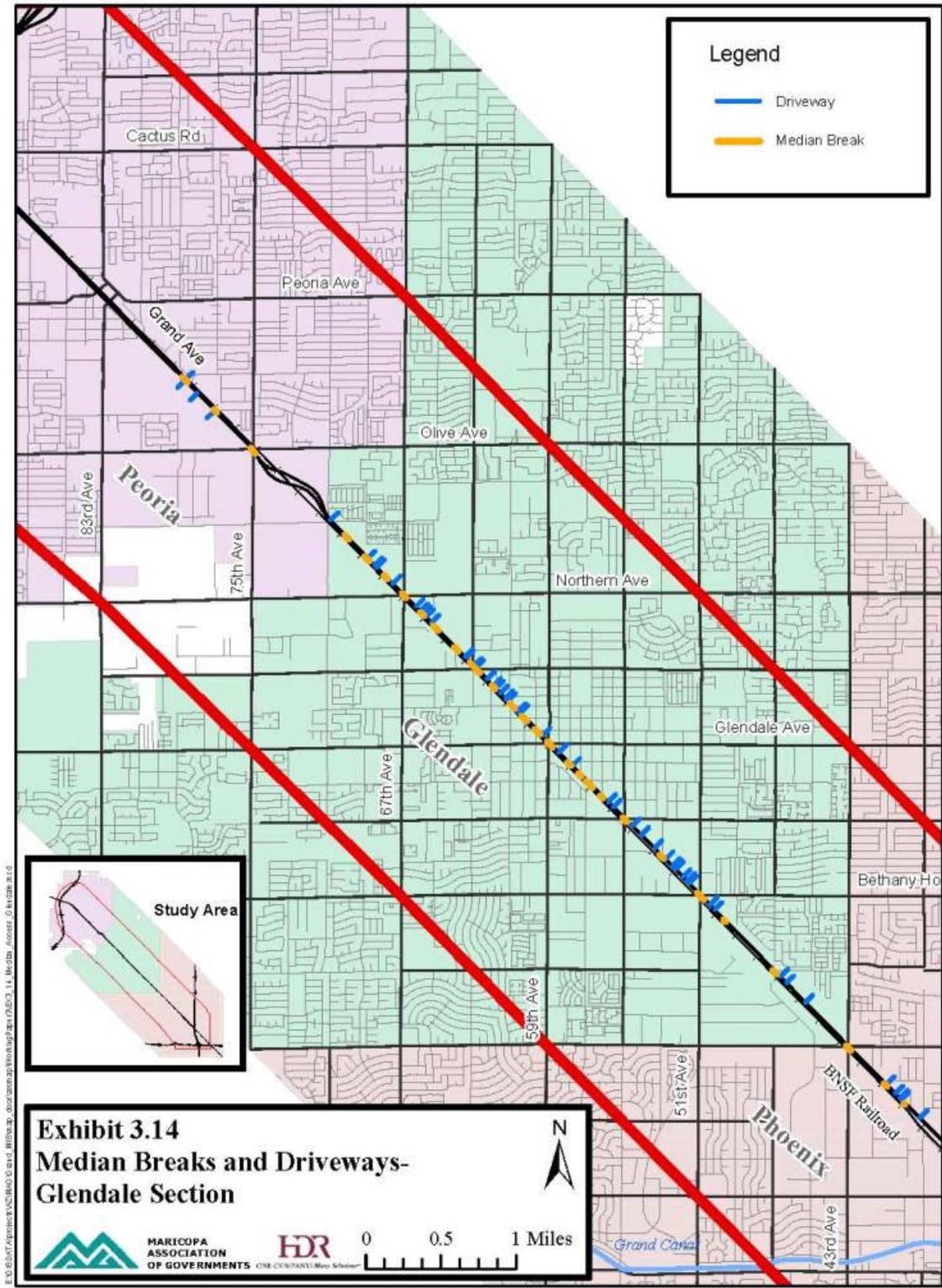
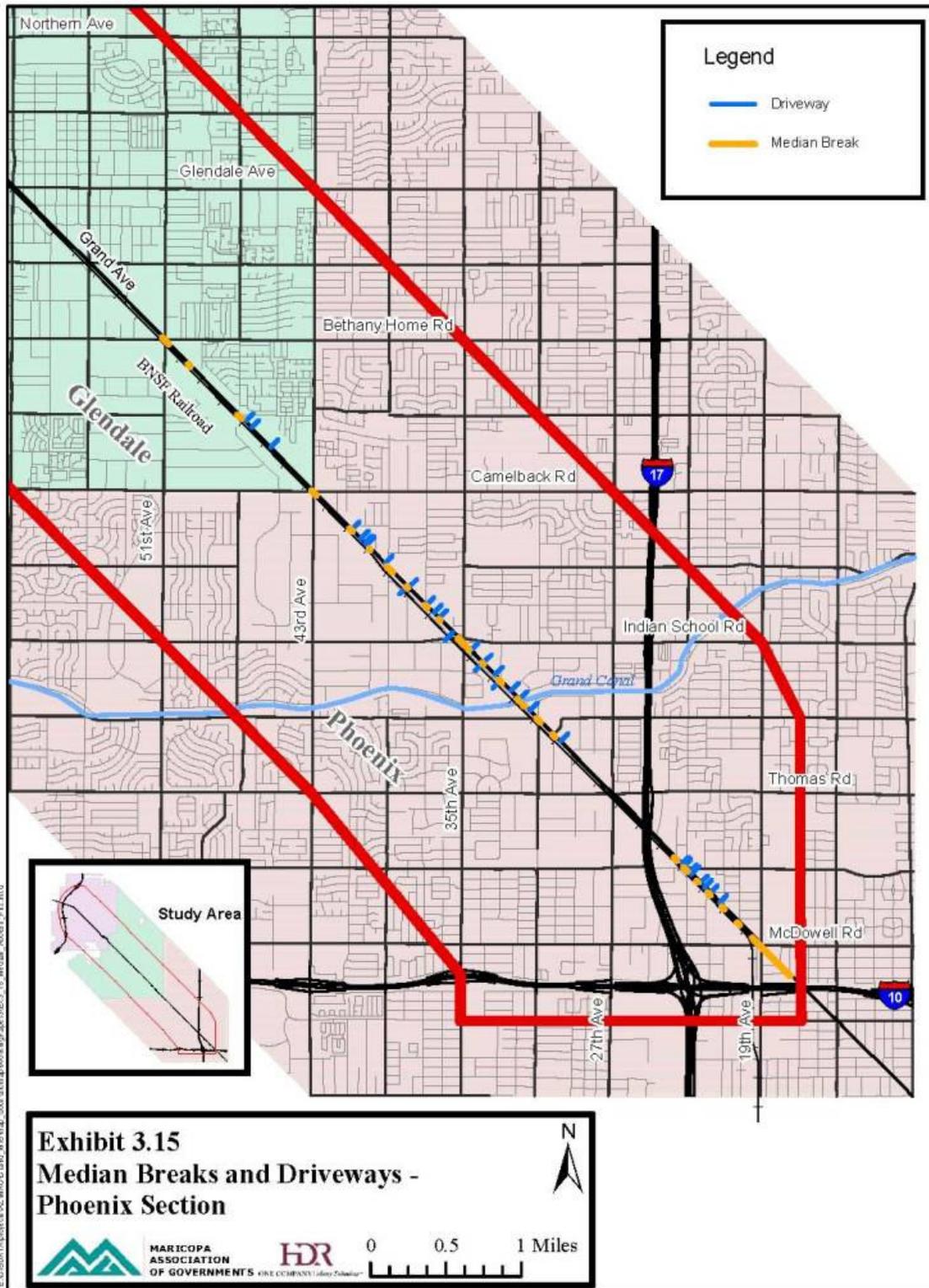


Exhibit 3.15 Median Breaks and Driveways - Phoenix Section



Based on information contained in their CIPs both the City of Glendale and the City of Peoria have access control improvements planned for the near future on or near Grand Avenue:

- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for street spot improvements for local access enhancements which may or may not occur along Grand Avenue or the arterials that cross it.
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for a design concept report (DCR) for the realignment of 83<sup>rd</sup> Avenue that may result in a change of access along this arterial.

### **3.1.7 BNSF Railway**

The BNSF Railway has one track and several facilities located within the Study Area. The BNSF track parallels Grand Avenue over its entire length within the Study Area, resulting in numerous at-grade crossings. In only one location does the track cross Grand Avenue at-grade, this being a spur track located south of Northern Avenue. Prior to the Grand Avenue grade-separation at 27<sup>th</sup> Avenue / Thomas Road, there was one additional crossing north of Thomas Road, but this crossing now occurs under the grade-separation.

Based on information contained in its CIP the City of Phoenix has railroad improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding for railroad crossing improvements that may or may not affect Grand Avenue or the arterials that cross it.

### **3.1.8 Pedestrian Facilities**

Pedestrian facilities, including sidewalks and multi-use paths, are limited along Grand Avenue. Along most of Grand Avenue, development is typically limited to the side opposite the BNSF. But even in these locations continuous sidewalk has not been installed to provide a linkage between developments, major arterial streets and the communities Grand Avenue connects.

Sidewalks have been provided at the following locations:

#### Westbound Grand Avenue

- 15<sup>th</sup> Avenue to 24<sup>th</sup> Avenue
- 24<sup>th</sup> Drive to Thomas Road (outside grade separation)
- 27<sup>th</sup> Avenue to east of Cherry Lynn Road (outside grade separation)
- Grand Canal to east of 37<sup>th</sup> Avenue (outside grade separation)
- Bethany Home Road / 51<sup>st</sup> Avenue intersection
- West of 55<sup>th</sup> Avenue to BNSF Railroad crossing (east of 67<sup>th</sup> Avenue)
- West of 67<sup>th</sup> Avenue to Butler Drive

### Eastbound Grand Avenue

- 88<sup>th</sup> Drive to 83<sup>rd</sup> Avenue
- 19<sup>th</sup> Avenue to 15<sup>th</sup> Avenue

Refer to Exhibit 3.16 for locations of existing sidewalk along Grand Avenue within the Study Area.

Based on information contained in their CIPs the cities of Phoenix, Glendale and Peoria have pedestrian improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding for street modernization that includes the addition of sidewalks as well as a neighborhood sidewalk plan.
- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for the addition of sidewalks along 51<sup>st</sup> Avenue between Camelback Road and Grand Avenue, Maryland Avenue between 51<sup>st</sup> Avenue and 59<sup>th</sup> Avenue, and 67<sup>th</sup> Avenue between Camelback Road and Grand Avenue.
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for ADA (Americans with Disabilities Act) accessible ramps as well as the Sidewalks Annual Program that funds pedestrian and sidewalk links where deficiencies exist. The CIP also includes the addition of sidewalks along the realigned 83<sup>rd</sup> Avenue and 71<sup>st</sup> Avenue between Grand Avenue and Olive Avenue. The Peoria Avenue / 83<sup>rd</sup> Avenue / Grand Avenue pedestrian project also includes improvements to sidewalks, sidewalk ramps and crosswalks at the intersections.

The ADOT Current Five-Year Transportation Facilities Construction Program (2004 – 2008) includes \$0.8 million for a pedestrian overpass along Grand Avenue.

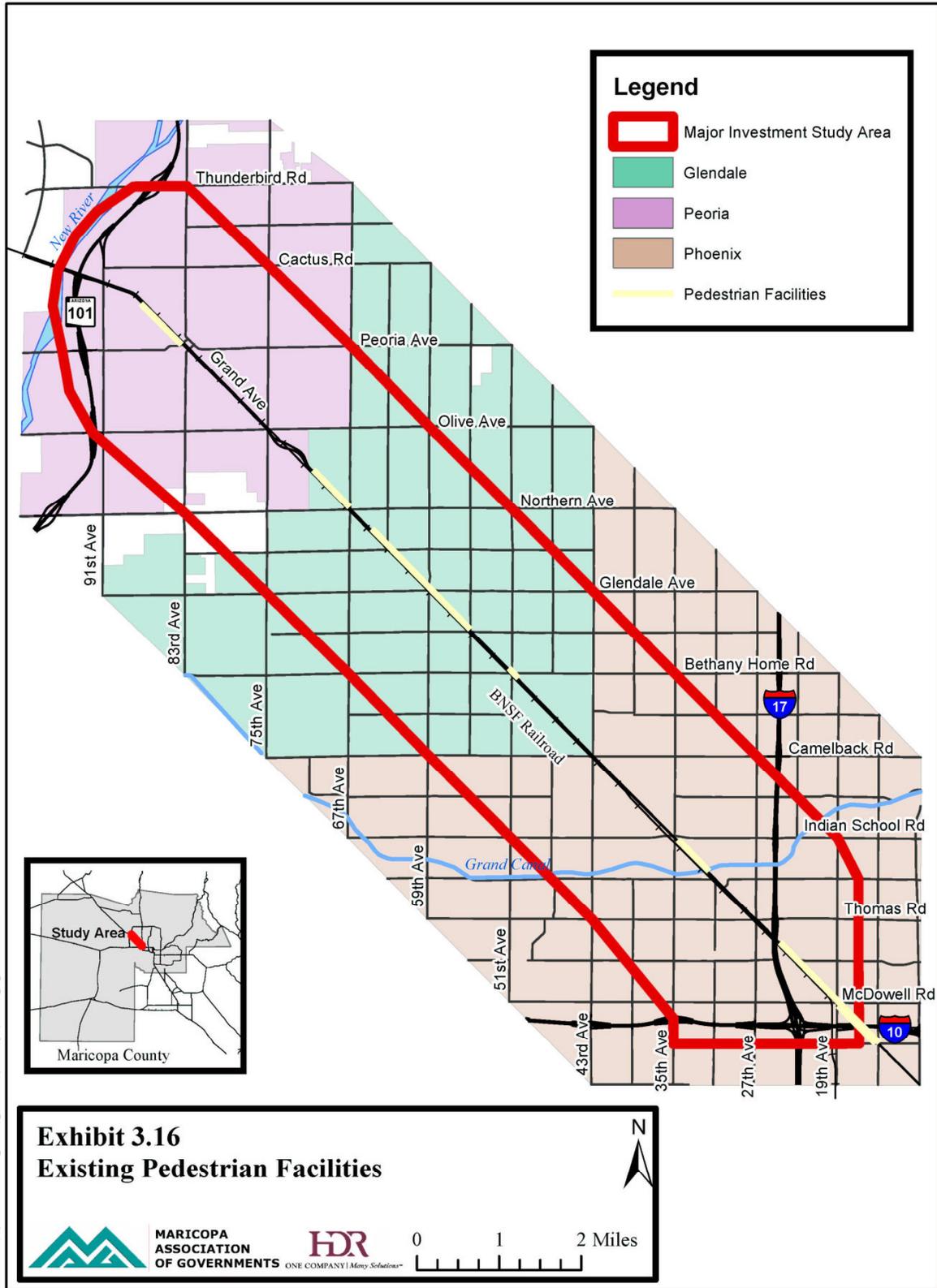
The RTP does set aside money specifically for pedestrian / bicycle facilities. The money, over \$200 million, comes from CMAQ (federally allocated moneys for congestion and air quality relief) and local sources.

### **3.1.9 Bicycle Facilities**

Several decades ago, the greater Phoenix metropolitan area, realizing the benefits provided by non-motorized transportation, began to develop a system of bike paths, routes and lanes that served to not only connect local neighborhoods but also different municipalities and regions.

Using data from 2002, there were 215 total miles of existing bicycle facilities in the City of Peoria, 82 total miles in the City of Glendale and 464 total miles in the City of Phoenix.

### Exhibit 3.16 Existing Pedestrian Facilities



Within the Study Area itself, there are no bike routes/lanes along Grand Avenue, but there are unpaved multi-use trails, on-street bike routes and popular undesignated routes that intersect and cross Grand Avenue. Based on information contained in the MAG Bikeways Map (2003), and confirmed with information contained in the original MIS (ADOT, 1999) as well as the General Plans for each of the three cities within the Study Area, the following facilities cross Grand Avenue:

- Grand Canal multi-use trail (unpaved) between Thomas Road and Indian School Road
- On-street bike route on Maryland Avenue
- Popular undesignated route along 61<sup>st</sup> Avenue

Refer to Exhibit 3.17 for an illustration of existing bicycle facilities within the Study Area.

Based on information contained in their CIPs the cities of Phoenix and Glendale have bicycle facility improvements planned for the near future near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding undetermined bikeways throughout the city to fill gaps in the bikeway system and improvements and additions of citizen requested bike lanes.
- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for bike route improvements along 63<sup>rd</sup> Avenue from Grand Avenue to Northern Avenue.

The RTP does set aside money specifically for pedestrian / bicycle facilities. The money, over \$200 million, comes from CMAQ (federally allocated moneys for congestion and air quality relief) and local sources.

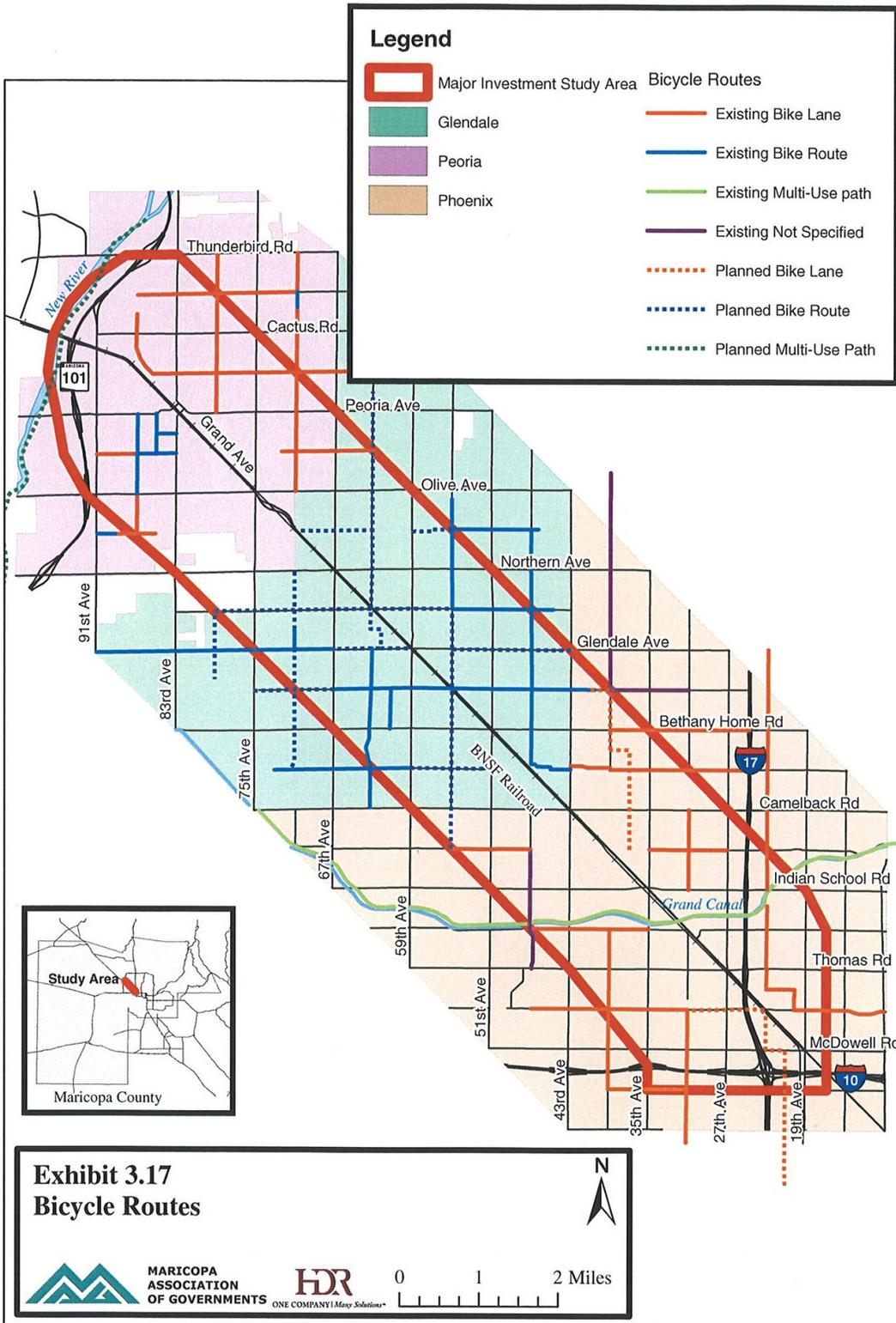
The following planned bike routes were identified in the RTP:

- 29<sup>th</sup> Avenue – Fills in voids to create a complete system from Bell Road to Van Buren Street
- 51<sup>st</sup> Avenue – Bell Road to Riggs Road
- 67<sup>th</sup> Avenue (or 65<sup>th</sup> Avenue) – Happy Valley Road to Glendale Avenue
- Glendale Avenue – Litchfield Road to 7<sup>th</sup> Street
- 21<sup>st</sup> Avenue (or 23<sup>rd</sup> Avenue) – Bell Road to Van Buren Street
- Grand Avenue – Wickenburg to 7<sup>th</sup> Avenue / Van Buren Street

The following potential corridors were identified in the RTP:

- Along the BNSF railroad parallel to Grand Avenue
- Along the Grand Canal

# Exhibit 3.17 Bicycle Routes



### 3.1.10 Canal Crossings

Within the Study Area, Grand Avenue crosses only one canal, the Grand Canal, located between Thomas Road and Indian School Road. Planned in 1877 and constructed in 1878, the Grand Canal is the oldest remaining pioneer canal on the north side of the Salt River. While the Grand Canal is not designated to carry storm flows, it does convey stormwater and may be jurisdictional, which means the US Army Corps of Engineers could require a Section 404 permit for any work along Grand Avenue that may impact the canal. Further investigation will be necessary to determine the Grand Canal's Section 404 status.

### 3.1.11 Landscaping

Within the Study Area, Grand Avenue is only minimally landscaped. Most of the existing landscaping is along the median, and this consists of a few trees planted hundreds of feet apart. At locations where grade separations are now open or being constructed, landscaping exists along the sides of Grand Avenue. Over a vast majority of its length, Grand Avenue is not landscaped. Exhibit 3.18 identifies locations where landscaping exists beginning at the southeastern termini of the Study Area and progressing to the northwest.

From visual inspection, existing landscaping surrounding two areas surpasses the landscaping provided in the remainder of the corridor:

- 15<sup>th</sup> Avenue – McDowell Road / 19<sup>th</sup> Avenue (City of Phoenix)
- Olive Avenue / 75<sup>th</sup> Avenue – 88<sup>th</sup> Drive (City of Peoria)

Refer to Exhibit 3.19 for locations of existing landscaping along Grand Avenue within the Study Area.

Based on information contained in their CIPs both the City of Glendale and the City of Peoria have landscaping / aesthetic improvements planned for the near future on or near Grand Avenue:

- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding to implement the recommendations made in *The Grand Vision – Grand Avenue Image Improvement Study* including landscaping along the outside and median of Grand Avenue. The City of Glendale also includes landscaping improvements on 67<sup>th</sup> Avenue from Grand Avenue to Northern Avenue, Maryland Avenue from 51<sup>st</sup> Avenue to 59<sup>th</sup> Avenue, 51<sup>st</sup> Avenue from Grand Avenue to Camelback Road, and along 59<sup>th</sup> Avenue in their CIP.
- The City of Peoria's FY 2004 Capital Improvement Program Highlights includes funding for a pedestrian project at Peoria Avenue / 83<sup>rd</sup> Avenue / Grand Avenue which includes landscaping improvements (also included in MAG Transportation Improvement Program (TIP)).

### Exhibit 3.18 Existing Landscaping Grand Avenue within Study Area

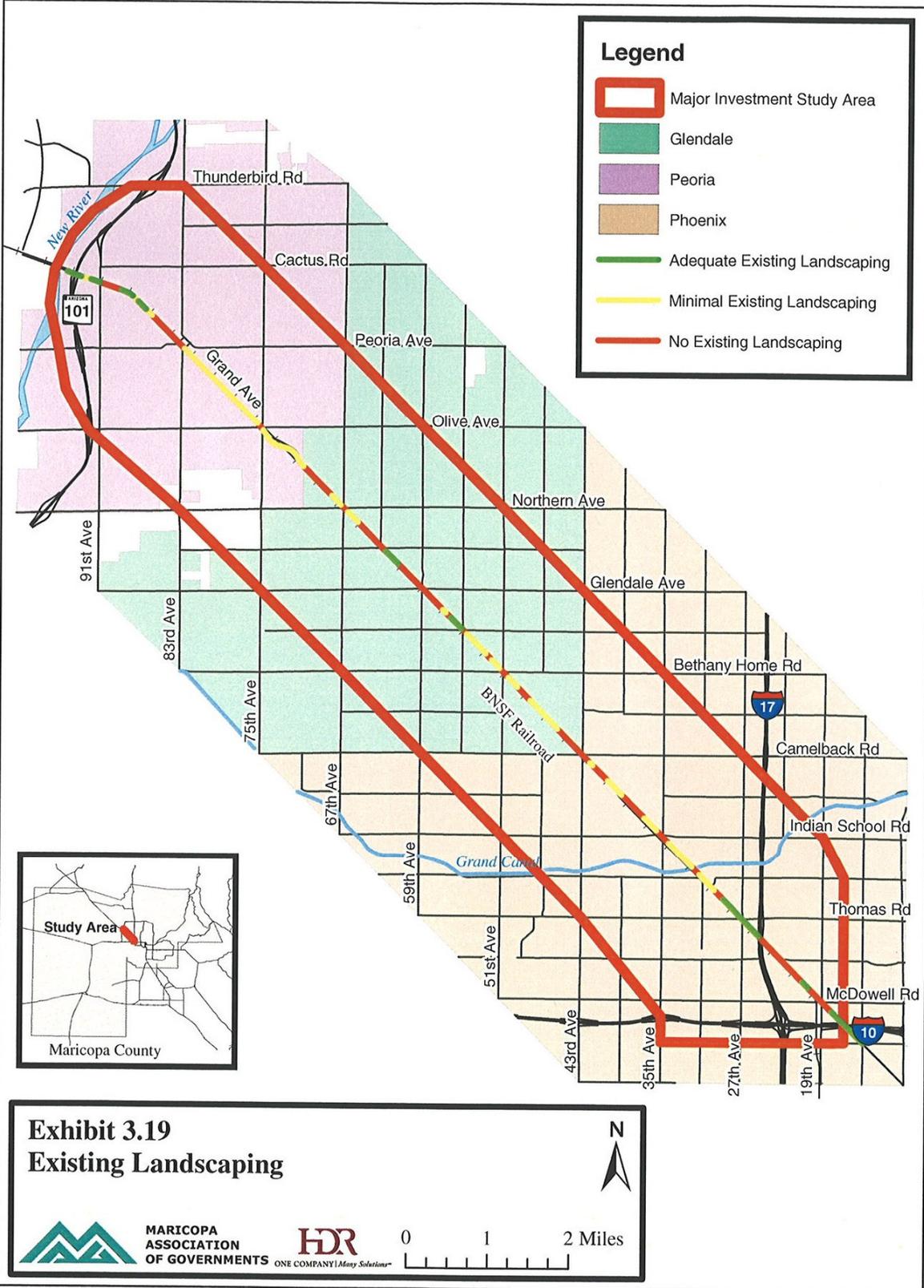
Location	Area	Type	Amount
15 <sup>th</sup> Avenue – 18 <sup>th</sup> Avenue	Outside	Trees Shrubs	~ 40 ~ 50
20 <sup>th</sup> Avenue – 21 <sup>st</sup> Avenue	Median	Shrubs	~ 10
Grand Avenue overpass at 27 <sup>th</sup> Avenue / Thomas Road	Outside	Trees Shrubs	* *
Grand Avenue / Osborn Avenue intersection	Median	Palm Trees	3
Grand Avenue / Osborn Avenue / 31 <sup>st</sup> Avenue	Median	Palm Trees	4
East of 33 <sup>rd</sup> Avenue	Median	Palm Trees	3
West of 33 <sup>rd</sup> Avenue	Median	Palm Trees	1
East of Grand Avenue / Indian School Road / 35 <sup>th</sup> Avenue	Median	Palm Trees	3
East of 37 <sup>th</sup> Avenue	Median	Palm Trees	6
East of 39 <sup>th</sup> Avenue	Median	Palm Trees	4
West of 39 <sup>th</sup> Avenue	Median	Palm Trees	3
East of Grand Avenue / Camelback Road / 43 <sup>rd</sup> Avenue	Median	Palm Trees	1
East of Missouri Avenue	Median	Palm Trees	2
West of Missouri Avenue	Median	Palm Trees	4
East of Grand Avenue / Bethany Home Road / 51 <sup>st</sup> Avenue	Median	Palm Trees Trees Shrubs	7 2 1
West of Grand Avenue / Bethany Home Road / 51 <sup>st</sup> Avenue	Median	Palm Trees	4
East of 53 <sup>rd</sup> Avenue	Median	Palm Trees	1
West of 53 <sup>rd</sup> Avenue	Median	Palm Trees	4
East of Maryland Avenue / 55 <sup>th</sup> Avenue	Median	Palm Trees	4
55 <sup>th</sup> Avenue – 56 <sup>th</sup> Avenue	Median	Trees Shrubs	~ 15 ~ 20
57 <sup>th</sup> Avenue	Median	Trees Shrubs	1 ~ 10
West of Myrtle Avenue / 61 <sup>st</sup> Avenue	Median	Trees Shrubs	~ 15 ~ 20
East of Northern Avenue / 67 <sup>th</sup> Avenue	Median	Trees	5
West of Northern Avenue / 67 <sup>th</sup> Avenue	Median	Trees	3
71 <sup>st</sup> Avenue – Olive Avenue / 75 <sup>th</sup> Avenue	Median / Outside	Trees Shrubs	* *
Olive Avenue / 75 <sup>th</sup> Avenue – Monroe Street / 81 <sup>st</sup> Avenue (west of Grand Avenue)	Outside	Trees Shrubs	* *
Monroe Street / 81 <sup>st</sup> Avenue – Peoria Avenue (east of Grand Avenue)	Outside	Trees Shrubs	* *
East of 87 <sup>th</sup> Avenue	Median	Trees	3
West of 87 <sup>th</sup> Avenue	Median	Trees Shrubs	~ 7 ~ 10
West of 88 <sup>th</sup> Drive	Median	Trees Shrubs	1 ~ 20
West of 91 <sup>st</sup> Avenue	Median	Trees	~ 10
SR 101L half diamond service interchange	Outside	Trees Shrubs	* *

\* Indicates areas where landscaping exists in such amount as to not be readily quantifiable.

#### 3.1.12 Lighting

Within the Study Area, street lighting is provided along Grand Avenue in the following segments:

### Exhibit 3.19 Existing Landscaping



### Westbound Grand Avenue

- 15<sup>th</sup> Avenue to west of 43<sup>rd</sup> Avenue
- 51<sup>st</sup> Avenue and Bethany Home Road intersection
- West of 55<sup>th</sup> Avenue to south of Butler Drive
- East of 81<sup>st</sup> Avenue to north of Peoria Avenue

### Eastbound Grand Avenue

- 88<sup>th</sup> Drive to west of 85<sup>th</sup> Avenue
- North of Peoria Avenue to Monroe Street
- East of 67<sup>th</sup> Avenue to 15<sup>th</sup> Avenue

Based on information contained in their CIPs both the City of Phoenix and the City of Peoria have street lighting improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding for street modernization including the installation of street lights that may or may not affect Grand Avenue or the arterials that cross it.
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for street lighting improvements along the realigned 83<sup>rd</sup> Avenue from Olive Avenue to Peoria Avenue.

### **3.1.13 Freight Facilities**

#### **Rail**

As discussed in Section 3.1.7, the BNSF Railway has track that parallels Grand Avenue throughout the Study Area. Along this alignment, there are several yards and one intermodal facility where freight is transferred to/from rail and truck. Refer to Section 3.4.4 for detailed information on the facilities and operations of the railway.

#### **Truck**

With the completion of SR 101L (Agua Fria Freeway) freight traffic along Grand Avenue has decreased. However, the presence of the BNSF intermodal facility as well as several municipal downtowns located either on or in the vicinity of Grand Avenue still requires the movement of freight by truck within the Study Area.

At the BNSF intermodal facility located north of Camelback Road and south of Grand Avenue, large amounts of freight are transferred from truck to train and vice versa. As the freight has destinations all across the Phoenix metropolitan area, it is likely a majority of the truck traffic either travels along Grand Avenue or crosses it.

Aside from the BNSF intermodal facility, there are no major trucking distribution centers along Grand Avenue within the Study Area.

## **3.2 Existing and Historical Traffic**

### **3.2.1 Average Weekday Daily Traffic Volumes**

Historical traffic count information was collected from various sources including a previous study completed by ADOT and information contained on MAG's website, which had a common base year for the available traffic counts of year 2002. Exhibit 3.20 illustrates the 2002 Average Daily Weekday Traffic along the Study Area. A comparison was made between the 1998 traffic volumes from the 1999 MIS and the obtained 2002 traffic volumes. This comparison is shown graphically in Exhibit 3.21. Numerical volume and percent differences along Grand Avenue are provided in Exhibit 3.22.

As can be seen from Exhibit 3.22, a majority of the sections of Grand Avenue have decreased in traffic volume between the years 1998 and 2002. This can be attributed to the opening of SR 101L which provides a continuous freeway facility between I-10 and I-17. The continuous section of SR 101L provides an alternative route choice in the West Valley area relieving short term traffic impacts along Grand Avenue.

A comparison between 2002 actual average daily traffic (ADT) counts obtained from MAG and the 2002 model ADT produced from the MAG transportation demand model is shown in Exhibit 3.23. In conformance with standard practice in traffic forecasting, future year traffic forecasts were adjusted based upon the results presented in this exhibit.

### **3.2.2 Peak Hour Traffic Volumes and Turning Movement Counts**

Derived from the MAG transportation demand model, Exhibit 3.24 presents the peak hour volumes, both AM and PM, for year 2002.

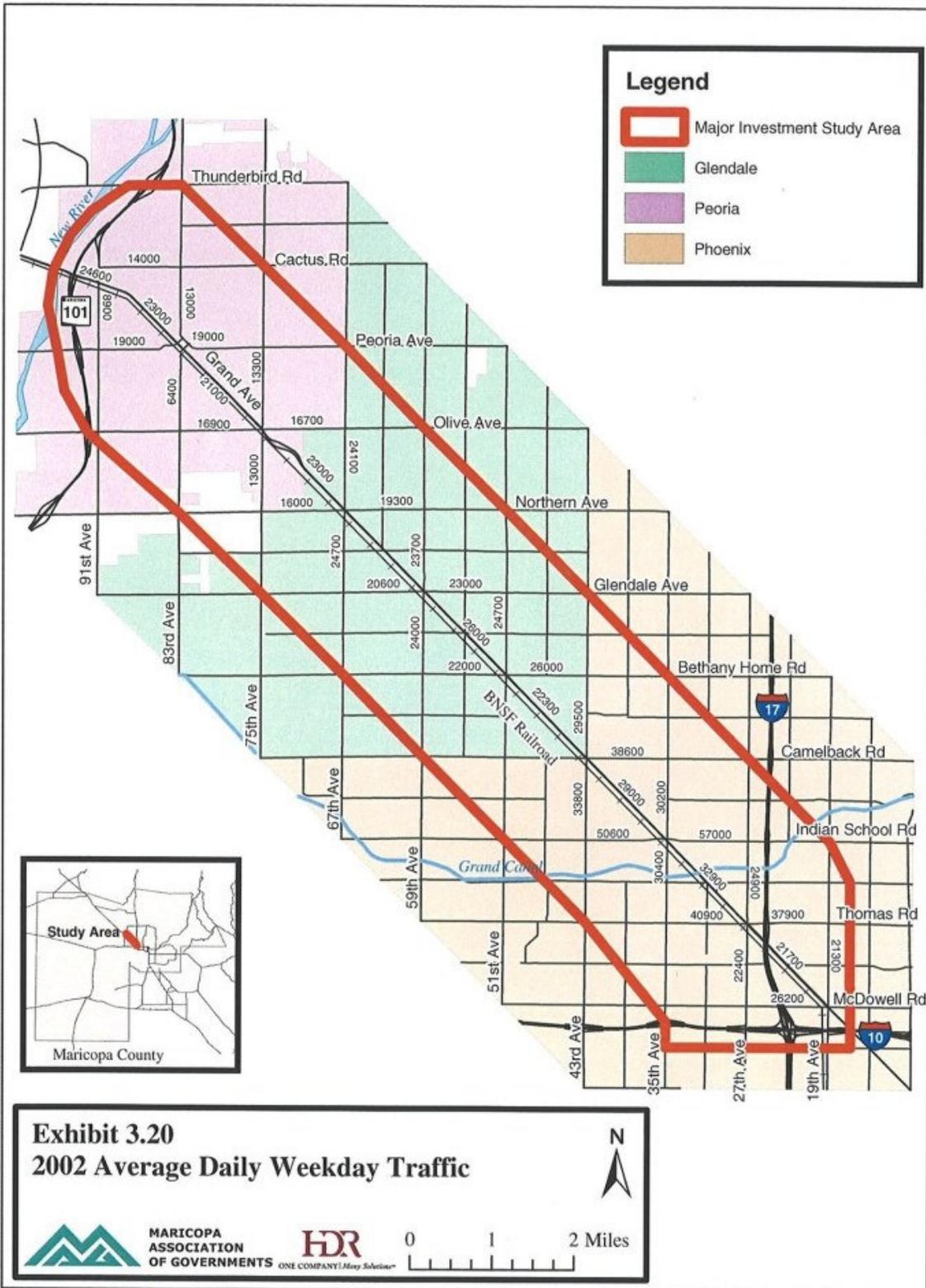
## **3.3 Existing Traffic Operating Conditions**

As discussed in the previous section, the year 2006 short-term forecast developed from the MAG regional travel demand model was used as the base condition. Roadway and intersection turning movement information based on the model data was then used to develop level of service analysis. Additionally, select link analysis was performed on Grand Avenue to identify where vehicle trips start and end that travel along specific sections of Grand Avenue. Comparative analysis was also performed between the forecast years.

### **3.3.1 Congestion and Level of Service (LOS)**

The intersection Level of Service (LOS) for the major intersections along Grand Avenue as generated by the MAG transportation demand model for year 2002 is presented in Exhibit 3.25.

Exhibit 3.20 2002 Average Daily Weekday Traffic





### Exhibit 3.22 Grand Avenue Traffic Volume Comparison Year 1998 and 2002

Section	1998 Average Weekday Daily Traffic*	2002 Average Weekday Daily Traffic**	Volume Difference from 1998 to 2002	Percent Difference from 1998 to 2002
SR 101L – 91 <sup>st</sup> Ave	30,100	24,600	-5,500	-18%
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	22,900	23,000	+100	0%
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	20,100	21,000	+900	+4%
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	21,000	23,000	+2,000	+10%
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	25,000	24,000	-1,000	-4%
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	24,500	26,000	+1,500	+6%
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	29,500	22,300	-7,200	-24%
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	34,900	29,000	-5,900	-17%
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	36,000	32,900	-3,100	-9%
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	25,300	21,700	-3,600	-14%

\*Source: Grand Avenue Major Investment Study Final Report, September 1999, ADOT.

\*\*Source: MAG "2002 / 2003 Average Weekday Volume Traffic Map (Final Draft)", Updated June 23, 2004, MAG.

### Exhibit 3.23 Volume Comparison 2002 Model versus 2002 Actual

Section	2002 Model ADT	2002 Actual ADT*	Volume Difference between Model and Actual	Percent Difference between Model and Actual
SR 101L – 91 <sup>st</sup> Ave	33,300	24,600	8,700	26%
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	28,700	23,000	5,700	20%
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	22,600	21,000	1,600	7%
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	29,800	23,000	6,800	23%
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	30,300	24,000	6,300	21%
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	30,600	26,000	4,600	15%
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	31,400	22,300	9,100	29%
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	30,400	29,000	1,400	5%
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	31,400	32,900	-1,500	-5%
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	32,000	21,700	10,300	32%

\*As shown in MAG "2002 / 2003 Average Weekday Volume Traffic Map (Final Draft)".

### Exhibit 3.24 Peak Hour Volumes from 2002 Model

Section	2002 Model Peak Hour Volumes	
	AM	PM
SR 101L – 91 <sup>st</sup> Ave	6,820	8,440
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	6,340	7,480
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	5,200	5,580
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	6,850	7,510
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	6,660	7,270
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	7,090	7,560
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	7,330	7,650
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	7,000	7,360
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	7,120	7,590
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	6,660	7,390

### Exhibit 3.25 Intersection Level of Service (LOS) 2002 Model

Intersection	2002 Model Intersection LOS	
	AM	PM
SR 101L / Grand Ave	B	C
91 <sup>st</sup> Ave / Grand Ave	B	C
Peoria Ave / Grand Ave	C	D
83 <sup>rd</sup> Ave / Grand Ave	C	C
75 <sup>th</sup> Ave / Olive Ave / Grand Ave	D	E/F
67 <sup>th</sup> Ave / Northern Ave / Grand Ave	N/A	C
59 <sup>th</sup> Ave / Glendale Ave / Grand Ave	D	E/F
51 <sup>st</sup> Ave / Bethany Home Rd / Grand Ave	E/F	E/F
43 <sup>rd</sup> Ave / Camelback Rd / Grand Ave	D	E/F
35 <sup>th</sup> Ave / Indian School Rd / Grand Ave	D	E/F
27 <sup>th</sup> Ave / Thomas Rd / Grand Ave	C	C
19 <sup>th</sup> Ave / McDowell Rd / Grand Ave	C	E/F

#### 3.3.2 Crash Analysis

The three most current years of crash data along Grand Avenue were collected from the ADOT Traffic Records Section. The data covers the time period from November 1, 2000 to October 31, 2003. A total of 1,304 crashes occurred along Grand Avenue within the Study Area over this three-year period. Approximately 57% (745) of all crashes occurred at major intersections along Grand Avenue while the remaining 43% (559) occurred along segments of Grand Avenue.

The crash data was broken down based on the incident occurring at either a six-legged intersection (also include 91<sup>st</sup> Avenue and 99<sup>th</sup> Avenue) or along a segment of Grand Avenue. For the purposes of this analysis, crashes occurring within 150 feet of a six-legged intersection are considered to occur at the intersection. Crashes occurring at all minor intersection are considered to occur along the segment.

As part of this crash analysis, nine data fields were analyzed and are discussed in detail below for both intersection and segment data. The nine data fields include:

- First Harmful – The first thing encountered by the initiating vehicle in the crash
- Daylight – Whether it was daytime, dawn/dusk or nighttime
- Weather – What the weather was like at the time of the crash
- Intersection Related – Whether an intersection, driveway or alley was an access point relating to the crash
- Injury – Whether the crash had fatalities, injuries or property damage only
- Collision Manner – How the initiating vehicle hit the other, if another was present
- Special Location – Did the crash occur at a special location such as a railroad crossing or pedestrian crosswalk
- Road Condition – The condition of the roadway at the time of the crash (i.e. under construction, pot-holes, flooded)
- Surface Condition – The condition of the surface of the roadway at the time of the crash (i.e. dry, wet, sand)

Within the “first harmful” field, 91% (678) of the intersection crashes involved another vehicle, 1% (8) involved a pedestrian, 1.5% (11) involved a train, 1% (8) involved a bicyclist and the remaining 5.5% (40) were other. Along the segments, 83% (463) of the segment crashes involved another vehicle, less than 1% (4) involved a pedestrian, 2% (10) involved a bicyclist and the remaining 14% (82) were other.

Within the “daylight” field, 71% (532) of the intersection crashes occurred during daylight hours, 4% (27) occurred during dawn/dusk, and 25% (185) occurred during darkness. Along the segments, 70% (390) of the crashes occurring during daylight hours, 7% (38) occurred during dawn/dusk, and 23% (129) occurred during darkness.

Within the “weather” field, 84% (627) of the intersection crashes occurred when the weather was clear, while only 3.6% (27) occurred when it was raining; the remaining 12% (91) were other. Along the segments, 89% (498) of the crashes occurring when the weather was clear, while only 3% (16) occurred when it was raining; the remaining 8% (45) were other.

Within the “intersection related” field, 77% (576) of the intersection crashes were related to intersections. Also worth noting, 22% (165) of the intersection crashes reported “no relationship” to an intersection in their filings. The remaining 1% (4) were related to driveways. Along the segments, 47% (262) of the crashes were related to intersections and 6% (33) were related to driveways. Similar to the intersection crashes, 47% (264) of the segment crashes reported “no relationship” to an intersection in their filings.

Within the “injury” field, 68% (510) of the intersection crashes were property damage only (PDO), 31% (230) were crashes in which injuries were sustained and 1% (5) were crashes in which the most severe injury was a fatality. Along the segments, 59% (332) of the crashes were property damage only, 40% (223) were crashes in which injuries were sustained and less than 1% (4) were crashes in which the most severe injury was a fatality. Exhibits 3.26 and 3.27 present injury data for both intersections and segments along Grand Avenue within the Study Area.

**Exhibit 3.26 Crashes by Severity on Grand Avenue at Major Intersections (11/1/2000 - 10/31/2003)**

Intersection	Crashes	Injury			Total
		Fatal	Injury	PDO	
15th / Roosevelt / Grand	20	1	4	15	20
19th / McDowell / Grand	29	0	12	17	29
27th / Thomas / Grand	48	0	14	34	48
35th / Indian School / Grand	41	0	10	31	41
43rd / Camelback / Grand	78	3	31	44	78
51st / Bethany Home / Grand	130	1	35	94	130
55th / Maryland / Grand	55	0	16	39	55
59th / Glendale / Grand	121	0	46	75	121
67th / Northern / Grand	58	0	16	42	58
75th / Olive / Grand	75	0	18	57	75
83rd / Peoria / Grand	38	0	6	32	38
91st / Grand	46	0	19	27	46
99th / Grand	6	0	3	3	6
<b>Total</b>	<b>745</b>	<b>5</b>	<b>230</b>	<b>510</b>	<b>745</b>

### Exhibit 3.27 Crashes by Severity on Grand Avenue between Major Intersection

Segment	Crashes	Injury			Total
		Fatal	Injury	PDO	
15th Ave - 19th Ave	26	0	9	17	26
19th Ave - 27th Ave	19	0	8	11	19
27th Ave - 35th Ave	101	1	44	56	101
35th Ave - 43rd Ave	100	2	52	46	100
43rd Ave - 51st Ave	33	0	13	20	33
51st Ave - 55th Ave	20	0	5	15	20
55th Ave - 59th Ave	25	0	9	16	25
59th Ave - 67th Ave	97	0	32	65	97
67th Ave - 75th Ave	31	1	15	15	31
75th Ave - 83rd Ave	36	0	19	17	36
83rd Ave - 91st Ave	54	0	11	43	54
91st Ave - 99th Ave	17	0	6	11	17
<b>Total</b>	<b>559</b>	<b>4</b>	<b>223</b>	<b>332</b>	<b>559</b>

Within the “collision manner” field, 47% (347) of the intersection crashes were rear-end, 17% (128) were sideswipe, 15% (115) were angle and the remaining 21% (155) were other. Along the segments, 35% (196) were rear-end, 15% (85) were sideswipe and 18% (101) were angle. In addition along the segments, 4% (23) involved a U-turn movement. The remaining 28% (154) were other.

Within the “special location” field, a vast majority of both intersection (97%, 719) and segment (98%, 550) crashes reported no special location. For intersection crashes, approximately 2.5% (18) involved a railroad crossing and 1% (6) involved a pedestrian crossing. The remaining crashes were other.

Within the “road condition” field, again a vast majority of both intersection (98%, 727) and segment (98%, 547) crashes reported no adverse roadway conditions. For intersection crashes, 2% (18) of crashes occurred along portions of the roadway that was either under construction or had temporary lane closures. For segment crashes, 2% (11) of crashes occurred along these same types of restrictions.

Within the “surface condition” field, 75% (554) of the intersection crashes occurred when the pavement was dry, while only 5% (38) occurred while the pavement was wet. For the intersection crashes 18% (136) of the incidents did not report the surface condition. The remaining 2% (17) were other. Along the segments, 75% (421) of the crashes occurred when the pavement was dry and 11% (64) of the crashes occurred when the pavement was wet. For segment crashes, 11% (60) of the incidents did not report the surface condition. The remaining 3% (14) were other.

The two intersections with the highest number of crashes were:

- 51<sup>st</sup> Avenue / Bethany Home Road / Grand Avenue with 130 crashes
- 59<sup>th</sup> Avenue / Glendale Avenue / Grand Avenue with 121 crashes

The three segments with the highest number of crashes were:

- 27<sup>th</sup> Avenue – 35<sup>th</sup> Avenue with 101 crashes
- 35<sup>th</sup> Avenue – 43<sup>rd</sup> Avenue with 100 crashes
- 59<sup>th</sup> Avenue – 67<sup>th</sup> Avenue with 97 crashes

Based on information contained in CIPs the cities of Phoenix, Glendale and Peoria have safety improvements planned for the near future on or near Grand Avenue:

- The City of Phoenix's 2003 – 2008 Capital Improvement Program includes funding projects at undetermined locations to reduce traffic congestion and eliminate safety hazards as needs are determined.
- The City of Glendale's 2003 – 2012 Capital Improvement Plan includes funding for traffic safety improvements to reduce accidents at high-incident locations.
- The City of Peoria's FY 2004 Capital Improvement Program includes funding for safety improvements for the Peoria Avenue / 83<sup>rd</sup> Avenue / Grand Avenue intersections.

### **3.4 Existing and Planned Multi-Modal Facilities and Usage**

Although the predominant mode of travel within the Study Area is by private automobile, Grand Avenue is a multi-modal transportation corridor that also includes transit, rail, pedestrian and bicycle facilities and services. There are short- and long-term plans to enhance the multi-modal facilities within the Study Area.

#### **3.4.1 Public Transit Service**

##### **Existing Public Bus Service**

As Exhibits 3.28 and 3.29 indicate, the Study Area is served by a strong combination of local, express, circulator, and RAPID bus routes. In January 2004, the Grand Avenue Limited route replaced the Yellow Line as the local route that runs along Grand Avenue. It provides four morning trips from the Peoria Community Center to downtown Phoenix and four evening trips in the opposite direction. The Grand Avenue Limited route intersects 13 long-standing and three new north-south and east-west local bus routes. The long-standing routes include: Routes 17, 19, 24, 27, 35, 41, 43, 50, 59, 60, 67, 106 and the Green Line. The new routes are Route 51, which runs along 51<sup>st</sup> Avenue, Route 70, which links Luke Air Force Base to downtown Glendale along Glendale Avenue, and the Glendale Urban Shuttle (GUS), which is a circulator around downtown Glendale. Weekday hours of service vary by route, but it is the general goal of Valley Metro to provide service from 4:00 – 5:00 AM to midnight with a peak frequency of 15 minutes and an off-peak frequency of 30 minutes.

In addition to routes intersecting the Grand Avenue Limited route, the Study Area is also served by bus routes which travel through the Study Area but do not intersect the Grand Avenue Limited

### Exhibit 3.28 Existing Valley Metro Bus Routes

Route	Weekday Hours	Municipality <sup>1</sup>	Total Passengers		Passengers per Mile	
			Weekday	Saturday	Weekday	Saturday
<b>Routes Along Grand Avenue</b>						
Grand Avenue Limited	4 am trips / 4 pm trips	Glendale	14	--	0.3	--
		Peoria	58	--	4.3	--
		Phoenix	69	--	1.2	--
		Total	141	--	1.1	--
<b>Routes Intersecting Grand Avenue</b>						
17 – McDowell	4:30am to midnight	Phoenix	8,687	3,988	3.8	3.3
		Total	9,264	4,415	3.8	3.3
19 – 19 <sup>th</sup> Avenue	4:00am to 12:20am	Phoenix	8,524	4,664	2.7	2.7
24 – Glendale / Lincoln	5:00am to midnight	Glendale	1,175	479	5.3	2.6
		Phoenix	5,372	2,781	3.1	2.6
		Total	6,547	3,260	3.3	2.6
27 – 27 <sup>th</sup> Avenue	5:00am to 10:45pm	Phoenix	4,430	2,765	3.4	2.2
35 – 35 <sup>th</sup> Avenue	5:30am to midnight	Phoenix	6,712	3,993	2.9	2.2
41 – Indian School	4:30am to 12:20pm	Phoenix	9,275	4,329	3.5	3.1
		Total	10,111	4,871	3.5	3.0
43 – 43 <sup>rd</sup> Avenue	4:50am to 11:00pm	Phoenix	3,177	1,770	2.7	1.7
50 – Camelback	4:20am to midnight	Phoenix	5,698	2,773	4.1	2.9
		Total	6,127	2,934	3.8	2.8
51 – 51 <sup>st</sup> Avenue	4:30am to 9:15pm	Glendale	446	191	1.4	1.2
		Phoenix	670	275	2.2	1.8
		Total	1,116	466	1.8	1.5
59 – 59 <sup>th</sup> Avenue	5:15am to 10:40pm	Glendale	1,771	945	2.4	1.3
		Phoenix	1,024	464	2.5	1.2
		Total	2,795	1,409	2.4	1.3
60 – Bethany Home	4:30am to 10:00pm	Glendale	615	269	3.0	1.3
		Phoenix	1,424	1,119	3.0	2.4
		Total	2,039	1,388	3.0	2.1
67 – 67 <sup>th</sup> Avenue	6:00am to 10:00pm	Glendale	1,404	854	2.1	1.5
		Phoenix	1,119	567	3.3	2.0
		Total	2,523	1,421	2.5	1.7
70 – Glendale / Luke Link	5:40am to 7:15pm	Glendale	319	153	0.8	0.6

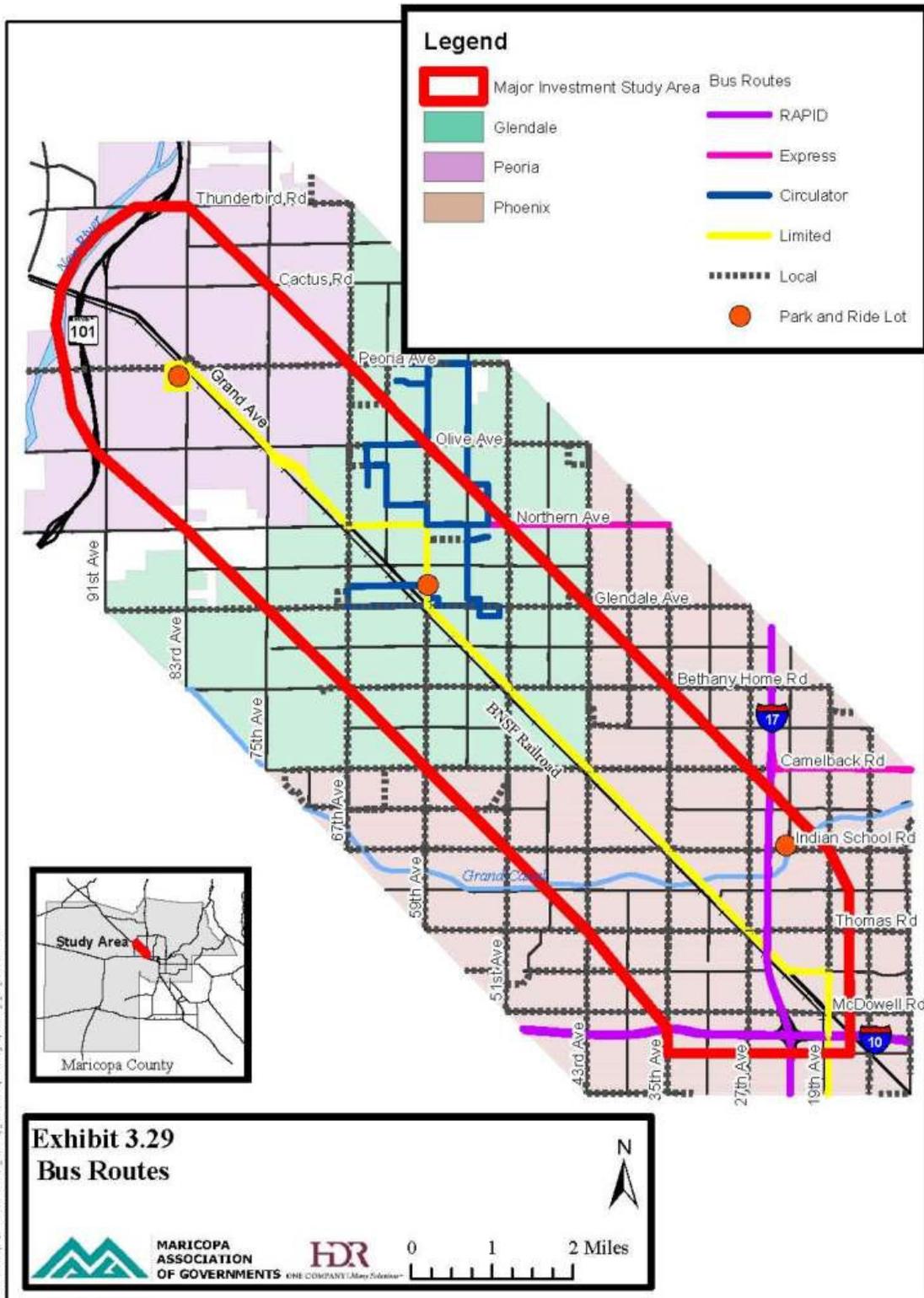
**Exhibit 3.28 Existing Valley Metro Bus Routes (cont.)**

Route	Weekday Hours	Municipality <sup>1</sup>	Total Passengers		Passengers per Mile	
			Weekday	Saturday	Weekday	Saturday
106 – Peoria / Shea	3:30am to midnight	Glendale	540	386	2.7	1.6
		Peoria	363	--	2.2	--
		Phoenix	2,648	1,673	2.0	1.5
		Total	3,938	2,275	1.8	1.4
Green – Thomas	4:30am to midnight	Phoenix	11,024	5,409	5.1	4.4
		Total	11,584	5,635	4.6	3.8
GUS	7:00am to 6:00pm	Glendale	241	161	0.8	1.6
<b>Other Routes Serving Study Area</b>						
80 – Northern	5:00am to 10:00pm	Glendale	413	193	2.8	1.3
		Phoenix	1,023	629	2.6	1.6
		Total	1,436	822	2.7	1.6
90 – Dunlap	5:00am to 10:00pm	Glendale	656	342	3.2	1.8
		Phoenix	2,203	1,454	2.4	1.7
		Total	2,859	1,796	2.5	1.7
122 – Cactus	5:30am to 9:30pm	Phoenix	382	239	0.8	0.5
560 – Avondale (Exp.)	2 am trips / 2 pm trips	Phoenix	82	--	1.3	--
		Total	123	--	1.2	--
570 – Glendale (Exp.)	2 am trips / 2 pm trips	Glendale	25	--	2.0	--
		Phoenix	43	--	0.7	--
		Total	68	--	0.9	--
581 – North Mtn. (Exp.)	3 am trips / 3 pm trips	Glendale	22	--	2.3	--
		Phoenix	90	--	0.9	--
		Total	112	--	1.0	--
I-10 West (RAPID)	12 am trips / 11 pm trips	Phoenix	541	--	1.8	--
I-17 (RAPID)	17 am trips / 19 pm trips	Phoenix	947	--	1.4	--
GUS III	?	Glendale	?	?	?	?

Source: Valley Metro November 2004 Monthly Ridership Report.

<sup>1</sup>Where no "Total" is listed, the route is wholly contained within the individual municipality listed. Municipalities outside the Study Area were not included, and thus the "Total" may not add up to the summation of the municipalities included.

Exhibit 3.29 Bus Routes



Route. These routes include local Routes 80, 90 and 122; express Routes 560, 570, and 581; RAPID Routes I-10 West and I-17; and the GUS III circulator.

The weekday hours of service and boarding data by municipality can be found for these routes in Exhibit 3.28.

### **Existing Paratransit Service**

Demand response service (also known as paratransit) is characterized by the lack of a predetermined route or schedule. Paratransit service is similar to taxi service in that passengers may board at any origin and be transported to any destination, as long as the origin and destination are within a specific service area. Unlike taxi riders, however, paratransit users may have to share their trip with other passengers who have a similar origin or destination.

Exhibit 3.30 lists paratransit systems operating in the Study Area. These services comply with the requirements of the Americans with Disabilities Act (ADA) to provide paratransit service complementary to local bus service for persons certified as ADA eligible. They also serve non-certified elderly and persons with disabilities and, in some cases, the general public.

Unlike bus routes, these paratransit systems typically do not cross municipal boundaries. An exception is Maricopa County Special Transportation Services, operated by the American Red Cross, which emphasizes medical trips and trips to senior centers. Another paratransit system, Sun Cities Area Transit, operates in the unincorporated area to the west of the Study Area.

Exact hours of operation vary by system. Basic weekday operating hours for all passengers are 7:00AM to 5:30PM in the City of Glendale, 6:00AM to 6:00PM in the City of Peoria, and 5:00AM to midnight in the City of Phoenix. ADA complementary paratransit service has longer hours of operation to match fixed route service. The City of Phoenix and City of Glendale provide Saturday and Sunday service also.

The base fare for dial-a-ride service is \$2.00 in the City of Glendale and \$3.00 in the City of Peoria. Both cities have discounted prices for seniors, persons with disabilities and children. They also provide some discounts for large groups and regular passengers. All ADA riders pay a \$2.00 fare. The City of Phoenix has a zone fare structure with a base fare of \$2.40 for the first zone plus \$1.20 per additional zone. They also discount fares for the elderly, persons with disabilities and children. All ADA riders pay the base fare of \$2.40. The Maricopa County Special Transportation Services provides free trips. Some coordination among the services is provided for transfers, but only Phoenix provides a discount on fares for riders transferring to fixed route service.

### Exhibit 3.30 Paratransit Systems Serving the Grand Avenue Corridor

System	Glendale Dial-a-Ride		Maricopa County Special Transportation Services	Peoria Dial-a-Ride		Phoenix Dial-a-Ride
<b>Eligibility</b>	General public, seniors, and persons with disabilities		Seniors, persons with disabilities, and low income individuals	General public, seniors, and persons with disabilities		Seniors and persons with disabilities
<b>Vehicles</b>	19		55	9		110
<b>Annual Boardings</b>	81,768		106,395	30,399		333,860
<b>Days and Hours of Service</b>	Non-ADA	ADA	All	Non-ADA	ADA	All
	Mon – Fri, 7AM to 5:30PM; Sat – Sun, 7AM to 5PM	Mon – Sun, 5AM to 10PM	Mon – Fri, hours vary	Mon – Fri, 6AM to 6PM	Mon – Fri, 5AM to 8PM	Mon – Fri, 5AM to 12AM; Sat – Sun, 5AM to 10PM
<b>Fare</b>	Base \$2.00	\$2.00	Free	Base \$3.00	\$2.00	Base \$2.40 1 <sup>st</sup> Zone \$0.60 Each Zone
	Discounted \$1.00			Discounted \$1.00		Discounted \$1.20 1 <sup>st</sup> Zone \$0.60 Each Zone
	Age 0 – 5 Free			Age 0 – 5 Free		ADA \$2.40 1 <sup>st</sup> Zone \$1.20 Each Zone
<b>Discounted Transfers</b>	No		No	No		Yes
<b>Coordinated Transfers</b>	Yes		No	Yes		Yes

Sources: Valley Metro Fiscal Year 2003-2004 Annual Transit Performance Report Regional Bus Fleet Summary: Dial-a-Ride and Vanpools Status Date: June 30, 2003

#### Existing Vanpool Service

Vanpools are organized ridesharing arrangements in which a relatively small group of commuters who have similar origins collectively agree to commute to work in a single vehicle. Vehicles for this type of service may be owned or leased by one of the commuters in the group, a company, or a third party representative.

The Valley Metro Vanpool Program provides vans to groups of eight to 15 commuters throughout the Phoenix metropolitan area, including the Grand Avenue Study Area. Passengers share the basic operating costs (fuel, preventative maintenance, etc.) of the van by paying an equitable monthly fee.

#### Park and Ride Lots

There are four park-and-ride lots in the Grand Avenue Study Area. Two of these lots are in the City of Peoria, while the City of Glendale and Phoenix each have one lot within the Study Area. The lots are available to transit riders by the cities or through informal agreements between property owners and Valley Metro that are subject to change on short notice. Exhibit 3.31 lists the locations of the park-and-ride lots and the bus routes that serve each. The location of the lots with respect to the bus routes can be seen in Exhibit 3.29.

### Exhibit 3.31 Park-and-Ride Lots

Location		Routes Designated	Spaces	Typical Occupancy
Peoria Park & Ride East Street & 84th Avenue,	Jefferson N. E. corner	Grand Avenue Limited, 106	38	30
Peoria Park & Ride West Street & 84th Avenue,	Washington S. W. corner	Grand Avenue Limited, 106	35	30
Glendale City Lot 59th Avenue & Myrtle Avenue, and S.W. corner	N.E.	59, 70, 570, GUS, Grand Avenue Limited	10	4
Thunderbird Fairlanes School Road & 24th Avenue	Indian	41	10	0

Source: City of Phoenix Park-and-Ride Update and Utilization Report dated January 12, 2004.

### Programmed and Planned Transit Improvements

The programmed transit improvements can be broken down into capital and operating investments. The capital investments include park-and-ride lots, maintenance facilities, buses, shelters, pull-outs, etc. The operating investments include lengthening of routes, adding a new routes route, and extending the operating hours of service. Operating improvements can be made to dial-a-ride service, fixed route service and vanpool service.

Exhibit 3.32 summarizes the programmed capital and operating improvements for Fiscal Year (FY) 2004 for the City of Peoria, City of Glendale, and City of Phoenix within the Grand Avenue Study Area. This information is from the Valley Metro/Regional Public Transportation Authority (RPTA) Annual Transit Performance Report for FY 2003/FY 2004.

### Exhibit 3.32 Programmed Transit Capital and Operating Improvements: FY 2004

Municipality	Improvement
<b>Planned Capital Improvements</b>	
Peoria	Replace three revenue vehicles
Glendale	Begin design of Park-and-Ride in Glendale
Phoenix	Bus purchases for replacement of existing fleet
	Maintenance for buses, parts, and components
	Purchase new fareboxes
	Construct various bus bays and bicycle lanes
<b>Planned Operating Improvements</b>	
Peoria	Upgrade transit dispatch system
Glendale	Implement new Grand Avenue Limited service
	Implement new Route 51 - 51st Avenue service
	Expand Glendale Urban Shuttle (GUS) to include a new route
Phoenix	Implement hourly weekday and Saturday service on Route 41-Indian School
	Implement new Grand Avenue Limited service
	Implement new Route 51 - 51st Avenue service
	Add one earlier morning eastbound trip on Route 60-Bethany Home Road

Source: Valley Metro Fiscal Year 2003-2004 Annual Transit Performance Report.

The City of Glendale approved a half-cent sales tax initiative in November 2001 that is charged with funding a comprehensive transportation program. Included in this program is the expansion of local bus service – including service seven days a week, and increased level of specialized

transit services – dial-a-ride hours of service, express bus routes, neighborhood collectors, and light rail.

The City of Peoria does not have a dedicated local transit funding source. They are served by the regional fixed route transit service provided by the RPTA. The only transit services operated and funded by the City of Peoria is the dial-a-ride service.

The City of Phoenix passed the Transit 2000 Plan in March 2000, which provided a dedicated funding source of a 0.4% sales tax. The plan calls for increased local bus service, improved dial-a-ride service, the introduction of new service such as light rail transit service, bus rapid transit service, limited stop services and neighborhood circulators. By 2005, regular bus service will operate on all major streets from 5am to midnight on Monday through Saturday and 6am to 10pm on Sundays and holidays.

In addition to the local city taxes, the planned transit improvements in the Grand Avenue Study Area as well as the whole of Maricopa County are dependent upon the passage of the RTP. The 20-year plan was passed by the voters of Maricopa County in November 2004. This multi-modal plan includes operational funding for improvements to fixed route service and new light rail service within the Study Area. Although most improvements are not detailed in the report, Exhibit 3.33 shows the designated routes and funding levels by phase for improvements to routes within the Study Area.

### Exhibit 3.33 Regional Transportation Plan

Route	Phase	Cost (million \$)
<b>Freeway Expressway/BRT</b>		
West SR 101L Connector (NEW)	I	5
Grand Avenue Limited	II	5.4
<b>Supergrid Route</b>		
Glendale Avenue (24)	I	11.6
Camelback Road	II	6.1
Peoria Avenue/ Shea Boulevard(106)	II	12.6
59th Avenue (59)	II	11.4
McDowell Road/ McKellips Boulevard (17)	II	35.3
Thomas Road (Green)	III	11.7
Indian School Road (41)	III	9.5
Dunlap Avenue/ Olive Avenue (90)	IV	5.5
83rd Avenue/ 75th Avenue (NEW)	IV	4.8
19th Avenue (19)	III	
35th Avenue (35)	III	
<b>Light Rail Transit</b>		
Glendale Link - 19th Avenue/Bethany Home Road to Downtown Glendale	III	180
I-10 West Link – Washington / Central to I-10 / 79 <sup>th</sup> Avenue	III	660

Source: MAG Regional Transportation Plan, Chapter 10.

The planned Glendale Link is a 5-mile section that will connect downtown Glendale to the minimum operating system scheduled to open in 2008. Construction is planned for the third phase of the RTP, which corresponds to FY 2015 – FY 2020. In addition to the Glendale Link, a new transit center and park-and-ride lot are planned at the termini of the link in downtown Glendale.

The planned I-10 West Link will parallel I-10 (Papago Freeway) and provide light rail transit service from the west valley to downtown Phoenix.

The RTP also includes bus purchases, paratransit vehicle purchases, vanpool vehicle purchases, and construction of transit centers, park-and-ride lots, maintenance facilities, and bus stop pullouts. All of these investments will improve transit operations within and around the Grand Avenue Study Area.

### **3.4.2 Non-Motorized Transportation Facilities**

The following types of non-motorized transportation facilities, those used by pedestrians and bicyclists, exist or are planned in the Grand Avenue Study Area:

- **Multi-Use Paths:** Paved or unpaved off-road trails shared by pedestrians, cyclists, and in some cases equestrians. Unpaved multi-use paths exist on both banks of the Grand Canal.
- **Bike Lanes:** On-street lanes signed and striped for the exclusive use of bicycles, typically on both sides of the roadway. Bike lanes may exist on arterial, collector and local streets.
- **Bike Routes:** Roadways without striped bike lanes that are designated as “Bike Routes” by signage only. Bike route signs are typically posted on collector and local streets rather than arterial streets.

#### **Existing Facilities**

The existing non-motorized transportation facilities are listed in Exhibit 3.34. All three types of facilities are represented within the Grand Avenue Study Area. There are three routes that cross Grand Avenue and 25 routes that enter the Study Area but do not cross Grand Avenue.

#### **Programmed and Planned Facilities**

There are four projects in the current MAG Transportation Improvement Program, 2004-2007, that improve non-motorized transportation within the Grand Avenue Study Area. The projects are listed in Exhibit 3.35 and include alleyway improvements, bike lanes, at-grade crossing, and a grade separated crossing.

Similar to the planned transit improvements, the planned non-motorized transportation improvements are tied into the MAG RTP. The money assumed to be available for non-motorized transportation facilities comes from local sources and from CMAQ funding, which is federally allocated for air quality and congestion relief. The funding level in the RTP is not sufficient to construct the entire regional non-motorized plan. A majority of the street projects, though, do include funding for improvements that will accommodate bicycle usage.

### Exhibit 3.34 Existing Bikeways and Trails

Location	Facility Type	Municipality
<b>Facilities that Cross Grand Avenue</b>		
Grand Canal	Multi-Use Paths	Phoenix
Maryland Avenue	Bike Lanes	Glendale
61 <sup>st</sup> Avenue, Maryland Avenue – Dunlap (Olive) Avenue	Popular Undesignated Route	Glendale
<b>Other Facilities Entering Corridor</b>		
23rd Avenue, Encanto Boulevard-Hatcher Road	Bike Lanes	Phoenix
31st Avenue, Washington Street-Encanto Boulevard & Indian School-Camelback Road	Bike Lanes	Phoenix
39th Avenue, Roosevelt Street-Osborn Road	Bike Lanes	Phoenix
47th Avenue, Campbell Avenue-Thomas Road	Bike Lanes	Phoenix
Encanto Boulevard, 47th-31st Avenue & 21st-3rd Avenue	Bike Lanes	Phoenix
Osborn Road, 47th-35th Avenue	Bike Lanes	Phoenix
Campbell Avenue, 55th-47th Avenue & 35th-27th Avenue	Bike Lanes	Phoenix
Missouri Avenue, 43rd Avenue-I-17	Bike Lanes	Phoenix
Bethany Home Road, 39th Avenue-I-17	Bike Lanes	Phoenix
47th Avenue, Missouri Avenue-Butler Drive	Bike Route	Glendale
55th Avenue, Orangewood-Olive Avenue	Bike Route	Glendale
61st Avenue, Bethany Home Road-Maryland Avenue	Bike Route	Glendale
63rd Avenue, Camelback Road-Glendale Avenue	Bike Route	Glendale
71st Avenue, Glendale-Myrtle Avenue	Bike Route	Glendale
Missouri Avenue, 73rd-59th Avenue & 47th-43 <sup>rd</sup> Avenue	Bike Route	Glendale
Glendale Avenue, 99th-67th Avenue	Bike Route	Glendale
Orangewood Avenue, 55th-45th Avenue	Bike Route	Glendale
71st Avenue, Olive Avenue-Thunderbird Road	Bike Lanes	Peoria
79th Avenue, Peoria Avenue-Thunderbird Road	Bike Lanes	Peoria
85th Avenue, Mountain View Road-Peoria Avenue	Bike Route	Peoria
87th Avenue, Orangewood-Peoria Avenue	Bike Lanes / Bike Route	Peoria
Mountain View Road, 73rd-63rd Avenue & 91st-85th Avenue	Bike Lanes	Peoria
Varney Lane/Cholla Street, 87th-31st Avenue	Bike Lanes	Peoria
Sweetwater Avenue, 87th-71st Avenue	Bike Lanes	Peoria
Monroe Street, 83rd-85th Avenue	Bike Route	Peoria

Source: "Bikeways in the Phoenix Metropolitan Area" (MAG, 2003).

### Exhibit 3.35 Programmed Bicycle / Pedestrian Improvements 2004 - 2007

Location	Description	Municipality	Year	Cost
Historic Catlin Court Alleyway	Improve four alleyways for multi-modal use	Glendale	2004	\$101,800
63rd Avenue, Olive Avenue to Grand Avenue	Design and construct bicycle lane	Glendale	2006	\$632,600
Grand Avenue at 83rd and Peoria Avenue	Design and construct at-grade pedestrian crossing	Peoria	2004	\$757,000

Source: MAG Transportation Improvement Program (FY 2004 – FY 2007).

The RTP includes three sub-plans that describe the future non-motorized transportation system. They are the MAG Regional Bicycle Plan, which deals mainly with on-street bicycle facilities, the Regional Off-Street System (ROSS) plan, which utilizes canal banks, railroad easements and other corridors to provide multi-modal trails, and the West Valley Multi-Modal Transportation Corridor Plan, which is a 42-mile trail network that generally follows the New River and lower Agua Fria River corridors. The projects from these three plans that lie within the Grand Avenue Study Area are listed in Exhibit 3.36.

### Exhibit 3.36 Planned Bikeways and Trails

Location	Facility Type	Municipality
<b>MAG Regional Bicycle Plan</b>		
Grand Avenue, SR 74 to Van Buren Street/7th Avenue	Bike Lanes	Peoria Glendale Phoenix
51st Avenue, Bell to Riggs Road	Bike Lanes	Glendale
67th Avenue, Happy Valley Road-Glendale Avenue	Bike Lanes	Glendale
Glendale Avenue, Litchfield Road-7th Street	Bike Lanes	Glendale
23rd Avenue, Bell Road-Van Buren Street	Bike Lanes	Phoenix
31st Avenue, Bell-Van Buren Road	Bike Lanes	Phoenix
<b>MAG Regional Off-Street System Plan (ROSS): Potential Corridors</b>		
High Voltage Power Lines, between Northern and Olive Avenue, 115th-Grand Avenue	Multi-Use Path	Peoria
Railroad along Grand Avenue	Multi-Use Path	Phoenix
Grand Canal	Multi-Use Path	Phoenix
<b>West Valley Multi-Modal Transportation Corridor Plan</b>		
Primary Trail crosses Grand Avenue at New River	Multi-Use Path	Peoria
Secondary Trail crosses Grand Avenue to the east of the Primary Trail at New River	Multi-Use Path	Peoria
Transit Connection Nodes located at intersection of Grand Avenue and Primary Trail and Secondary Trail	Connection	Peoria
Neighborhood/Transit/Connector Trail, West Transit Connection Node along Grand Avenue to Sun City	Multi-Use Path	Peoria

Source: MAG Regional Transportation Plan, Chapter 12.

Refer to Exhibit 3.17 for information on existing and planned bicycle facilities.

#### 3.4.3 Pedestrian Facilities and Restrictions

As noted above in Section 3.1.8, sidewalks do exist along portions of the Grand Avenue corridor. While a continuous sidewalk does not exist along the entire corridor, the side of Grand Avenue opposite the BNSF track does provide for some pedestrian movement. In general, approximately 50% of the corridor in the City of Phoenix and in the City of Glendale has sidewalk. In the City of Peoria, approximately 15% of the corridor has sidewalk.

Signalized intersections do allow for pedestrian movements within the Study Area and pedestrians were observed using them during the field visits. In addition to signalized intersections, several other pedestrian crossings of Grand Avenue were documented.

#### 3.4.4 Rail Facilities and Services

The BNSF Railway parallels the entire length of Grand Avenue within the Study Area. For approximately 70% of the corridor the BNSF is located to the south of Grand Avenue, for the remaining 30% the railroad is located north of Grand Avenue. Between Bell Road and the end of track south of downtown Phoenix, there are 118 potential rail served customers. Cargo traveling along this route includes groceries, asphalt, cement, lumber, building supplies and automobiles.

Within the Study Area, there are six BNSF facilities:

- Mobest Yard, located south of Grand Avenue at the intersection of McDowell Road and 19<sup>th</sup> Avenue, functions as the BNSF's major classification yard in the City of Phoenix. At this location, trains are broken up, reassembled and shipped to their final destinations.
- The BNSF Intermodal Facility is located south of Grand Avenue at the end of Tom Murray Avenue (north of Camelback Road). At this location, freight is transferred between trains and trucks.
- The Santa Fe Center, a rail-served industrial park, is located south of Grand Avenue between Indian School Road and Camelback Road.
- Glendale Yard North and Glendale Yard South exist south of Grand Avenue centered around Maryland Avenue. In the future, these two yards may be combined, potentially reducing the number of trains headed to Mobest Yard.
- The Glendale Depot, located south of Grand Avenue at Glenn Drive (north of Glendale Avenue), functions as BNSF corporate office space.
- The BNSF Automotive Distribution Center, located at Grand Avenue and Thompson Ranch Road (outside Study Area) in the City of El Mirage functions as the BNSFs major distribution center for automobiles heading to the Phoenix metropolitan area.

Commuter rail currently does not exist along Grand Avenue. The BNSF has indicated that the Grand Avenue corridor, as it exists with only one track, could accommodate limited (AM/PM peak) commuter rail in addition to freight rail, so long as the schedules were carefully coordinated. They have also indicated that the potential exists that the Grand Avenue corridor could be double-tracked within existing right-of-way, thereby permitting both freight and commuter rail service within the Study Area throughout the day.

### **3.5 Intelligent Transportation Systems (ITS)**

The MAG ITS Strategic Plan Update (April 2001) is an update of the original ITS Strategic Plan completed in 1995. The Update includes a history of the ITS architecture that currently exists in the region as well as recommendations for improvements and additions to this architecture over the next 20 years.

With respect to existing infrastructure, the Update recognizes the following agencies within the Study Area as being regionally connected, either on the regional fiber optic network or on leased communication links:

- Glendale Police Department
- Glendale Traffic Management Center (TMC)
- Peoria Police Department
- Peoria TMC
- Phoenix Fire

- Phoenix Police Department
- Phoenix TMC
- Phoenix Transit

Based on information contained in the Update, the following roadways currently have or are recommended to have in the near future fiber optic connectivity to the regional system:

- I-17 from Peoria Avenue to I-10 terminus
- 35<sup>th</sup> Avenue from Washington Street to Dear Valley Road
- 59<sup>th</sup> Avenue from Camelback Road to Bell Road
- I-10 from SR 101L to Chandler Boulevard
- Glendale Avenue from SR 101L to Grand Avenue
- Olive Avenue from 79<sup>th</sup> Avenue to 59<sup>th</sup> Avenue

The following list of projects was identified in the Update based on the Draft Transportation Improvement Program ITS Projects (FY 2001 – 2005):

- Glendale Computerized Signal System – Construct Phase I of computerized signal system on 59<sup>th</sup> Avenue from Camelback Road to Beardsley Road, include hardware and software interface with Peoria and Phoenix signals.
- Glendale Computerized Signal System – Construct Phase II of computerized signal system on Bell Road from 51<sup>st</sup> Avenue to 83<sup>rd</sup> Avenue.
- Glendale Computerized Signal System – Construct Phase III of computerized signal system on Glendale Avenue from 43<sup>rd</sup> Avenue to 99<sup>th</sup> Avenue, integrate with Peoria and Phoenix.
- Glendale Traffic Management Center – Design, construct and operate Glendale Traffic Management Center.
- Peoria Citywide Traffic signal Interconnect System – Design and construct citywide traffic signal interconnect system.
- Peoria Citywide Interconnect – Interconnect citywide traffic signal system.

The Update makes reference to the 24 Systematically Managed Arterial (SMART) Corridors identified in the AZTech Metropolitan Model Deployment Initiative (MMDI), of which Grand Avenue is included. SMART Corridors are key arterial links that span the urban area and pass through multiple jurisdictions. They include the implementation of closed-circuit television (CCTV) cameras, variable message signs (VMS) and detection as well as the coordination of traffic signals across multiple jurisdictional boundaries. Within the Study Area, the following arterials have been identified as SMART Corridors:

- Grand Avenue from Van Buren Street to Bell Road
- 59<sup>th</sup> Avenue from I-10 to SR 101L (Agua Fria Freeway)

- Indian School Road from SR 101L (Agua Fria Freeway) to SR 101L (Pima Freeway)
- Camelback Road from SR 101L (Agua Fria Freeway) to Hayden Road
- Glendale Avenue from SR 101L (Agua Fria Freeway) to Scottsdale Road

Based on information contained in its CIP the City of Glendale has ITS improvements planned for the near future on or near Grand Avenue:

- The City of Glendale’s 2003 – 2012 Capital Improvement Plan includes funding for the installation of hardware and software for a computerized signal system throughout Glendale.

### **3.6 Right-of-Way / Property Boundaries**

Property boundaries within the Study Area were identified using Maricopa County property assessor maps and supplemented with ADOT as-built and construction plans.

For those areas along Grand Avenue and the cross-streets where proposed geometric improvements will be analyzed, parcel lines were mapped. Properties owned by ADOT and the State of Arizona were also mapped.

### **3.7 Drainage Facilities**

Two drainage facilities exist within the Study Area. The Grand Canal, discussed in Section 3.1.10, while not designated to carry storm flows, does convey stormwater. The Grand Canal, which travels east-west through the Study Area, is located between Osborn Road and Indian School Road. In addition to the Grand Canal, detention basins are located north of Grand Avenue between Missouri Avenue and Bethany Home Road. Further investigation should identify which systems feed these basins.

Refer to Exhibit 3.1 for the location of the Grand Canal through the Study Area.

### **3.8 Future Conditions**

#### **3.8.1 Future Volumes**

The MAG transportation demand model was run for the year 2030 assuming “base” conditions. “Base” conditions include all improvements identified in the Regional Transportation Plan (RTP) with the exception of improvements along Grand Avenue. While the Project Team understands funding for improvements to Grand Avenue was included in the RTP, part of the objective of this Study was to identify what improvements are needed, and thus a “base” network was reviewed.

As shown in Exhibit 3.37 there is tremendous growth in the ADT along Grand Avenue between 2002 and 2030 (base). The change in volumes range from 28% to a maximum of 126%.

### Exhibit 3.37 Volume Comparison 2002 Model versus 2030 Base Model

Section	2002 Model ADT	2030 Base Model ADT	Volume Difference between 2002 and 2030 Base	Percent Difference between 2002 and 2030 Base
SR 101L – 91 <sup>st</sup> Ave	33,300	54,500	+21,200	+64%
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	28,700	42,800	+14,100	+49%
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	22,600	51,100	+28,500	+126%
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	29,800	57,500	+27,700	+93%
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	30,300	57,400	+27,100	+89%
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	30,600	54,900	+24,300	+79%
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	31,400	59,600	+28,200	+90%
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	30,400	59,500	+29,100	+96%
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	31,400	57,600	+26,200	+83%
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	32,000	40,900	+8,900	+28%

#### 3.8.2 Future Level of Service (LOS)

The future level of service (LOS) at the major intersections along Grand Avenue were investigated for year 2030. Exhibit 3.38 presents a comparison between the AM and PM intersection LOS for years 2002 and 2030 Base.

### Exhibit 3.38 Intersection Level of Service (LOS) Comparison 2002 Model versus 2030 Base Model

Intersection	2002 Model Intersection LOS		2030 Base Model Intersection LOS	
	AM	PM	AM	PM
SR 101L / Grand Ave	B	C	C	D
91 <sup>st</sup> Ave / Grand Ave	B	C	D	E/F
Peoria Ave / Grand Ave	C	D	C	E/F
83 <sup>rd</sup> Ave / Grand Ave	C	C	C	D
75 <sup>th</sup> Ave / <i>Olive Ave</i> / Grand Ave*	D	E/F	E/F	E/F
67 <sup>th</sup> Ave / <i>Northern Ave</i> / Grand Ave*	N/A	C	E/F	E/F
59 <sup>th</sup> Ave / <i>Glendale Ave</i> / <i>Grand Ave</i> *	D	E/F	E/F	E/F
51 <sup>st</sup> Ave / <i>Bethany Home Rd</i> / Grand Ave*	E/F	E/F	E/F	E/F
43 <sup>rd</sup> Ave / <i>Camelback Rd</i> / <i>Grand Ave</i> *	D	E/F	E/F	E/F
35 <sup>th</sup> Ave / <i>Indian School Rd</i> / Grand Ave*	D	E/F	E/F	E/F
27 <sup>th</sup> Ave / <i>Thomas Rd</i> / <i>Grand Ave</i> **	C	C	E/F	E/F
19 <sup>th</sup> Ave / <i>McDowell Rd</i> / Grand Ave	C	E/F	E/F	E/F

\*Roadway in *italics* modeled as grade-separated in year 2030.

\*\*Roadway in *italics* modeled as grade-separated in years 2002 and 2030.

## 4.0 ISSUES AND NEEDS IDENTIFICATION

### 4.1 Introduction

A number of issues concerning the Grand Avenue corridor were identified in the scope of work for the Study, through consultation and through technical analyses. Consultation included discussions with the Agency Steering Group and stakeholders for the corridor, input received at the public meeting, and review of the previous 23 studies or reports identified that relate to the Grand Avenue corridor. From this review, fourteen key issues were identified:

- 1) Connectivity to I-10, I-17, and SR 101L
- 2) Route Transfer
- 3) Ultimate Concepts (Roadway, Transit, Bicycle, Pedestrian, and Community Mitigation)
- 4) Grade Separations
- 5) Intersection Improvements (including skewed & offset intersections)
- 6) Intelligent Transportation Systems (ITS) and signals
- 7) Bottlenecks
- 8) Access Management (including medians and local access needs)
- 9) Safety
- 10) Bicycle and Pedestrian Requirements
- 11) Transit Requirements
- 12) Goods Movement
- 13) Community Mitigation
- 14) Drainage

The issues and needs discussed in this chapter assisted with development of alternatives for transportation improvement projects in the next step of the process.

### 4.2 Issues and Needs Identification

#### 4.2.1 Public and Stakeholder Involvement

To develop as comprehensive a listing as possible of the issues and needs along the Grand Avenue corridor, input from two key groups was solicited. These groups include 1) the general public and other stakeholders, and 2) local, state and federal agencies. Public and stakeholder input were obtained through a public meeting held early in the Study process. Local, state and federal agency representatives participated in the ASG established for the Study and are coordinated with on an ongoing basis. Additionally, representatives of the BNSF railway attended ASG meetings throughout the Study process as a key stakeholder. In addition, the major issues and needs that were identified while reviewing previous reports are included.

Other issues such as potential bottlenecks were identified through field reviews and analyses of results of traffic forecasting developed for the Study. Findings from the traffic forecasting analysis are included in Section 4.2.

## General Public and Other Stakeholders

Project stakeholders are those individuals and public and private entities that have an interest in the project and are not otherwise represented on the Agency Steering Group. They include property owners or tenants along or near Grand Avenue; persons or entities that depend on the portion of Grand Avenue within the Study Area for their livelihood, welfare, or other reasons; or other entities or persons.

On March 30, 2004, the first Public Meeting for the Grand Avenue MIS Phase II project was held at the Peoria Civic Center in the City of Peoria. The objective of this meeting was to gather input on corridor issues. The meeting was attended by approximately 34 members of the public. Also in attendance to answer questions were representatives from each of the three cities within the Study Area (Peoria, Glendale and Phoenix) as well as MAG, ADOT and FHWA.

On July 14, 2005, the second Public Meeting for the Grand Avenue MIS Phase II project was held at the Glendale Civic Center in the City of Glendale. The objective of this meeting was to gather input on the alternatives developed by the ASG. The meeting was attended by approximately 24 members of the public and other stakeholders including representatives from each of the three cities within the Study Area as well as MAG, ADOT, and FHWA.

## Agency Steering Group and Other Participating Agency Representatives

The ASG includes representation from the Cities of Peoria, Glendale and Phoenix as well as ADOT, FHWA, and Valley Metro. Meetings of the ASG were open to the public and other stakeholders, and were consistently attended by representatives of the BNSF Railroad. MCDOT also participated later in the project, following their decision to join with the Cities of Glendale and Peoria for the RTP funded Northern Avenue improvement project, which intersects with Grand Avenue.

In order to gain more input to the Study from local agencies, interviews of elected representatives and others for each agency were solicited. The following interviews were conducted:

Councilmembers Mattox and Simplot (Phoenix) Meeting	August 12, 2004
Councilmember Lingner (Phoenix) Meeting	August 26, 2004
Village Planners (Phoenix) Meeting	September 1, 2004
Maryvale Village Planning Committee (Phoenix) Meeting	September 14, 2004
Encanto Village Planning Committee (Phoenix) Meeting	October 4, 2004
Planning Department (Peoria) Meeting	October 6, 2004
Central City Village Planning Committee (Phoenix) Meeting	October 11, 2004
Councilmember Dennis (Peoria) Meeting	October 12, 2004
Councilmember Hunt (Peoria) Meeting	October 14, 2004
Alhambra Village Planning Committee (Phoenix) Meeting	October 26, 2004
Transportation Planning Department (Glendale) Meeting	November 30, 2004
BNSF Railway Meeting	December 7, 2004
ADOT Meeting	December 9, 2004
Valley Metro Meeting	December 15, 2004

The City of Glendale provided all of their input via their designated senior staff representative on the Agency Steering Group. Most meetings of the Agency Steering Group were held at City of Glendale offices, as this was a central location on the corridor that helped to minimize travel time for Study participants. Meeting at this location also provided additional opportunities for other City of Glendale staff and representatives to participate in the Study if they so wished.

## **Previous Studies**

Appendix A, *Related Studies, Plans, and Programs*, provides a review of the major studies that have been undertaken recently along Grand Avenue. In total, twenty-three reports were reviewed.

## **Corridor Issues**

Discussions of each of the identified issues are presented below. The input received from each of the sources – the general public and other stakeholders, the Agency Steering Group and other participating agency representatives, and the review of previous studies – is presented.

### **4.2.2 Connectivity to I-10, I-17 and SR 101L**

When roadways of varying capacity (collectors, arterials and freeways) cross one another, a junction between the two is typically formed. For local roadways, these junctions are referred to as intersections. When a major arterial intersects with a freeway or expressway, a service interchange is typically provided. And when a major freeway or expressway crosses another major freeway or expressway, a system interchange is typically provided. These connections allow for the movement of traffic from one route to another route, with the ease of movement increasing as the capacity along the routes increases.

On its diagonal path through the central and western portions of the region, Grand Avenue crosses three major freeway corridors: I-10, I-17 and SR 101L.

Grand Avenue currently passes underneath I-10 between 17<sup>th</sup> Avenue and 16<sup>th</sup> Drive. There is no access provided directly to Grand Avenue from I-10. Service interchange access is available at 7<sup>th</sup> Avenue in the form of a Single Point Urban Interchange (SPUI) and at 19<sup>th</sup> Avenue in the form of a half-diamond interchange. The location of the Grand Avenue underpass is approximately 3/4-mile east of the I-10 / I-17 system interchange and one-mile west of the Margaret T. Hance Park tunnel (Deck Park Tunnel) along I-10.

Grand Avenue currently passes over I-17 between Encanto Boulevard and Thomas Road. There is no local access provided to Grand Avenue from I-17. Full diamond service interchanges are provided at McDowell Road (3/4-mile south of the Grand Avenue overpass) and at Thomas Road (1/4-mile north of the Grand Avenue overpass). In this location, Grand Avenue has been reconstructed as a grade-separation over Thomas Road and 27<sup>th</sup> Avenue.

Grand Avenue currently passes over SR 101L between 91<sup>st</sup> Avenue and 99<sup>th</sup> Avenue. A half-diamond service interchange on Grand Avenue provides direct access in the form of a southbound SR 101L entrance ramp and a northbound SR 101L exit ramp. The other two movements, a northbound SR 101L entrance ramp and a southbound SR 101L exit ramp, are provided along 91<sup>st</sup>

Avenue in the form of direct connection ramps (no traffic signals). 91<sup>st</sup> Avenue currently terminates/begins with these access ramps to SR 101L.

Comments related to connectivity of Grand Avenue to the three major freeway corridors are detailed below.

### **General Public and Other Stakeholders**

The following comments related to roadway connectivity were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Connections to I-10 and I-17 were identified on a comment form when asked about “major issues and challenges for the corridor”.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to roadway connectivity were documented:

- ADOT stated that maintaining Grand Avenue as a state highway would require improvements in both functionality and connectivity.
- ADOT does not think a connection to I-17 should be considered in detail as part of this Study, as it has been studied before and rejected based on cost. Also, the Regional Transportation Plan includes funding for I-17 improvements that have not yet been defined. It is recommended that a Grand Avenue/I-17 connection be considered as part of a future I-17 study.
- ADOT does think a connection to I-10 should be considered, possibly along 19<sup>th</sup> Avenue.
- The ASG agreed to address potential connections to both I-10 and I-17 to some degree in the MIS. Given that the RTP includes \$1 billion in funding for improvements to the neighboring section of I-17, for which design studies will be needed, the MIS should make recommendations for a connection or alternative connections for the I-17 DCR to assess in more detail.
- Traffic along Grand Avenue wishing to travel on SB I-17 (to EB I-10) should be on a separate lane and connect with I-17 south of I-10. Traffic on Grand Avenue at 19<sup>th</sup> Avenue destined for downtown Phoenix should be distributed along McDowell Road, 19<sup>th</sup> Avenue, and Grand Avenue.
- Is it even possible to connect Grand Avenue to either I-10 or I-17?
- Identify, cost, evaluate and make recommendations for connections to I-10 and I-17 (Scope).

## **Previous Studies**

The following comments related to roadway connectivity were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The *Grand Avenue Corridor Study; Beardsley Canal to 7<sup>th</sup> Avenue / Van Buren Street* (MAG, 1998) considered freeway connections to SR 101L and I-17. It did not consider enhanced arterial or expressway connections to these facilities.

### **4.2.3 Route Transfer**

Arizona statutes give the State Transportation Board authority to accept, revise and remove routes on the state highway system and describe procedures to remove (abandon) routes no longer serving a state function. (ARS 28-304 and 28-7201 through 28-7215).

Comments related to the transfer of roadway routes from one jurisdiction to another along Grand Avenue within the Study Area are detailed below.

### **General Public and Other Stakeholders**

The following comments related to route transfer were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Addressing the question of long-term responsibility for Grand Avenue (local jurisdiction or ADOT?) was identified on one comment form when asked about “major issues and challenges for the corridor
- That Grand Avenue would become a local street and ignored by state and local officials was identified by one commenter as their “worst fear”.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to route transfer were documented:

- ADOT Comment: Highways within the state system that do not contribute to the mission and purpose of the system create problems for ADOT and for transportation in Arizona for the following reasons:
  1. They use resources that could be going to meet statewide transportation needs.
  2. They generate administrative and liability costs that are disproportionate to their contribution to the state highway system.
  3. Local jurisdictions often have different objectives from those of the state in terms of how these roads are developed and used.
  4. Their presence on the state system sometimes prevents appropriate treatments as part of local road functions.

- ADOT is interested in investigating the possibility of transferring Grand Avenue south of SR 101L to local jurisdictions based on a lack of functionality and connectivity to the state system.
- ADOT does not want any discretionary funds allocated to the Grand Avenue corridor and recommends that RARF funds that would stay with the corridor following a transfer be used instead.
- The City of Glendale suggested that Northern Avenue be transferred to the state so that the combined Northern Avenue / Grand Avenue facility would be a state highway.
- No consensus has been reached on route transfer. The Study reviewed options for improving Grand Avenue, addressing both functionality and connectivity.
- The City of Phoenix is open to having the issue of route transfer addressed in this Study. They are however not open to having Maricopa County take over Grand Avenue, an option suggested by the City of Glendale.
- The City of Glendale has suggested that a consortium involving Glendale, Peoria and either the County or the State be used to manage the construction of Northern Avenue and Grand Avenue.
- The transfer of Grand Avenue from the State to the cities is not supported.
- If Grand Avenue is converted to a controlled-access facility, and money is made available for maintenance, Grand Avenue could possibly be transferred to the municipalities.
- Controlled-access facilities function as state highways and should remain under ADOT's jurisdiction.
- Route transfer has benefits and drawbacks. If the City has jurisdiction over Grand Avenue, it would control access, landscaping, etc. But there are concerns about operations and maintenance.
- One issue that must be addressed is route transfer in the event that future plans for this section of Grand Avenue do not provide for better functionality and connectivity to the state highway system (Scope).

## **Previous Studies**

No comments related to route transfer were documented during review of previous studies.

### **4.2.4 Ultimate Concepts (Roadway, Transit, Bicycle, Pedestrian, and Community Mitigation)**

The purpose of the Grand Avenue MIS Phase II is to provide recommendations for transportation infrastructure improvements both along and across Grand Avenue within the Study Area. Recommendations might include (but are not limited to) expanded transit (including rail) service, improved pedestrian and bicycle facilities, additional grade-separations and/or aesthetic

treatments consistent with land uses prescribed in local general plans. These recommendations will be made with the assumption they will be incorporated into local, regional, or state TIPs for implementation in the near future.

Comments related to ultimate concepts that were considered in the analysis are detailed below.

### **General Public and Other Stakeholders**

The following comments related to ultimate transportation concepts were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Grand Avenue should be considered as an elevated expressway.
- Providing commuter rail along BNSF could alleviate traffic congestion.
- Consider leasing air rights over BNSF and build elevated transit.
- Consider providing a masonry wall (four to six feet tall) along the BNSF that blocks the railroad with landscaping in front of it.
- The decision as to whether Grand Avenue is going to be an expressway or a limited expressway was identified on comment forms when asked about “major issues and challenges for the corridor”.
- The determination of Grand Avenue as either an expressway or not in the long term, along with providing Grand Avenue as an express route with priority over north-south and east-west arterials at intersections were identified on three comment forms when asked about one’s “greatest hope for the corridor”.
- It was suggested that Grand Avenue be double-decked with the upper level carrying through traffic and the lower level being maintained for business access.
- That nothing will be done to Grand Avenue was identified by one commenter as their “worst fear”.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to the ultimate transportation concept were documented:

- Northern Avenue should be considered for modeling and alternative purposes as a “super-street”, resulting in capacity improvements and higher travel speeds.

- Grand Avenue was identified in the scope of work as developed with the ASG as a partially controlled access facility (expressway or limited expressway) including selected grade separations and community mitigation.
- In the future, commuter rail will likely be needed in the Grand Avenue corridor from Wickenburg to Phoenix. If commuter rail is put into the corridor, light rail will not be necessary. Commuter and light rail would probably intersect at a station in Glendale.
- In lieu of commuter rail, Grand Avenue will likely need to be widened.
- If possible, use the BNSF railroad tracks for public transportation.
- It is important that all proposed improvements to Grand Avenue not only accommodate potential future commuter rail, but also do not preclude commuter rail in the corridor.
- Grand Avenue should be an express route for its ultimate concept. Reduced access along Grand Avenue is acceptable so long as good access is provided at the grade separations.
- If commuter rail is recommended along the BNSF tracks, parking and pedestrian needs will have to be considered. A transit center that accommodates auto / bus / rail / pedestrians should be considered.
- Grand Avenue should be a non-stop roadway, with access to local businesses in downtown Peoria provided via the planned bypass, which would connect with Grand Avenue at Monroe Street / 81<sup>st</sup> Avenue.
- Grand Avenue is a major artery that should be fully developed with moderate speed and access.
- Since Grand Avenue is a state highway, why is rubberized asphalt not being used to mitigate against noise?
- Gateways indicating entrance into different cities are crucial and included in future City plans. How and where will gateways along Grand Avenue occur?
- Previous and current improvements along Grand Avenue have made commuting to downtown Phoenix much faster. However, signing could be improved to better locate arterials.
- Established businesses along 83<sup>rd</sup> Avenue may make improvements to 83<sup>rd</sup> Avenue difficult.
- Review high capacity transit options as part of the ultimate concept (Scope).
- The BRT service specified in the RTP was detailed in this Study, along with a transition program as needed to the ultimate concept (Scope).

- The RTP identifies the Grand Avenue corridor as eligible for high capacity transit service, using unspecified technology, as part of its ultimate concept (Scope).
- This Study will detail the BRT service funded in the RTP as well as review high capacity transit options and their detailed transition program (Scope).

### **Previous Studies**

The following comments related to ultimate transportation concepts were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The upgrading of Northern Avenue to Northern Parkway, and its median-to-median flyover ramp connections were recommended in the *Final Design Concept Report for Northern Parkway* (City of Glendale, 2003). Grand Avenue would need to be widened and substantial right-of-way would need to be acquired.
- The *Northwest Area Transportation Study, Final Report* (MAG, 2003) included the recommendation to upgrade Northern Avenue to a “super-street” that would enhance east-west capacity. Grand Avenue was identified as an arterial roadway corridor.

### **4.2.5 Grade Separations**

Comments related to grade separations along Grand Avenue within the Study Area are detailed below.

### **General Public and Other Stakeholders**

The following comments related to grade separations were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- At grade-separations, ADOT should secure access rights for parcels prior to turning them back / selling them.
- In construction areas along Grand Avenue where grade-separations are being constructed, provide more and better advanced notice of one-lane restrictions.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to grade separations were documented:

- Why was Camelback Road constructed as the arterial overpass when the other two arterials (Grand Avenue and 43<sup>rd</sup> Avenue) have more traffic on them?
- Landscaping, as well as art, aesthetics, and sculpture could alleviate the visual impacts along Grand Avenue, particularly at grade separations.

- Grade separations make it harder for bicycle traffic to get to where it needs to go.
- The City of Peoria requested that the impacts of an overpass, both on 83<sup>rd</sup> Avenue and Peoria Avenue, at the 83<sup>rd</sup> Avenue / Peoria Avenue / Grand Avenue intersection be assessed as part of this Study.
- Give special consideration to the connections between Grand Avenue and local arterials where new grade separations are programmed (Scope).
- On future grade separations, take the arterials that cross the railroad tracks on the grade separation. It doesn't make any sense to have Grand Avenue as the grade separation when the railroad tracks cause the delay.
- The Cactus Road / 91<sup>st</sup> Avenue / Grand Avenue intersections are very congested on all legs. The existing signals are either too close together or the timing needs to be improved. Consider the possibility of an overpass or constructing Cactus Road as a through street.
- A grade separation at 83<sup>rd</sup> Avenue is supported, which is consistent with the upgrading of Grand Avenue to an expressway through Peoria.
- A grade separation should be considered at the “north crossing” as opposed to the “south crossing” at 83<sup>rd</sup> Avenue / Peoria Avenue / Grand Avenue as the north crossing carries more traffic.
- An underpass in downtown Peoria would be preferred to an overpass as businesses are sometimes put off by the aesthetics of an overpass.
- If Grand Avenue is being planned as a major traffic carrier, all overpasses should be on Grand Avenue.
- Residents in neighborhoods surrounding grade separations have complained about increased noise levels as a result of the elevated traffic, a concern that did not exist before. Noise walls, tall vegetation or rubberized asphalt could help mitigate (the City does put rubberized asphalt on arterial streets).
- If Grand Avenue is being planned as a major traffic carrier, why do only three of the eight overpasses carry Grand Avenue?
- Identify potential locations, cost and access options for grade separations and make recommendations (Scope).
- Potential grade separations at Northern Avenue, Bethany Home Road, Indian School Road and 19<sup>th</sup> Avenue should specifically be addressed (Scope).

## Previous Studies

The following comments related to grade separations were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The closure of various intersecting streets, alleys and unused driveways along Grand Avenue was proposed in *Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report* (City of Glendale, 2003). It also noted that the proposed Grand Avenue overpass at 59<sup>th</sup> Avenue and Glendale Avenue would alter the manner in which vehicles enter downtown Glendale.
- The *Regional Transportation Plan* includes \$147 million of improvements on Grand Avenue, \$94 million of which is earmarked for grade separations at three locations within the Study Area.
- The Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report (City of Glendale, 2003) recommended a three-level crossing at Bethany Home Road and 51<sup>st</sup> Avenue, with Grand Avenue remaining at-grade. Through the use of collector roads, these routes would be connected. The six-legged signalized intersection would be removed.
- Eight intersections were recommended for grade-separations in the *Grand Avenue Major Investment Study* (ADOT, 1999). The recommendations eliminated all six-legged intersections within the Study Area except for 19<sup>th</sup> Avenue / McDowell Road / Grand Avenue. The current Study is a continuation of this report.

### 4.2.6 Intersection Improvements (including skewed and offset intersections)

Within the Study Area, Grand Avenue is host to over 60 three-, four-, five- and six-legged intersections that are either stop controlled or signal controlled. A majority of these intersections are stop controlled along the minor roadway, allowing Grand Avenue traffic to flow freely.

The original Grand Avenue MIS (ADOT, 1999) identified a total of 148 traffic signals in its Study Area. Of these, 20 were located on Grand Avenue between SR 101L and McDowell Road. The remainder were located within one mile of Grand Avenue along city arterials and collectors. A field review was conducted on January 20, 2004 to confirm the location of previously identified traffic signals as well as document any changes in traffic control within the Study Area. All signalized intersections present during the writing of the 1999 MIS remain in their previously identified location. No new signalized intersections exist along Grand Avenue within the Study Area.

As Grand Avenue runs diagonally across the one-mile grid system of arterial streets that make up the roadway network in Phoenix's greater metropolitan area, skewed intersections, where an intersecting road connects at an angle other than 90 degrees, exist at majority of the intersections. Of the 60-plus intersections along Grand Avenue in the Study Area, approximately 65% are skewed. The remaining intersections have been reconstructed into perpendicular intersection (such as those in downtown Peoria) or as grade-separations.

Refer to Section 3.1.3 and Exhibit 3.9 for more detailed information on signalized and unsignalized intersections within the Study Area.

Comments related to skewed intersections along Grand Avenue within the Study Area are detailed below.

### **General Public and Other Stakeholders**

The following comments related to intersections were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- The intersection of 91<sup>st</sup> Avenue / Grand Avenue is very congested during both the AM and PM peaks.
- Cactus Road will be widened in the future which will likely put more traffic on Grand Avenue.
- The intersection of SR 101L / Grand Avenue is very dangerous because of vehicles making U-turns. In addition, the traffic signal needs to stay green longer along Grand Avenue.
- The intersection of Frontage Road / Grand Avenue needs improvements, as does the intersection of 83<sup>rd</sup> Avenue / Grand Avenue.
- The six-legged intersection near downtown Glendale (59<sup>th</sup> Avenue / Grand Avenue) and access across Grand Avenue were identified on comment forms when asked about “major issues and challenges for the corridor”.
- The odd angles at intersections were identified as one’s “worst fear”.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to intersections were documented:

- The City of Phoenix and ADOT have requested that the realignment of skewed and offset intersections be included in the alternatives analysis portion of this Study.
- Identify turning lane needs at all intersections along Grand Avenue (Scope).
- Identify, evaluate and cost potential improvements and make recommendations (Scope).
- Realign skewed or offset intersections (Scope).
- Address street access and capacity needs to, from and across Grand Avenue (Scope).

### **Previous Studies**

No comments related to intersections were documented in Appendix A – *Related Studies, Plans, and Programs*, that have not been included in other sections of the report (i.e. Grade Separations).

#### **4.2.7 Intelligent Transportation Systems (ITS) and Signals**

Based on the *MAG ITS Strategic Update* (MAG, 2001), Grand Avenue within the limits of this Study has been identified as a “SMART” Corridor; a systematically managed arterial. SMART Corridors are key arterial links that span the urban area and pass through multiple jurisdictions. They include the implementation of closed-circuit television (CCTV) cameras, variable message signs (VMS) and detection as well as the coordination of traffic signals across multiple jurisdictional boundaries. In addition to Grand Avenue, many other major arterials within the Study Area have also been designated as SMART Corridors.

Refer to Section 3.5 for more detailed information on ITS.

Comments related to ITS and traffic signals along Grand Avenue within the Study Area are detailed below.

#### **General Public and Other Stakeholders**

The following comments related to ITS and traffic signals were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms, or were submitted at another time:

- Traffic signals along Grand Avenue should be synchronized and timed to discourage speeding.
- Smooth, steady traffic, timed traffic signals, traffic flow, traffic control and progression of signals were identified on comment forms when asked about “major issues and challenges for the corridor”.
- More traffic signals, particularly at every intersection, were identified as their “worst fear” by three commenters.
- Will a traffic light be installed on the north side of Grand Avenue at 67<sup>th</sup> Avenue?

#### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to ITS and traffic signals were documented:

- ADOT asked if the City of Phoenix has any plans to alter the signal timing along Grand Avenue. The City manages all signals along Grand Avenue through Phoenix.
- The City of Glendale confirmed that ADOT manages all signals along Grand Avenue through Glendale.
- ADOT manages the signals along Grand Avenue through Peoria.
- Due to signals at I-17 ramps, Indian School Road between 27<sup>th</sup> Avenue and I-17 gets very congested
- Signal spacing between 27<sup>th</sup> Avenue and I-17 does not function well.

- Traffic signal synchronization is very important. Phoenix’s signals are all synchronized, but the City has no control over interchange signals.
- Signal coordination needs to be improved. Traffic flow along north-south and east-west arterials across Grand Avenue could be improved through signal coordination, not just grade separations.
- Signal coordination crossing the freeway is a problem (not specifically referring to Grand Avenue).
- The existing intersection at 27<sup>th</sup> Avenue and Thomas Road is confusing. Vehicles have a difficult time determining what lane to be in to make various movements, or simply cannot navigate the lanes necessary to make certain movements.
- Identify needs consistent with the MAG ITS Strategic Plan, options to address the identified needs, and evaluate and cost the potential improvements (Scope).
- Address options for reducing the number of signals (Scope).
- Identify, evaluate and cost all signal changes and make recommendations (Scope).

### **Previous Studies**

The following comments related to ITS and traffic signals were documented in Appendix A – *Related Studies, Plans, and Programs*:

- Grand Avenue was identified as a potential commuter rail corridor in the *Grand Avenue Northwest Corridor Study; SR 303L to SR 101L* (MAG, 2003). ITS implementation along Grand Avenue as a SMART Corridor within the Study Area was also recommended.
- The possibility of improved travel along Grand Avenue through the use of signal coordination was presented in the *Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study* (BNSF, 2003). The study noted a benefit to this could be the reduced need for expensive grade-separations.
- The *MAG ITS Strategic Plan Update* (MAG, 2001) identifies Grand Avenue within the Study Area as a SMART Corridor.
- The *Regional Transportation Plan* (MAG, 2003) also identified Grand Avenue within the Study Area as a SMART Corridor. The *Regional Transportation Plan* sites the *MAG ITS Strategic Plan Update* repeatedly and endorses again its recommendations.

### **4.2.8 Bottlenecks**

Transportation networks are made up of many different elements, including roadways (arterials, highways, etc), bike routes and lanes, pedestrian facilities, and mass transit facilities. In order for a transportation network to function optimally, all elements of the network must work together, in

unison. When a bus breaks down along an arterial roadway with no bus pull-out, thereby blocking one of the through lanes, the capacity of that roadway has been reduced as the number of through lanes have been reduced. When the delay at a stop-controlled intersection results in excessive queuing along the minor roadway, the level of service along that minor roadway has been diminished by use of an inappropriate traffic control device.

Often referred to as “bottlenecks”, these locations have a profound affect on the greater transportation system by not only affecting the route directly served, but many of the routes and modes that intersect it as well. Whether it is capacity, level of service or some other factor that measures a facility’s congestion, bottlenecks can affect an area beyond that in which the bottleneck is located.

Comments related to roadway bottlenecks along Grand Avenue within the Study Area are detailed below.

### **General Public and Other Stakeholders**

The following comments related to bottlenecks were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Railroad conflicts and traffic control were identified on comment forms when asked about “major issues and challenges for the corridor”.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to bottlenecks were documented:

- The ASG identified issues relating to bottlenecks to be addressed in the Study, e.g. grade separations, intersection improvements, signals, and ITS.
- The intersections of 83<sup>rd</sup> Avenue and Peoria Avenue with Grand Avenue received a lot of complaints from residents and merchants. This location creates a bottleneck in downtown Peoria.

### **Previous Studies**

The following comments related to bottlenecks were documented in Appendix A – *Related Studies, Plans, and Programs*:

- Both I-10 and I-17 at the east end of the Grand Avenue corridor were identified as bottleneck locations in the *MAG Regional Freeway Bottleneck Study, Draft* (MAG, 2003). Re-striping was suggested for I-10. General widening, possibly through double-decking was suggested for I-17.

#### 4.2.9 Access Management

Based on the ADOT Roadway Design Guidelines (ADOT, 1996), “access control is achieved by regulating public access rights to and from properties abutting highways”. Two types of access control exist, full access control and partial access control.

Full access control “gives preference to through traffic by providing access only through selected public roads and by prohibiting at-grade crossings or direct access from abutting property” (ADOT, 1996). In other words, along a route with full access control, ingress and egress from the facility are provided only at service or system interchanges.

Partial access control “still gives preference to through traffic but permits some crossings at grade and some private driveway connections” (ADOT, 1996). Within the Study Area, Grand Avenue currently exists as a partial access controlled facility over much of its length.

Access management is achieved by implementing the types of access control detailed above. It involves managing “access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed” (AASHTO, 2001). Access management incorporates all types of roadways and views major highways and their surrounding activities and roadway networks as a single system.

Based on the AASHTO “Green Book” (AASHTO, 2001), the following principals define access management techniques:

- *Classify the road system by the primary function of each roadway.* Freeways emphasize movement and provide complete access control. Local streets emphasize property access rather than traffic movement. Arterial and collector streets must serve a combination of both property access and traffic movement.
- *Limit direct access to roads with higher functional classification.* Direct property access should be denied or limited along higher class roadways, wherever reasonable access can be provided to a lower class roadway.
- *Locate traffic signals to emphasize through traffic movements.* Signalized access points should fit into the overall signal coordination plan for traffic progression.
- *Locate driveways and major entrances to minimize interference with traffic operations.* Driveways and entrances should be located away from other intersections to minimize crashes, to reduce traffic interference, and to provide for adequate storage length for vehicles turning into entrances.
- *Use curbed medians and locate median openings to manage access movements and minimize conflicts.*

All five points detailed in the “Green Book” will be applied, where appropriate and when feasible, to Grand Avenue within the Study Area.

Comments related to access management along Grand Avenue within the Study Area are detailed below.

### **General Public and Other Stakeholders**

The following comments related to access management were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms, or were submitted at another time:

- The smaller the building, the more of them, and thus, the more access points along Grand Avenue.
- Some properties along Grand Avenue only have access to Grand Avenue (no rear access). Consider combining parcels to allow for rear access off Grand Avenue.
- Smooth, steady traffic, limited ingress and egress, lights and access, traffic flow, access across Grand Avenue, and reduction in individual access were identified on comment forms when asked about “major issues and challenges for the corridor”.
- How will my customers be able to turn around and head back to the City safely (if medians are closed)?
- Some of the proposed median closings could prevent emergency crews from accessing property and people in the case of an actual emergency.
- Closing the median in front of my property could pose a hardship for our business since it will prevent large trucks from accessing our business.

### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to access management were documented:

- The term “partially controlled access facility (expressway or limited expressway)” will be used for Grand Avenue south of SR 101L unless and until the Study gains consensus on a new terminology.
- The City of Glendale has set aside money for right-of-way acquisition in support of access control efforts.
- The concept of Grand Avenue as a limited access expressway with access only at the mile arterials was supported.
- East of I-17, Grand Avenue should maintain its current level of access, as any reduction would hurt adjoining businesses and wouldn’t fit with the neighborhood’s character. West of I-17, limited access along Grand Avenue could be possible.

- Consider frontage roads for access to businesses along Grand Avenue.
- Analyze approaches to reducing direct access to Grand Avenue including the use of: right turn lanes, frontage roads, road closures, alternative points of access, removal of activities and combining curb cuts. Special consideration was given to combining access control with redevelopment opportunities (Scope).
- Identify all median openings and identify, evaluate and cost opportunities to close medians not located at signalized intersections (Scope).

## Previous Studies

The following comments related to access management were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The closure of various intersecting streets, alleys and unused driveways along Grand Avenue was proposed in *Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report* (City of Glendale, 2003). 57<sup>th</sup> Drive and Myrtle Avenue were proposed as access routes to and from Grand Avenue. Eight existing median openings along Grand Avenue were also identified for closure.
- The *Regional Transportation Plan* (MAG, 2003) stated that the section of Grand Avenue “south of SR 101L is a partially controlled access facility (expressway or limited expressway) and may be further defined” following completion of this Study.

### 4.2.10 Safety

One of the most important issues along Grand Avenue, as stated by the general public as well as government / municipal officials, is safety. In addition to vehicular safety along and across Grand Avenue, bicycle and pedestrian safety also require a thorough investigation.

Based on the crash analysis conducted as part of chapter 3, over 1,300 crashes occurred along Grand Avenue within the Study Area between November 1, 2000 and October 31, 2003. Of these crashes, more than half occurred at intersections.

Based on the crash analysis, the two intersections with the highest number of crashes were:

- 51<sup>st</sup> Avenue / Bethany Home Road / Grand Avenue (130 crashes)
- 59<sup>th</sup> Avenue / Glendale Avenue / Grand Avenue (121 crashes).

Based on the crash analysis, the three segments with the highest number of crashes were:

- 27<sup>th</sup> Avenue – 35<sup>th</sup> Avenue (101 crashes)
- 35<sup>th</sup> Avenue – 43<sup>rd</sup> Avenue (100 crashes)
- 59<sup>th</sup> Avenue – 67<sup>th</sup> Avenue (97 crashes)

Comments related to safety along Grand Avenue within the Study Area are detailed below.

## **General Public and Other Stakeholders**

The following comments related to safety were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Speed limits are poorly enforced along Grand Avenue.
- Traffic lights along Grand Avenue are not visible when tall vehicles are in front of you.
- Two intersections were identified as being “bad” (unsafe): 91<sup>st</sup> Avenue at Grand Avenue and 91<sup>st</sup> Avenue at Cactus Road.
- The intersection of 39<sup>th</sup> Avenue and Grand Avenue was identified as being unsafe. It was also noted that “legal right turns” are not possible and that a traffic signal or realignment is necessary.
- Medians save lives.
- Right turns lanes (deceleration lanes) are needed along Grand Avenue to access businesses.
- Smooth, steady traffic, lights and access, railroad conflicts, and safety were identified on comment forms when asked about “major issues and challenges for the corridor”.
- Pedestrian walkways over Grand Avenue near schools were identified on comment forms when asked about one’s “greatest hope for the corridor”.
- A child being killed while crossing Grand Avenue on the way to school was identified by one individual as their “worst fear”.

## **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to safety were documented:

- Safety was identified in the scope of work as a key issue to be addressed in the Study.
- Pedestrian safety must be considered, especially with the potential of additional transit services within the Grand Avenue corridor.
- Many students who attend Peoria High School jump the BNSF railroad tracks and cross Grand Avenue at locations not signed for pedestrian crossings.
- Decorative walls that have been proposed to shield peoples’ view of the railroad tracks should be less than four feet tall, and therefore may not shield much. Taller walls may create Crime Prevention Through Environmental Design (CPTED) concerns, as would tall vegetation. In addition, any size wall may become a “canvas” for local gangs and taggers.
- Identify, evaluate and cost options for making safety improvements and make recommendations (Scope).

## Previous Studies

The following comments related to safety were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The *Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report* (City of Glendale, 2003) recommended the addition of dedicated right-turn lanes along westbound Grand Avenue and limiting movements on streets that intersect Grand Avenue to right-in / right-out only.
- The Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study (BNSF, 2003) presented the possible solution of relocating both BNSF yards within the Study Area northwest of their current locations. Based on this relocation, the BNSF would be able to eliminate all inbound and outbound trains along Grand Avenue during the AM and PM peak periods. The study also noted a reduction in the amount of vehicle / trains crashes.

### 4.2.11 Bicycle / Pedestrian Requirements

Comments related to bicycle and pedestrian needs along Grand Avenue within the Study Area are detailed below.

#### General Public and Other Stakeholders

The following comments related to bicycle and pedestrian facilities were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Improve bicycle access across Grand Avenue, not necessarily along it, particularly at 61<sup>st</sup> Avenue.
- Improved lighting and shading is needed along Grand Avenue for both bicycles and pedestrians.
- Pedestrian access across Grand Avenue is needed between Peoria High School and Cheyenne Elementary School either in the form of a bridge or tunnel. Students have been hit in this location crossing Grand Avenue. A pedestrian walkway is also needed at 81<sup>st</sup> / 82<sup>nd</sup> Avenue and Grand Avenue.
- Without pedestrian and bicycle improvements, it will be difficult to limit access points along Grand Avenue and people need to be able to move along the corridor.
- Building setbacks along Grand Avenue are too small, resulting in poor sight distance for cars to see pedestrians and cyclists.
- Pedestrian crossings, pedestrian enhancements, alternative methods of transportation, and access to bus lines were identified on comment forms when asked about “major issues and challenges for the corridor”.
- Pedestrian walkways over Grand Avenue near schools were identified on comment forms as one’s “greatest hope for the corridor”.
- A child being killed while crossing Grand Avenue on the way to school was identified as one’s “worst fear”.

## **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to bicycle and pedestrian facilities were documented:

- The ASG identified bicycle and pedestrian facilities as an issue to be addressed in the Study.
- Even though their cost will be high, consider below grade bicycle / pedestrian crossings of Grand Avenue.
- How bicycles and pedestrians cross Grand Avenue will need to be looked at.
- Pedestrian facilities bordering and crossing Grand Avenue will be necessary in the area west of Grand Avenue between Peoria Avenue and Washington Avenue to service the redevelopment park.
- CMAQ funding is in place to enhance pedestrian crossings at Grand Avenue and Peoria Avenue. Enhancements include crosswalk pavers and landscaping along Grand Avenue.
- The Peoria Planning Department would rather see Grand Avenue near Peoria Avenue converted to an enhanced pedestrian corridor that would link their future transit center (east of Grand Avenue, south of Peoria Avenue) with their future park (west of Grand Avenue) and the historic downtown area.
- Pedestrian facilities are supported both along and across Grand Avenue where feasible.
- More right-of-way along Grand Avenue may be needed to adequately provide pedestrian facilities as well as landscaping. Currently, sidewalks are adjacent to the roadway, within the clear zone, and landscaping is provided for outside the sidewalks.
- A pedestrian overpass may be useful at 87<sup>th</sup> Avenue to provide access across Grand Avenue for the high school and elementary school.
- A pedestrian overpass or underpass should also be considered in the downtown area near 83<sup>rd</sup> Avenue.
- Sidewalks should not be precluded along Grand Avenue. Taking into account the eight-foot clear zone along Grand Avenue, how much available right-of-way is there for improvement?
- The Study will address bicycle and pedestrian needs (Scope).
- Pedestrian and bicycle access across Grand Avenue and to transit stops will need to be addressed (Scope).
- The inclusion of pedestrian and bicycle facilities must be consistent with the ultimate concept for the corridor. Conflicts with roadway and transit vehicles that could decrease the safety of pedestrians and cyclists should be avoided (Scope).

## **Previous Studies**

The following comments related to bicycle and pedestrian facilities were documented in Appendix A – *Related Studies, Plans, and Programs*:

- *The Grand Vision: Grand Avenue Image Improvement Study, Final Report* (City of Glendale, 2001) recommended constructing a larger bridge (or deck) at 59<sup>th</sup> Avenue and

Glendale Avenue to provide greater pedestrian connections across Grand Avenue to the east and west sides of Glendale. The study also recommended providing a continuous detached sidewalk along the north side of Grand Avenue that would enhance convenience, comfort, safety and accessibility. The construction of pedestrian overpasses at strategic locations along Grand Avenue, possibly at Paltaire and Lamar, was also recommended.

- By providing more functional pedestrian facilities, such as walkable routes to work and school, as well as better access to transit, the *Pedestrian Area Policies and Design Guidelines* (MAG, 1995) stated it was possible to achieve better air quality by reducing trips and cold starts. It also recommended providing walkways adjacent to roadways but separated by landscaping or a bike lane.

#### **4.2.12 Transit Requirements**

Comments related to transit along Grand Avenue within the Study Area are detailed below.

##### **General Public and Other Stakeholders**

The following comments related to transit were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Extreme heat could hinder public transportation as people do not want to wait in the heat. Consider having public transportation stations inside buildings along the route, not outside, such as City Halls, MetroCenter, etc.
- People would pay more for public transportation (in fares) for climate controlled waiting areas.
- Make sure rail transit is tied to the bus system.
- Grand Avenue is a natural high-capacity corridor, and RAPID transit should be implemented.
- The Yellow Line (bus route) should be brought back.
- Alternative methods of transportation, “good” bus service (not just RAPID) and access to bus lines / covered bus stops were identified on comment forms when asked about “major issues and challenges for the corridor”.
- Light rail service and additional bus routes were identified on one comment form as their “greatest hope for the corridor”.

##### **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to transit were documented:

- Following discussion at the ASG, the Study will detail the BRT service funded in the RTP as well as review high capacity transit options (bus, light rail, heavy rail, and commuter rail) as part of the ultimate concept for the corridor. It will also detail a transition program as needed from the BRT service to the ultimate concept. This

includes any roadway provisions needed to accommodate the transit service, including an initial consideration of potential station/stop locations. The implications of rail transit service options as part of the ultimate concept on bus transit service will be considered.

- The BNSF has indicated they are serious about discussing commuter rail in the corridor. It is unclear if a relocation of mainline freight activity is a prerequisite for commuter rail operations. Options such as moving freight off the line, changing freight schedules and double tracking exist. While there is currently no set schedule for railroad operations (and thus no possible way to know when a train will travel the Grand Avenue corridor), in the future, if in fact commuter rail becomes a reality in the corridor, the trains would follow a specified schedule. How wide is the railroad right-of-way in the Grand Avenue corridor? Is there the potential for putting light rail on new track within the BNSF right-of-way?
- Light rail transit and commuter rail are not huge issues, but greater bus service within the city, between the downtown Peoria area (Grand Avenue and Peoria Avenue) and the main business area (Bell Road and 83<sup>rd</sup> Avenue) is needed.
- The bus service that used to exist along Grand Avenue should be returned. Peoria currently has one park-and-ride lot located in downtown Peoria south of Grand Avenue.
- Roadway provisions need to accommodate transit service (Scope).
- The transit focus is on upgrading local bus service to regional service, including limited stop, express bus, and bus rapid transit (Scope).
- Connections to local buses at cross streets should be considered (Scope).
- A major focus of this project will be locating and costing capital projects including bus pull outs, bus access ramps, transit stations, queue hoppers, and park and ride facilities (Scope).
- The selected option should provide regional service and include facilities so transit vehicles do not stop in through lanes and block traffic (Scope).
- Close attention will be given to the integration and connectivity of transit service including dial-a-ride, shuttles, neighborhood circulators, local buses, bus rapid transit and rail (Scope).

### **Previous Studies**

The following comments related to transit were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The *Northwest Area Transportation Study, Final Report* (MAG, 2003) identified several key projects for further study including the potential for commuter rail / bus rapid transit

along the BNSF corridor, a light rail extension along Glendale Avenue, and a possible light rail extension or rapid bus transit line along 59<sup>th</sup> Avenue.

- A need for additional transit by 2030 within the Study Area was documented in the *Regional Transit System Study* (Valley Metro, 2003), particularly in the cities of Glendale and Phoenix. Within this study, Grand Avenue was identified as a regional expressway route both within and outside the Study Area.
- The *Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study* (BNSF, 2003) identifies the potential to provide a corridor for commuter rail as one of its benefits.
- Making all bus stops ADA accessible and providing permanent shade, seating and trash containers was one of the recommendations included in *The Grand Vision: Grand Avenue Image Improvement Study, Final Report* (City of Glendale, 2001). The *Pedestrian Area Policies and Design Guidelines* (MAG, 1995) also stated that shade and sufficient seating should be provided at transit stops.
- Two future park-and-ride facilities were identified near Grand Avenue in the MAG Park-and-Ride Study, Final Report (MAG, 2001). The first is at 91<sup>st</sup> Avenue and Olive Avenue, and is programmed for the near-term. The second is at 59<sup>th</sup> Avenue and Myrtle Avenue, and is programmed for the long-term.
- The *Regional Transportation Plan* includes \$147 million of improvements on Grand Avenue: \$53 million for unspecified widening, access control, and community mitigation (\$30M in phase I, \$20M in phase II, and \$3M in phase IV); \$17 million for additional ramps at the 51<sup>st</sup> Avenue grade separation (phase IV); \$38.5 million for additional ramps at the 35<sup>th</sup> Avenue grade separation (phase IV); and \$38.5 million for a new 19<sup>th</sup> Avenue grade separation (phase IV).

#### **4.2.13 Goods Movement**

As noted previously, Grand Avenue was originally constructed in the late 1800s to connect the agricultural communities of the West Valley with downtown Phoenix. This connection expanded with the introduction of the BNSF Railway adjacent to Grand Avenue. Since its beginning, Grand Avenue has served as a major facility for the importation and exportation of goods from the Phoenix metropolitan area. Today, Grand Avenue, and the BNSF Railway, continue to be used for the movement of goods, although increases in traffic congestion along Grand Avenue and its intersecting arterials have resulted in a reduction in their levels of service.

Comments related to the movement of goods along Grand Avenue within the Study Area are detailed below.

## **General Public and Other Stakeholders**

The following comments related to the movement of goods were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- Railroad conflicts were identified on one comment form when asked about “major issues and challenges for the corridor”.

## **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to the movement of goods were documented:

- The BNSF has confirmed that there is no set schedule for railroad operations along Grand Avenue. The schedule is set by factors outside the greater Phoenix metropolitan area, thus it is not possible to state that a train will travel the Grand Avenue corridor at a specified time on a specified day.
- Review and address identified issues with goods movements, including rail and truck modes (Scope).
- Identify, evaluate and cost options and make recommendations (Scope).

## **Previous Studies**

The following comments related to the movement of goods were documented in Appendix A – *Related Studies, Plans, and Programs*:

- The *High Capacity Transit Plan* (MAG, 2003) notes that the BNSF has been considering the relocation and consolidation of several freight rail facilities in downtown Phoenix to sites north of the Study Area.

### **4.2.14 Community Mitigation**

During its infancy, in the late 1800s, Grand Avenue served to connect the agricultural centers of the West Valley to downtown Phoenix. With the introduction of rail activity parallel to Grand Avenue, the West Valley continued to develop and began to transform from an agriculture-centered region to an industrial/agriculture-centered region. As the population continued to grow and the area became more industrial, the aesthetics of Grand Avenue became less and less people oriented. Now, with the redevelopment of Grand Avenue in such areas as downtown Peoria and Glendale, as well as portions in Phoenix, the overall aesthetics of Grand Avenue is a higher profile issue than it has been in the past.

Comments related to community mitigation along Grand Avenue within the Study Area are detailed below.

## **General Public and Other Stakeholders**

The following comments related to beautification were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms, or were submitted at another time:

- Beautification can lead to better development
- Initiate policies such as CPTED.
- Announce cities along Grand Avenue so people know where they are.
- Most billboards along Grand Avenue exist on private property, including the railroad. The billboards are dangerous.
- The undergrounding of utilities should be considered to enhance future development options.
- Spot beautification, perhaps only in non-industrial areas, is better than along the entire corridor.
- Portions of Grand Avenue in the City of Phoenix have been improved.
- The best beautification along Grand Avenue would be to pick up the trash, perhaps through an Adopt-a-Street program. Trash along Grand Avenue brings down the pride of ownership.
- Add more trees and color along Grand Avenue.
- Find some way to reduce or eliminate embarrassing establishments along Grand Avenue.
- The need for beautification and land use improvements, particularly next to the railroad, improved shading and landscaping, removing “bad” businesses and improving the overall appearance of Grand Avenue were identified on comment forms when asked about “major issues and challenges for the corridor”.
- To beautify Grand Avenue was identified on a comment form as one’s “greatest hope for the corridor”.
- Need more information on the beautification aspects presented.
- The frontage road south of Grand Avenue and east of SR 101L is within ADOT right-of-way. How can the City fix up the area to improve the image, parking, access and landscaping?

## **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to beautification were documented:

- The City of Phoenix would like the study to inventory billboards along the route and compile background information in order to assess options to remove the billboards as part of the beautification process.
- The City of Peoria has been in discussion with ADOT regarding landscaping along Grand Avenue within city limits. The City of Peoria would like to plant trees between the curb and the sidewalk. ADOT prefers to maintain a clear zone consistent with AASHTO standards behind the vertical curb to minimize liability, thus preferring that the sidewalk be located immediately adjacent to the curb. This Study will research the issue of

- liability and determine if cities could accept the liability for Grand Avenue as they do with other streets in their city.
- The potential for trees (and other landscaping) blocking sightlines was raised.
  - Beautification was a key issue identified in the scope of work to be addressed in the Study.
  - Part of the beautification process is to figure out what type of facility Grand Avenue should be and fully fund it.
  - Beautification along Grand Avenue is supported. Beautification should also include the railroad right-of-way as the railroad creates a visual division in the city.
  - The railroad creates a visual nuisance.
  - Beautification along the corridor is a must.
  - The Pima Freeway in Scottsdale was mentioned as an excellent example of beautification.
  - Landscaping is key along Grand Avenue and at abutting developments. It should be done within ADOT's right-of-way.
  - A tiny triangle of land northwest of McDowell Road / 19<sup>th</sup> Avenue is an historic district (Villa Verde Historic District).
  - Consider all elements of beautification including landscaping, hardscaping, lighting, signage, screening walls, structural enhancements and elimination of unsightly land uses (Scope).
  - Identify and asses options for removing billboards (Scope).
  - Look for opportunities to relocate overhead utilities underground (Scope).

## Previous Studies

The following comments related to community mitigation were documented in Appendix A – *Related Studies, Plans, and Programs*:

- Beautification and landscaping along Grand Avenue medians and the railroad right-of-way, the purchase of billboards along Grand Avenue for their removal, the undergrounding of existing electrical lines that run along the north side of Grand Avenue and the installation of new street lighting along Grand Avenue were all recommendations included in the *Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report* (City of Glendale, 2003).
- *The Grand Vision: Grand Avenue Image Improvement Study, Final Report* (City of Glendale, 2001) identified a number of policy, program and physical improvements that could be made along Grand Avenue including adopting a public art master plan, scheduling regular trash and debris pickup, collaborating with ADOT to visually enhance roadway improvements and overpasses, and installing landscaping along the edges and median of Grand Avenue.

### 4.2.15 Drainage

Comments related to drainage along Grand Avenue within the Study Area are detailed below.

## **General Public and Other Stakeholders**

The following comments related to drainage were documented at the March 30, 2004 Public Meeting either from comments made during the oral discussion or written comments submitted on comment forms:

- To improve the water retention basins near Bethany Home Road, a walkway should be provided between the basins and landscaping should be added.

## **Agency Steering Group and Other Participating Agency Representatives**

Based on discussion that has occurred at the ASG meetings and meetings attended by agency representatives, the following comments related to drainage were documented:

- The ASG identified drainage as a key issue to be addressed in the Study.
- Major drainage utilities within the area will need to be identified and potential impacts discussed, including drainage patterns, however detailed mapping need not be completed for this Study (Scope).
- Review and address drainage issues. Identify, evaluate and cost options for improvements and make recommendations (Scope).

## **Previous Studies**

No comments related to drainage were documented in Appendix A – *Related Studies, Plans, and Programs*.

## 5.0 ALTERNATIVES ANALYSIS

### 5.1 Introduction

The next step in developing recommendations for improvements to Grand Avenue was to identify, develop and evaluate alternatives to address the issues and needs identified in the previous chapter. *Note: Exhibits with an underline are not graphically shown in this chapter, but are included in the Report as Appendix D.*

### 5.2 Alternatives Analysis

#### 5.2.1 Connectivity to I-10, I-17 and SR 101L

Information concerning the I-17 and I-10 connections described below came from the *Grand Avenue Corridor Study (MAG 1998)*. Within that study, the “Option 6 – Full Expressway” included a concept for Grand Expressway/I-17/I-10 Traffic Interchange (TI) and High Occupancy Vehicle (HOV) connections. The concept assumed that Grand Avenue would be a full expressway with HOV lanes and no traffic signals and utilized Collector-Distributor (C-D) roadways to connect the I-10 ramps to Grand Avenue and median ramps from Grand Avenue to I-17 for the HOV lanes and mainline lanes. The concept was ultimately deemed unfeasible and Option 6 was not selected as the preferred alternative.

#### Current Connection Methods

The current methods for connecting to the interstates and SR 101L include:

- I-10 – Grand Avenue southeast bound traffic turns south on 19<sup>th</sup> Avenue and accesses the interstate using the 19<sup>th</sup> Avenue entrance ramp (eastbound I-10 only). Westbound I-10 traffic exits at 19<sup>th</sup> Avenue, turns north onto 19<sup>th</sup> Avenue and accesses northwest bound Grand Avenue at the 19<sup>th</sup> Avenue/McDowell Road/Grand Avenue intersection. This connection would be enhanced by implementing one of the grade separation alternatives identified in Section 5.2.4.
- I-17 – Access to and from Grand Avenue occurs along a ¼ mile stretch of Thomas Road in the City of Phoenix. This connection was simplified in 2002 with the Arizona Department of Transportation’s (ADOT) construction of the Grand Avenue overpass at 27<sup>th</sup> Avenue/Thomas Road.
- SR 101L – There is a direct connection between Grand Avenue and the west side ramps for SR 101L. The east side ramps require access along a ¼ mile portion of 91<sup>st</sup> Avenue in the City of Peoria.

#### Connection Alternatives

Direct connections from Grand Avenue to I-10 and I-17 are difficult due to the close proximity of existing interchanges. This Study evaluated the options identified in the *Grand Avenue Corridor Study (MAG 1998)* for connecting Grand Avenue to I-10 and I-17 and findings are presented at the

end of this section. Major features of the Grand Avenue/I-17 connection using median ramps are shown below.

- Major reconstruction and relocation of I-17 and Grand Avenue in the connection area would be required.
- I-17 mainline lanes would be realigned to accommodate the median ramps pushing the frontage roads out approximately 25' in each direction.
- Existing grade-separation structure for Grand Avenue at 27<sup>th</sup> Avenue/Thomas Road would require major modifications to accommodate a much longer Grand Avenue structure over I-17 and the intersection.
- Significant new ROW would be required.
- Estimated Cost (2005 \$) = \$125,000,000

Major features of the Grand Avenue/I-10 connection using C-D roads from the I-10 ramps are shown below.

- C-D roads would run approximately 3000' between I-17 mainline lanes and frontage roads.
- C-D roads would fit between the I-17 mainline and frontage roads if the mainline was constricted to the minimum lanes required.
- Only I-10 directional ramps would have access to NB Grand Avenue.
- Significant new ROW would be required.
- Estimated Cost (2005 \$) = \$60,000,000

The current ramp configurations at the Grand Avenue/ SR 101L interchange allow all four movements since the construction of the east side ramps by ADOT in 2001. The east side ramps require access along a ¼ mile portion of 91<sup>st</sup> Avenue in the City of Peoria, which the City has requested to be designated as part of the state highway system. For purposes of this Study, this section of 91<sup>st</sup> Avenue was considered an arterial street and not a state highway component since that portion of 91<sup>st</sup> Avenue also provides access to Cactus Road. *Improvements to the intersection of 91<sup>st</sup> Avenue and Grand Avenue are being planned as part of a future Grand Avenue Widening Project from 83<sup>rd</sup> Avenue to 99<sup>th</sup> Avenue being developed by ADOT.*

### **Feasibility of Connection Improvements**

Due to the extreme overall costs of providing connectivity to I-10 and I-17 and the recent and future improvements to the SR 101L connection, this Study recommends maintaining the existing connection methods as described earlier in this section. Further studies of the need for direct connectivity should be addressed in the future to determine feasibility and regional importance.

### **5.2.2 Route Transfer**

Comments from the Agency Steering Group (ASG) pertaining to transfer of Grand Avenue to the local jurisdictions are summarized in Chapter 4. ADOT commented that Grand Avenue does not provide the functionality or the connectivity to the interstate system to merit classification as a

State Highway. The improvements proposed in this Study should provide better functionality for Grand Avenue; however connectivity to the state highway system is still considered marginal. The alternatives to improve connectivity to the interstate system are costly and should be studied in greater detail in the future to determine feasibility. Although transfer of US 60 (Grand Avenue) from SR 101L to McDowell Road to the local jurisdictions has been a topic of discussion for a number of years, the State Transportation Board recently tabled discussions pertaining to this issue. Therefore, this Study recommends Grand Avenue remain a state highway in the foreseeable future.

### **5.2.3 Ultimate Concepts**

Recommendations in this Study would support the ultimate concepts for Grand Avenue as identified below:

- Grand Avenue Roadway – The projects identified in this document and constructed as a result of the previous Grand Avenue MIS support the ultimate concept for Grand Avenue as an Enhanced Arterial/Limited Expressway
- Bus Rapid Transit (BRT) – The projects identified in this document will support the ultimate concept for BRT as Limited BRT including Park-n-Ride Lots
- Commuter/Light Rail – The projects identified in this document do not preclude addition of commuter rail/light rail facilities within the railroad ROW or on City streets
- Bicycle/Pedestrian – The projects identified in this document support the ultimate concept of providing grade-separated facilities that cross Grand Avenue and facilities that parallel Grand Avenue in the “Old Town” areas of Glendale and Peoria
- Community Mitigation – The projects identified in this document support the ultimate concept of providing a visually-pleasing corridor for the traveling public and the surrounding communities

### **5.2.4 Grade Separations**

Grand Avenue is a diagonal street that connects US 60 from the northwest Phoenix metropolitan area to the southeast Phoenix metropolitan area. By doing so, Grand Avenue intersects many arterial streets creating six-legged intersections. The purpose of this analysis is to identify design alternatives that would eliminate the six-legged intersections or in some other way provide key intersections an acceptable level-of-service (LOS) while maintaining prioritized traffic flow on Grand Avenue.

#### **Existing Intersection Locations and Descriptions**

##### *Grand Avenue/Peoria Avenue/83<sup>rd</sup> Avenue*

Grand Avenue intersects with Peoria Avenue, creating a four-legged intersection. The lane configuration for this intersection is described below:

- Grand Avenue southeast bound: one left-turn lane, two through lanes, one shared through and right-turn lane.
- Grand Avenue northwest bound: one left-turn lane, two through lanes, one shared through and right-turn lane.
- Peoria Avenue northeast bound: one left-turn lane, one through lane, one shared through and right-turn lane.
- Peoria Avenue southwest bound: one left-turn lane, one through lane, one shared through and right-turn lane.

Grand Avenue connects with 83<sup>rd</sup> Avenue, also creating a four-legged intersection. The lane configuration for this intersection is described below:

- Peoria Avenue northeast bound: two left-turn lanes, one through lane, two right-turn lanes.
- Peoria Avenue southwest bound: one left-turn lane, one shared through and right-turn lane.
- 83<sup>rd</sup> Avenue southeast bound: one left-turn lane, two through lanes, one shared through and right-turn lane, one right-turn lane.
- 83<sup>rd</sup> Avenue northwest bound: two left-turn lanes, one through lane, one shared through and right-turn lane.

Grand Avenue/Northern Avenue/67<sup>th</sup> Avenue

Currently the 67<sup>th</sup> Avenue bypass extends over Northern Avenue and Grand Avenue. This bypass is utilized by the northbound and southbound through traffic only. The traffic on 67<sup>th</sup> Avenue that utilizes Northern Avenue and Grand Avenue still enters the six-legged intersection to make left and right turns. Each of the three streets is described below.

- Grand Avenue is three through lanes per direction (southeast bound and northwest bound) with dual left-turn lanes and free-flow right turn movements.
- Northern Avenue is two lanes in each direction (eastbound and westbound) with single left-turn lanes.
- The 67<sup>th</sup> Avenue bypass is two lanes per direction (northbound and southbound).

Grand Avenue/Bethany Home Road/51<sup>st</sup> Avenue

The 51<sup>st</sup> Avenue bypass extends over Bethany Home Road and Grand Avenue. This bypass is utilized by the northbound and southbound through traffic only. The northbound traffic on 51<sup>st</sup> Avenue that utilizes Northern Avenue and Grand Avenue from the south does so by using Montebello Avenue. Each of the three roadways at the intersection is described below:

- Grand Avenue is three through lanes per direction (southeast bound and northwest bound) with single left-turn lanes and free-flow right turn movements.
- Bethany Home Road is two lanes in each direction (eastbound and westbound) with single left-turn lanes. A westbound right-turn lane also exists.

- The 51<sup>st</sup> Avenue bypass is two lanes per direction (northbound and southbound).

#### Grand Avenue/Indian School Road/35<sup>th</sup> Avenue

The Indian School Road bypass extends over Grand Avenue and 35<sup>th</sup> Avenue. This bypass is utilized by the eastbound and westbound through traffic only. In addition, a westbound Indian School Road to northwest bound Grand Avenue bypass exists. Each of the three roadways at this intersection is described below:

- Grand Avenue is three through lanes per direction (southeast bound and northwest bound) with single left-turn lanes and free-flow right turn movements.
- The Indian School Road bypass is two through lanes per direction (eastbound and westbound). A one lane westbound to northbound right-turn lane exists to 35<sup>th</sup> Avenue and a one lane westbound to northwest bound right-turn lane exists to Grand Avenue. At the six-legged intersection, Indian School Road has eastbound dual right-turn lanes onto Grand Avenue and 35<sup>th</sup> Avenue. There is no westbound Indian School Road approach to the intersection.
- 35<sup>th</sup> Avenue is three through lanes in the northbound direction and two through lanes in the southbound direction. One left-turn lane per direction exists.

#### Grand Avenue/McDowell Road/19<sup>th</sup> Avenue

Each of the three roadways at this intersection is described below:

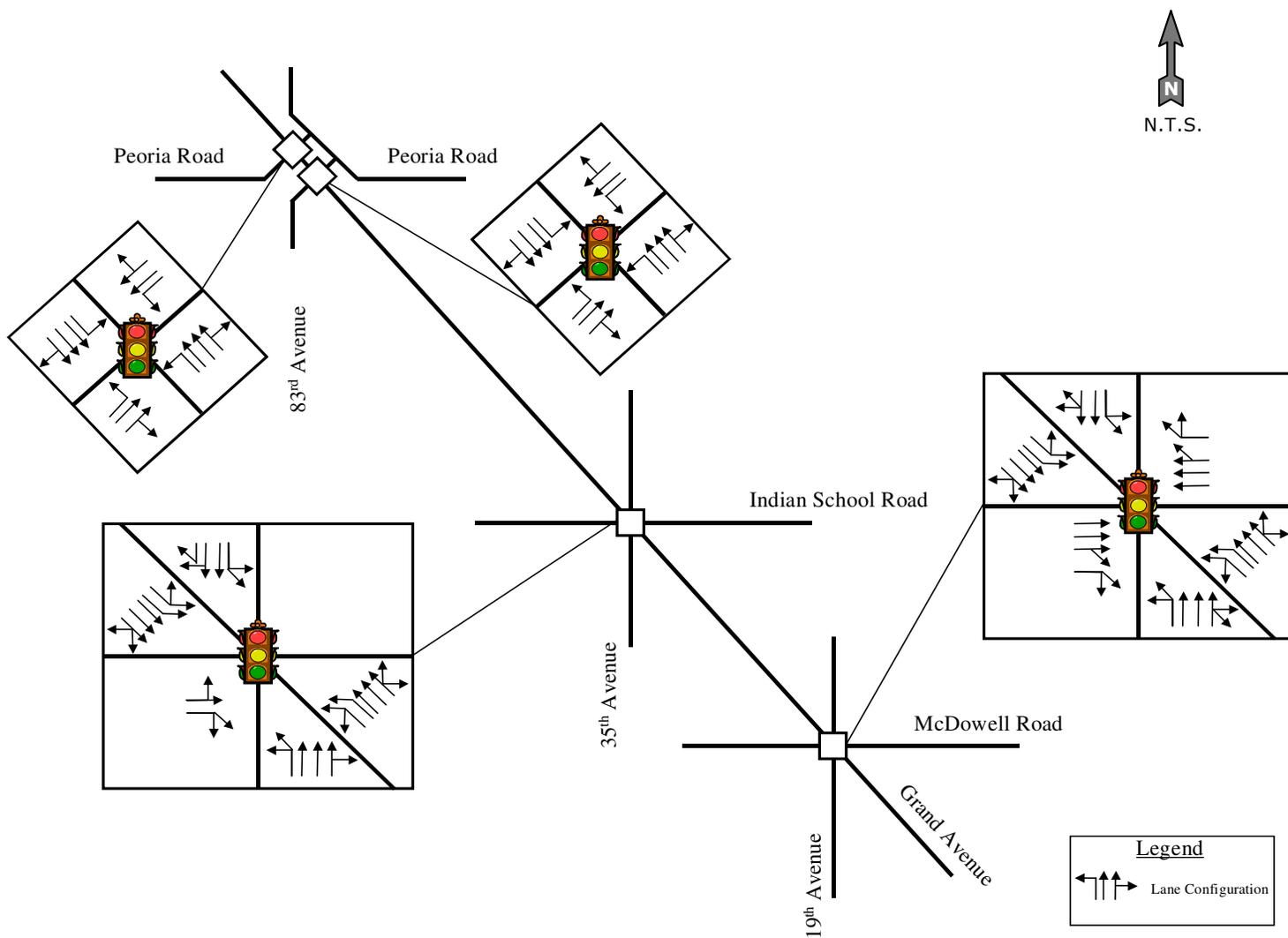
- Grand Avenue is three through lanes per direction (southeast bound and northwest bound) with dual left-turn lanes and free-flow right turn movements.
- McDowell Road is three through lanes per direction (eastbound and westbound). A single eastbound right-turn lane and dual westbound right-turn lanes exist. Left turns are not permitted in either direction.
- 19<sup>th</sup> Avenue is three through lanes in the northbound direction and two through lanes in the southbound direction. A single left-turn lane per direction exists.

### **Existing Traffic Analysis**

For purposes of this analysis the year 2004 is considered the existing year. Existing traffic analysis was performed for the peak hours at the following locations:

- Grand Avenue/Peoria Road/83<sup>rd</sup> Avenue.
- Grand Avenue/Indian School Road/35<sup>th</sup> Avenue.
- Grand Avenue/McDowell Road/19<sup>th</sup> Avenue.

The existing lane configurations for the above intersections are shown in Exhibit 5.3.



### Exhibit 5.3 Existing Lane Configurations

Traffic volume counts were obtained for the intersection of Grand Avenue/Peoria Road/83<sup>rd</sup> Avenue for the year 2002. A linear growth factor of 8% was applied to these turning movement counts to obtain the year 2004 expected turning movements. These calculated turning movements were then used for analysis in this report.

Traffic volume counts were obtained for the intersection of Grand Avenue/Indian School Road/35<sup>th</sup> Avenue for the year 1997. A linear growth factor of 8% was applied to these turning

movement counts to obtain the year 2004 expected turning movements. These calculated turning movements were then used for analysis in this report.

Traffic Research & Analysis, Inc. provided turning movement counts for the intersection of Grand Avenue/McDowell Road/19<sup>th</sup> Avenue on March 25, 2004.

The existing turning movements at the above intersections are shown in Exhibit 5.5.

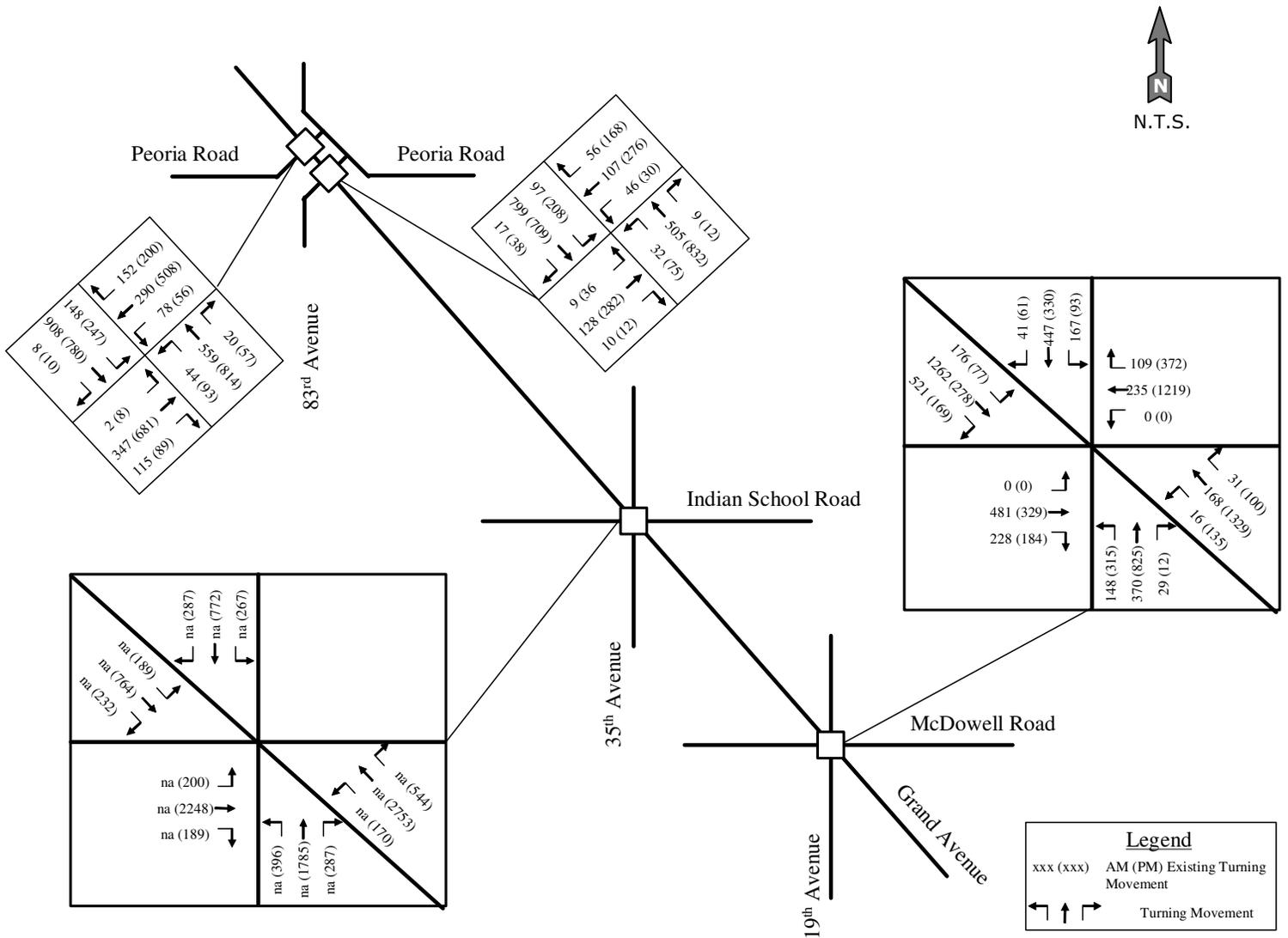
Synchro software was utilized to calculate the level-of-service (LOS) for each existing intersection. The results of this calculation are provided in Appendix E and are summarized in Exhibit 5.4 below.

#### Exhibit 5.4 Existing Level-of-Service

Intersection	AM LOS	PM LOS
<b>Grand Avenue/Peoria Avenue</b>		
Northwest Approach	B	C
Southeast Approach	B	C
Northeast Approach	C	C
Southwest Approach	C	C
<i>Intersection</i>	C	C
<b>Grand Avenue/83<sup>rd</sup> Avenue</b>		
Northwest Approach	B	B
Southeast Approach	B	B
Northeast Approach	C	D
Southwest Approach	C	D
<i>Intersection</i>	B	C
<b>Grand Avenue/Indian School Road/35<sup>th</sup> Avenue</b>		
Eastbound Approach	-	F
Westbound Approach	-	-
Northwestbound Approach	-	F
Southeastbound Approach	-	F
Northbound Approach	-	F
Southbound Approach	-	F
<i>Intersection</i>	-	F
<b>Grand Avenue/McDowell Road/19<sup>th</sup> Avenue</b>		
Eastbound Approach	E	D
Westbound Approach	D	F
Northwestbound Approach	C	F
Southeastbound Approach	E	D
Northbound Approach	E	F
Southbound Approach	E	E
<i>Intersection</i>	E	F

The current configuration of Grand Avenue and Peoria Road operates at a LOS C during the morning and evening peak hours. The current configuration for Grand Avenue and 83<sup>rd</sup> Avenue operates at LOS C or better during the morning and evening peak hours.

The intersection of Grand Avenue/Indian School Road/35<sup>th</sup> Avenue operates at a LOS F during the evening peak hour. It is expected that this intersection also operates at a LOS F during the morning peak hour.



**Exhibit 5.5 Existing 2004 Peak Hour Turning Movements**

The intersection of Grand Avenue/McDowell Road/19<sup>th</sup> Avenue operates at a LOS E and F during the morning peak and evening peak hours, respectively.

### **Intersection Alternatives and Analysis Using Existing Traffic**

The goal of these alternatives is to eliminate the six-legged type of intersection at the locations previously described. The description and layout for the alternatives for each intersection are summarized below and shown in Exhibits 5.14 through 5.21. The LOS outputs are provided as Appendix F.

Analysis of each alternative was performed using the existing traffic volumes. The existing traffic volumes were redistributed as per the lane configuration of each scenario. The lane configuration, redistributed traffic volumes, and LOS for each alternative are described and shown below.

#### **Grand Avenue/Peoria Avenue/83<sup>rd</sup> Avenue**

The *83<sup>rd</sup> Avenue Realignment Report* includes the design for this intersection. Grand Avenue is proposed to be depressed under Peoria Avenue. This would allow for uninterrupted traffic flow on Grand Avenue and Peoria Avenue. This design also converts 84<sup>th</sup> Avenue into a cul-de-sac at Grand Avenue and 83<sup>rd</sup> Drive into a cul-de-sac at Peoria Avenue. The intersection of 83<sup>rd</sup> Avenue and Grand Avenue would be eliminated. 83<sup>rd</sup> Avenue is proposed to be a three legged “T” intersection at Washington Street and closed on the north side of Grand Avenue. The underpass of Grand Avenue would eliminate traffic to and from Grand Avenue via 83<sup>rd</sup> Avenue and Peoria Avenue.

#### **Grand Avenue/Northern Avenue/67<sup>th</sup> Avenue**

The *Northern Parkway Design Concept Report, 2003* includes the preferred design for this intersection. Included in the design is a flyover for eastbound Northern Parkway traffic to southeast bound Grand Avenue traffic and for northwest bound Grand Avenue traffic to westbound Northern Parkway traffic. Currently a bypass for 67<sup>th</sup> Avenue northbound and southbound through traffic exists. Connector roadways to the north and south of the main intersection allow for connection from 67<sup>th</sup> Avenue to Grand Avenue and Northern Avenue. The traffic analysis for this intersection can be found in the *Northern Parkway DCR*. Further alternatives were not identified for this report.

#### **Grand Avenue/Bethany Home Road/51<sup>st</sup> Avenue**

The *Grand Avenue Design Concept Report (DCR)* includes the design for this intersection. Included in the design is the current 51<sup>st</sup> Avenue bypass configuration as described previously. An addition to this design is an alternative where Bethany Home Road is depressed under Grand Avenue. This would allow uninterrupted through movements on all three roadways.

Connector Roadway A east of 51<sup>st</sup> Avenue from Bethany Home Road to Grand Avenue is proposed. Traffic signals on Grand Avenue and Bethany Home Road are proposed at these connector roadway locations.

Connector Roadway B west of 51<sup>st</sup> Avenue from Bethany Home Road to 51<sup>st</sup> Avenue is proposed. Traffic signals on Bethany Home Road and 51<sup>st</sup> Avenue are proposed at these connector roadway locations. The traffic analysis for this intersection can be found in the Grand Avenue Interim Design Concept Report. Further alternatives were not identified for this report.

### **Grand Avenue/Indian School Road/35<sup>th</sup> Avenue**

Two alternatives to help alleviate congestion at this intersection were identified. These alternatives and analyses are described below.

#### *Alternative 1: Grand Avenue under Indian School Road/35<sup>th</sup> Avenue*

In addition to the Indian School Road bypass and the Indian School Road/Grand Avenue flyover, Alternative 1 suggests Grand Avenue be depressed under 35<sup>th</sup> Avenue. This would allow uninterrupted through movements on Grand Avenue. 33<sup>rd</sup> Avenue to the east of 35<sup>th</sup> Avenue would become the connector roadway for Indian School Road to Grand Avenue.

The Indian School Road and 35<sup>th</sup> Avenue intersection would then become a four-legged intersection. The lane configuration, redistributed traffic volumes and LOS for this reconfigured intersection are shown in Exhibit 5.6.

#### *Alternative 2: 35<sup>th</sup> Avenue under Grand Avenue/Indian School Road*

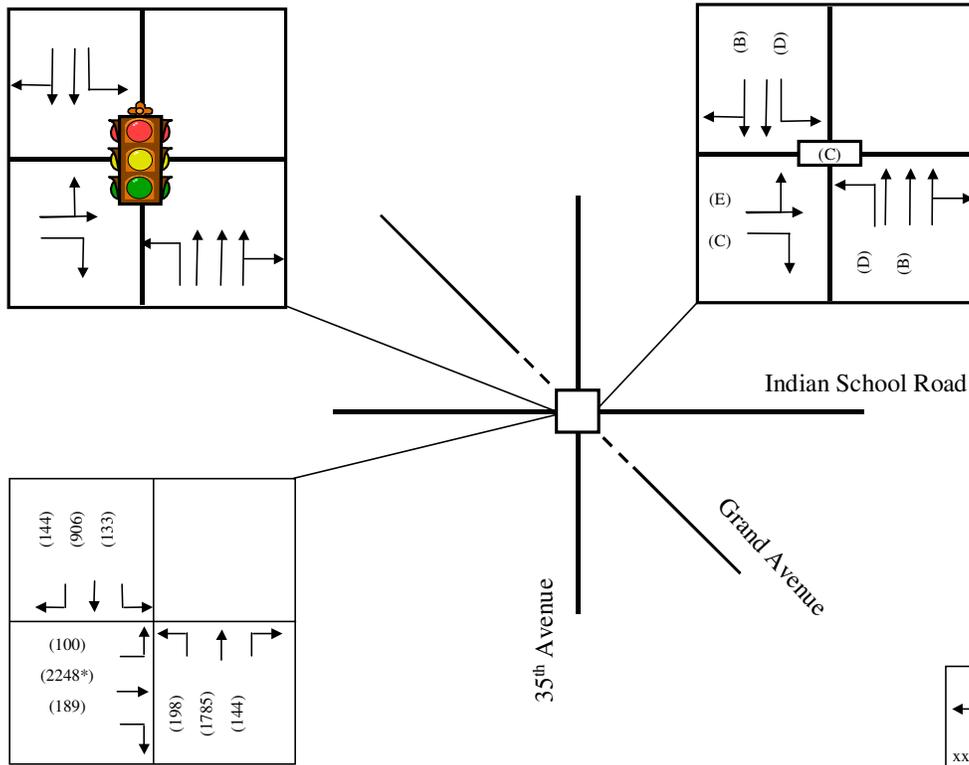
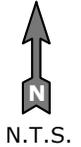
Alternative 2 suggests the through lanes of 35<sup>th</sup> Avenue be depressed under Grand Avenue. Frontage roads along 35<sup>th</sup> Avenue would provide access to the properties along 35<sup>th</sup> Avenue. The frontage roads would also provide access to Indian School Road and Grand Avenue. Indian School Road would remain as right-in right-out access controlled. The lane configuration, redistributed traffic volumes and LOS for this reconfigured intersection are shown in Exhibit 5.7.

### **Grand Avenue/McDowell Road/19<sup>th</sup> Avenue**

Three alternatives were identified for this location. These alternatives are described below.

#### *Alternative 1: 19<sup>th</sup> Avenue/Grand Avenue Flyover*

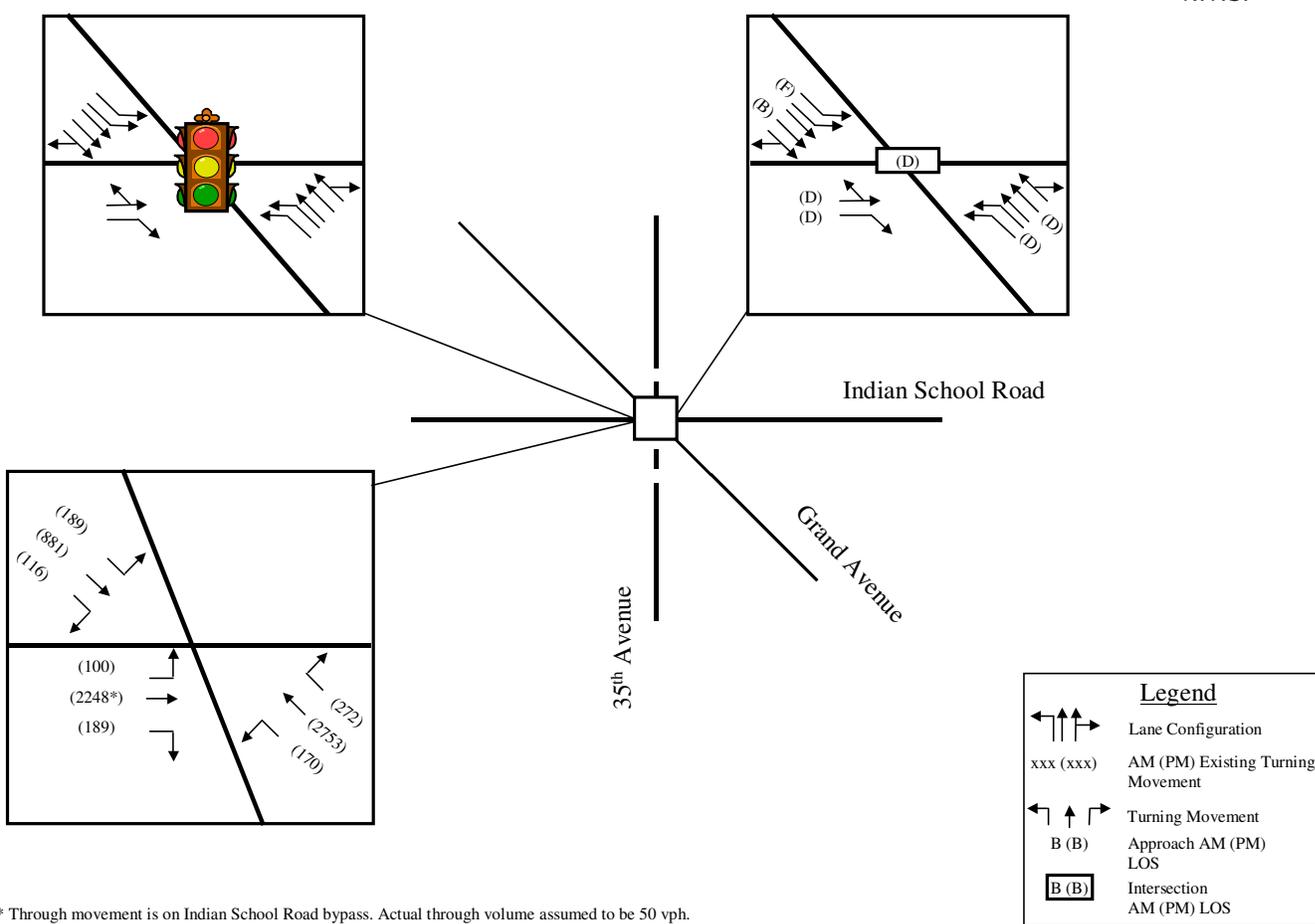
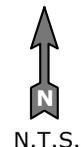
This alternative suggests a flyover for northbound 19<sup>th</sup> Avenue traffic to northwest bound Grand Avenue traffic and for southeast bound Grand Avenue traffic to southbound 19<sup>th</sup> Avenue traffic. The flyover would eliminate one northbound left-turn movement from the six-legged intersection; however a six-legged intersection would still remain. The flyover is proposed to connect to the median of 19<sup>th</sup> Avenue and the median of Grand Avenue. Both 19<sup>th</sup> Avenue and Grand Avenue would need to be widened to support the additional lanes and structure. The new LOS for the intersection is summarized in the Exhibit 5.8 below.



\* Through movement is on Indian School Road bypass. Actual through volume assumed to be 50 vph.

Legend	
	Lane Configuration
xxx (xxx)	AM (PM) Existing Turning Movement
	Turning Movement
B (B)	Approach AM (PM) LOS
	Intersection AM (PM) LOS

**Exhibit 5.6 Alternative 1 - Grand/Indian School/35<sup>th</sup>**



\* Through movement is on Indian School Road bypass. Actual through volume assumed to be 50 vph.

### Exhibit 5.7 Alternative 2 - 35<sup>th</sup> Avenue Under Grand Avenue/Indian School Road

## Exhibit 5.8: Alternative 1 - Grand/McDowell/19<sup>th</sup> Future LOS

Intersection	AM LOS	PM LOS
<b>Grand/McDowell/19<sup>th</sup> Avenue</b>		
Eastbound Approach	E	D
Westbound Approach	D	F
Northwestbound Approach	D	F
Southeastbound Approach	D	D
Northbound Approach	D	E
Southbound Approach	D	E
<i>Intersection</i>	<i>D</i>	<i>E</i>

### Alternative 2: McDowell Road over 19th Avenue/Grand Avenue

Alternative 2 includes a bypass for through traffic on McDowell Road. This bypass is proposed just south of the existing McDowell Road alignment. This alternative would allow uninterrupted traffic flow for the through traffic on McDowell Road.

Connector Roadway A is proposed west of 19<sup>th</sup> Avenue and would connect the eastbound McDowell Road traffic to intersection of McDowell Road/19<sup>th</sup> Avenue for free-flow right-turns onto southbound 19<sup>th</sup> Avenue. This connector roadway would also connect Grand Avenue and 19<sup>th</sup> Avenue traffic to westbound McDowell Road. Westbound McDowell Road traffic would still be able to make a free flow westbound right turn to northbound 19<sup>th</sup> Avenue.

Connector Roadway B is proposed east of 19<sup>th</sup> Avenue and would provide a connection for McDowell Road Traffic with Grand Avenue and 19<sup>th</sup> Avenue traffic. Connection from McDowell Road to Grand Avenue is proposed at the following locations:

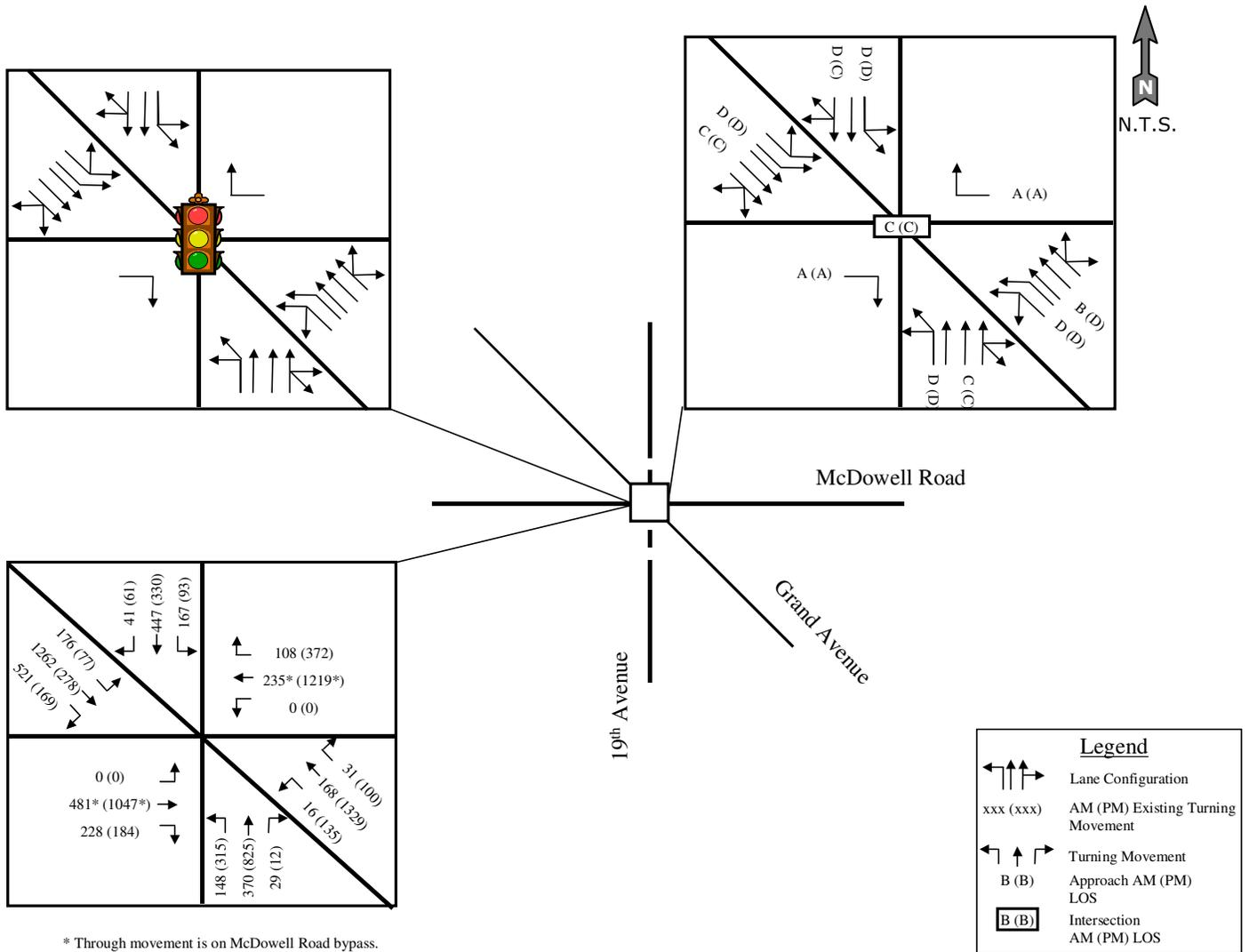
- McDowell Road traffic to northbound 22<sup>nd</sup> Avenue to Grand Avenue.
- Westbound left-turn from McDowell Road at Connector Roadway B/Grand Avenue.

The lane configuration, redistributed traffic volumes and LOS for this reconfigured intersection are shown in Exhibit 5.9.

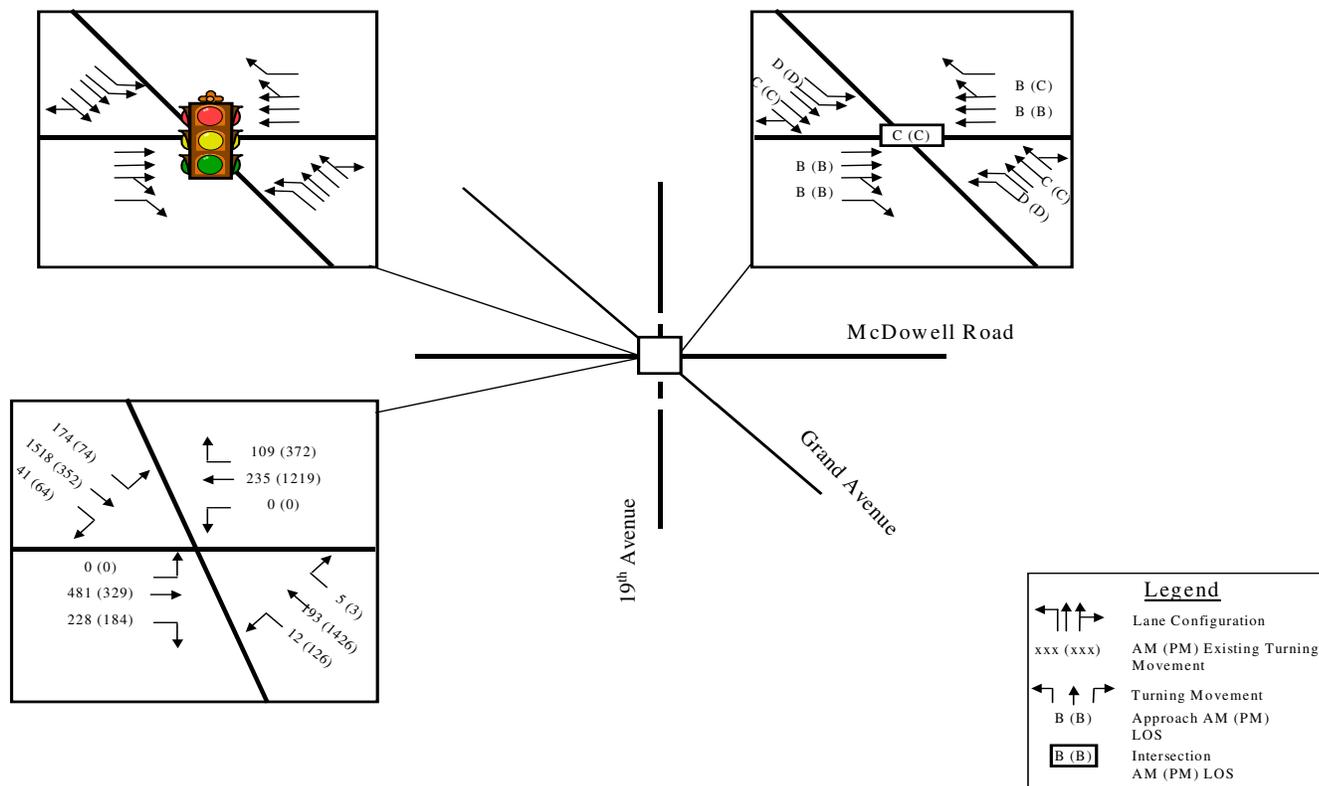
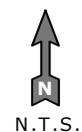
### Alternative 3: 19th Avenue over Grand Avenue/McDowell Road

Alternative 3 includes a bypass for through traffic on 19<sup>th</sup> Avenue. This bypass is proposed just west of the existing 19<sup>th</sup> Avenue alignment. This alternative would allow uninterrupted traffic flow for the through traffic on 19<sup>th</sup> Avenue.

Connections to 19<sup>th</sup> Avenue and McDowell Road would occur via local streets. The lane configuration, redistributed traffic volumes and LOS for this reconfigured intersection are shown in Exhibit 5.10.



**Exhibit 5.9 Alternative 2 - McDowell Road Over 19<sup>th</sup> Avenue/Grand Avenue**



### Exhibit 5.10 Alternative 3 - 19<sup>th</sup> Avenue Over Grand Avenue/McDowell Road

#### Alternative to Existing LOS Comparison

Alternatives at the following intersections were compared to existing conditions.

- Grand Avenue/Indian School Road/35<sup>th</sup> Avenue
- Grand Avenue/McDowell Road/19<sup>th</sup> Avenue

The results of the LOS comparison are displayed in Exhibit 5.11.

## Exhibit 5.11 LOS Comparison - Alternatives to Existing

Intersection	Existing		Alternative 1		Alternative 2		Alternative 3	
	AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS	AM LOS	PM LOS
<b>Grand/Indian School/35<sup>th</sup></b>								
Eastbound Approach	-	F	-	D	-	D		
Westbound Approach	-	-	-	-	-	-		
Northwestbound Approach	-	F	-	-	-	D		
Southeastbound Approach	-	F	-	-	-	D		
Northbound Approach	-	F	-	C	-	-		
Southbound Approach	-	F	-	C	-	-		
<i>Intersection</i>	-	<i>F</i>	-	<i>C</i>	-	<i>D</i>		
<b>Grand/McDowell/19<sup>th</sup></b>								
Eastbound Approach	E	D	E	D	A	A	B	B
Westbound Approach	D	F	D	F	A	A	B	C
Northwestbound Approach	C	F	D	F	C	D	C	C
Southeastbound Approach	E	D	D	D	C	C	C	C
Northbound Approach	E	F	D	E	C	C	-	-
Southbound Approach	E	E	D	E	D	C	-	-
<i>Intersection</i>	<i>E</i>	<i>F</i>	<i>D</i>	<i>E</i>	<i>C</i>	<i>C</i>	<i>C</i>	<i>C</i>

For the intersection of Grand Avenue/Indian School Road/35<sup>th</sup> Avenue, Alternative 1 provides the best LOS for all approaches and for the intersection.

For the intersection of Grand Avenue/McDowell Road/19<sup>th</sup> Avenue, Alternative 2 and Alternative 3 provide the same intersection LOS, a LOS C. Alternative 2 provides a better LOS A for eastbound and westbound traffic on McDowell Road where Alternative 3 provides a LOS B. Alternative 2 also provides right-turn access from McDowell Road to 19<sup>th</sup> Avenue.

### Final Evaluation Criteria and Alternative Evaluation

The Grand Avenue/Indian School Road/35<sup>th</sup> Avenue and the Grand Avenue/McDowell Road/19<sup>th</sup> Avenue intersections were the two intersections identified for further evaluation. The other three intersections either have a previously identified alternative or are not being carried forward in this Study. The evaluation criteria were applied to each of the alternatives to determine the recommended alternative.

For each of the three categories, the pertinent criteria were defined as:

#### Service

- Eliminate six-legged intersections
- Eliminate railroad crossings
- Improve regional mobility and serve the statewide function of US 60
- Accommodate projected travel demand in the corridor

## **Impact**

- Number of residences taken or impacted
- Number of businesses taken or impacted
- Neighborhoods impacted by improvements
- Acreage of new right-of-way needed for improvements

## **Implementation**

- Cost of engineering, construction, and right-of-way
- Engineering issues and uncertainties
- Phased construction opportunities

The criteria are not intended to be of equal importance; instead, they are intended to identify the differences between the options. Quantitative measures were utilized whenever possible. Narrative and subjective measures were also used to identify how the options differ for a given criterion. The differences, advantages, and disadvantages of each option are summarized for each of the three categories of criteria at the end of this section.

Through the steering committee, stakeholders and public meetings, a consensus for one option should emerge based on the data and analyses presented herein for each intersection. The preferred option will be presented in the next chapter.

Three alternatives for the Grand Avenue/McDowell Road/19<sup>th</sup> Avenue intersection were previously described in this chapter. Of the three alternatives for this intersection, the McDowell Road over Grand Avenue/19<sup>th</sup> Avenue alternative was eliminated due to significant cost and was not included for further analysis.

The two alternatives for the Grand Avenue/Indian School Road/35<sup>th</sup> Avenue intersection were evaluated based on the above criteria and are summarized in Exhibit 5.12. The two remaining alternatives at Grand Avenue/McDowell Road/19<sup>th</sup> Avenue were evaluated based on the above criteria and are summarized in Exhibit 5.13.

## **Findings**

The purpose of this analysis is to identify alternatives to eliminate the six-legged intersections or in some other way provide key intersections an acceptable level-of-service (LOS) while maintaining prioritized traffic flow on Grand Avenue. Below are the findings for this Study.

- The intersection of Grand Avenue/Peoria Avenue/83<sup>rd</sup> Avenue currently operates with a LOS C or better during the morning and evening peak hours. The preferred alternative will be outlined in Chapter 6 of this report; Estimated Cost (2005 \$) = \$24,493,000.

## Exhibit 5.12 Summary Evaluation at Grand Avenue/Indian School Road/35<sup>th</sup> Avenue

	Alternative 1 Grand Ave. Under 35 <sup>th</sup> Ave.	Alternative 2 35 <sup>th</sup> Ave. Under Grand Ave.
Criterion		
<b>Service</b>		
Eliminates six-legged intersections	YES, resulting in four-legged intersection	YES, resulting in four-legged intersection.
Eliminates railroad crossings	NO	YES
Improves Regional mobility of traffic	YES, no signal for Grand Avenue traffic	NO
Accommodates future demand	YES, provides LOS C for existing traffic	YES, provides LOS D for existing traffic.
<b>Impact</b>		
Number of Residences	0	0
Number of Businesses	2	1
Number of Acres	14.8	6.8
Neighborhoods Impacted	<ul style="list-style-type: none"> <li>• Minor visual impacts.</li> <li>• Access to Indian School Road via 33<sup>rd</sup> Avenue.</li> <li>• Access to 35<sup>th</sup> Avenue via Osborn.</li> <li>• Potential for increased volumes on Grand Avenue.</li> </ul>	<ul style="list-style-type: none"> <li>• Minor visual impacts.</li> <li>• Access to properties via frontage roads.</li> <li>• Potential for increased volumes on 35<sup>th</sup> Avenue.</li> </ul>
<b>Implementation</b>		
Total Estimated Cost (2005 \$)	\$37,472,000	\$29,632,000
Engineering issues/uncertainties	N/A	Coordination with BNSF railroad during construction.
Phased construction opportunities	Roadway cross-section compatible with Grand Avenue.	Requires larger cross-section for 35 <sup>th</sup> Avenue (one additional lane).

### Exhibit 5.13 Summary of Evaluation at Grand Avenue/McDowell Road/19<sup>th</sup> Avenue

Criterion	Alternative 1 19 <sup>th</sup> Avenue Flyover	Alternative 3 19 <sup>th</sup> Ave. Over Grand Ave.
Service		
Eliminates six-legged intersections	NO	YES, resulting in four-legged intersection.
Eliminates railroad crossings	NO	NO
Improves regional mobility of traffic	YES, direct access from I-10 to US 60.	NO
Accommodates future demand	NO, results in LOS E for existing traffic.	YES, provides LOS C for existing traffic.
<b>Impact</b>		
Number of Residences	0	0
Number of Businesses	4	11
Number of Acres	13.3	19.1
Neighborhoods Impacted	<ul style="list-style-type: none"> <li>• 1,030' long structure visible by businesses and residents.</li> <li>• Potential for increased volumes on 19<sup>th</sup> Avenue from I-10.</li> </ul>	<ul style="list-style-type: none"> <li>• 420' long structure visible by businesses and residents.</li> <li>• Access Grand/McDowell via connector road to the south of existing intersection.</li> </ul>
<b>Implementation</b>		
Total Estimated Cost (2005 \$)	\$16,627,000	\$18,972,000
Engineering issues/uncertainties	Does not provide better LOS for intersection.	Removal of businesses.
Phased construction opportunities	Requires larger cross-section for 19 <sup>th</sup> and Grand Avenues (add'l lanes in medians).	Roadway cross-section compatible with 19 <sup>th</sup> Avenue.

- Northern Parkway Directional Ramps at the intersection of Grand Avenue/ Northern Avenue/67<sup>th</sup> Avenue is the preferred configuration per the *Northern Parkway DCR*. Since this project is currently identified and funded in the arterial street portion of the Regional Transportation Plan (RTP), this Study concludes that the project would be funded separately; Estimated Cost (2005 \$) = \$25,804,000.
- Bethany Home Road Under Grand Avenue/51<sup>st</sup> Avenue is the preferred configuration per the *Grand Avenue Limited Expressway Design Concept Study in the Glendale Area, 2003 (Grand Avenue DCR)*; Estimated Cost (2005 \$) = \$32,694,000.
- For the intersection of Grand Avenue/Indian School Road/35<sup>th</sup> Avenue, Alternative 1 provides a LOS C during the evening peak hour while Alternative 2 provides a LOS D during the evening peak hour. Both alternatives provide an acceptable LOS. The preferred alternative will be outlined in the next chapter.
- For the intersection of Grand Avenue/McDowell Road/19<sup>th</sup> Avenue, Alternative 1 does not improve the LOS. Alternatives 2 and 3 provide LOS C for the intersection during the morning and evening peak hours. The preferred alternative will be outlined in the next chapter.

### 5.2.5 Intersection Improvements

Within the Study Area, Grand Avenue is host to over 60 three-, four-, five- and six-legged intersections that are either stop controlled or signal controlled. A majority of these intersections are stop controlled along the minor roadway, allowing Grand Avenue traffic to flow freely. Of these 60-plus intersections, approximately 65% are skewed. The remaining intersections have been reconstructed into perpendicular intersection (such as those in downtown Peoria) or as grade-separations.

The Study team has identified four potential candidates for intersection improvements. The locations currently intersect Grand Avenue at a skew and the proposed improvements would realign the arterial street to intersect perpendicular to Grand Avenue. Realignment of skewed intersections can simplify turning movements and increase intersection safety by creating a more conventional intersection layout.

The first two locations, shown on [Exhibit 5.22](#), are three-legged intersections with 39<sup>th</sup> Avenue and 37<sup>th</sup> Avenue, to the north. 39<sup>th</sup> Avenue is a half-mile collector street that could benefit from the potential realignment. 37<sup>th</sup> Avenue is a minor collector that was identified for potential realignment because of the possible park-n-ride identified in this Study, located directly adjacent to the intersection with Grand Avenue. Both realignments would require new right-of-way. Improvements to Grand Avenue would include right-turn only lanes and acceleration lanes for traffic turning right onto Grand Avenue. Estimated Cost (2005 \$) = \$2,099,000

The third location, shown on [Exhibit 5.23](#), is at the intersection of Grand Avenue with 31<sup>st</sup> Avenue and Osborn Road. The existing intersection configuration currently has two signals spaced approximately 900 feet apart along Grand Avenue. The northernmost intersection is a five-legged skewed intersection including Grand Avenue, 31<sup>st</sup> Avenue and Osborn Road to the west. The southernmost intersection is a three-legged perpendicular intersection including Grand Avenue and Osborn Road to the east. The proposed realignment would eliminate one of the signals and create a perpendicular four-legged intersection, but would require new right-of-way. Improvements to Grand Avenue associated with the new intersection could include right-turn only lanes and acceleration lanes for traffic turning right onto Grand Avenue. Estimated Cost (2005 \$) = \$7,250,000

The fourth location, shown on [Exhibit 5.24](#), is a five-legged intersection with Grand Avenue, Encanto Boulevard and 23<sup>rd</sup> Avenue to the north. The realignment concept would cul-de-sac 23<sup>rd</sup> Avenue to the north, creating a four-legged intersection with Encanto Boulevard and Grand Avenue. The proposed realignment would require new right-of-way and would relocate the existing railroad crossing approximately 350 feet to the southeast. Improvements to Grand Avenue would include right-turn only lanes and acceleration lanes for traffic turning right onto Grand Avenue. Estimated Cost (2005 \$) = \$3,888,000

The fifth location, shown on [Exhibit 5.25](#), is at the six-legged intersection with Grand Avenue, McDowell Road and 19<sup>th</sup> Avenue. The dual-left turn lanes would require new right-of-way along 19<sup>th</sup> Avenue. Estimated Cost (2005 \$) = \$1,472,000

The total estimated cost for the proposed intersection improvements is \$14,709,000.

### **5.2.6 Intelligent Transportation System (ITS) and Signals**

ITS involves the application of electronics and communication technologies in an integrated manner to increase the safety and efficiency of the surface transportation system by:

- Collecting and disseminating information on traffic conditions and transit schedules to aid travelers before and during trips
- Relieving congestion by reducing the number of traffic incidents through better coordination, detecting and clearing incidents quickly when they occur, and rerouting traffic flow
- Helping drivers reach desired destinations with navigational aid systems
- Raising the productivity of vehicle fleets through automated tracking, dispatch and weigh-in-motion systems
- Benefiting public and governmental agencies through lower costs, enhanced services and a healthier environment for all
- Helping people and goods move more safely and efficiently by providing information links between travelers, vehicles and infrastructure

The Maricopa Association of Governments (MAG) prepared a regional ITS Strategic Plan and has incorporated that plan into the Regional Transportation Plan. Grand Avenue is identified as a Phase 1 SMART Corridor in the regional ITS Strategic Plan. The ITS Strategic Plan identifies SMART Corridors as including a range of traffic management devices such as: traffic signals, controllers, vehicle sensors, cameras, and electronic message boards. These devices are to be managed from traffic management centers operated by the controlling agencies. Grand Avenue has several traffic signals, which are managed by ADOT. The crossing arterial streets are managed by the cities of Glendale, Peoria, and Phoenix. All four agencies have operating traffic management centers and coordinate their respective traffic signals. However, the lack of high-speed data communications along the corridor limits their ability to coordinate between each other. Also, limited real-time data restricts their ability to actively manage the corridor and to disseminate information to travelers. The ITS improvements to Grand Avenue consist of communications, inter-jurisdictional signal coordination, real-time traffic monitoring and surveillance, and information dissemination.

The proposed ITS improvements along Grand Avenue include:

- Integrated traffic signal coordination between the ADOT and the cities of Peoria, Glendale and Phoenix, which includes installation of fiber optic transceivers and other communication equipment at 20 locations; Estimated Cost (2005 \$) = \$40,000
- Traffic surveillance and monitoring including traffic sensors along the roadway and closed circuit cameras at 10 key intersections; Estimated Cost (2005 \$) = \$300,000
- Variable message signs at the approaches to I-10/I-17 and SR 101L; Estimated Cost (2005 \$) = \$100,000

- A fiber optic network for communication with, and management of, the devices in the corridor; Estimated Cost (2005 \$) = \$1,200,000

Estimated Cost (2005 \$) = \$1,640,000.

### 5.2.7 Bottlenecks

The at-grade railroad crossings contribute to significant delays on the intersecting roadways and have been the source of complaints for many years. With the implementation of Option 4 – Alternating Grade Separations from the *1999 Grand Avenue MIS (ADOT 2003)*, local travelers can now choose from four grade separations of the railroad, two in the north/south direction and two in the east/west direction. Additional grade separations in the east/west direction for Bethany Home Road and in the north/south direction for 19<sup>th</sup> Avenue have been proposed as part of this Study, ultimately giving local travelers six different options. Also, in the case of the grade separation of Maryland Avenue at Grand Avenue, BNSF will be able to expand their train-building yard, decreasing the need to “shut-down” adjacent major intersections for extended periods of time to build trains.

Potential options identified in this Study to address bottlenecks include constructing additional right-turn lanes on the arterial streets to allow turns during train delays, implementation of additional arterial street grade separations, and improving signal timing and synchronization. Also, future traffic patterns of local travelers may change to utilize existing grade separations with the railroad to avoid potential bottlenecks related to extended train delays.

### 5.2.8 Access Management

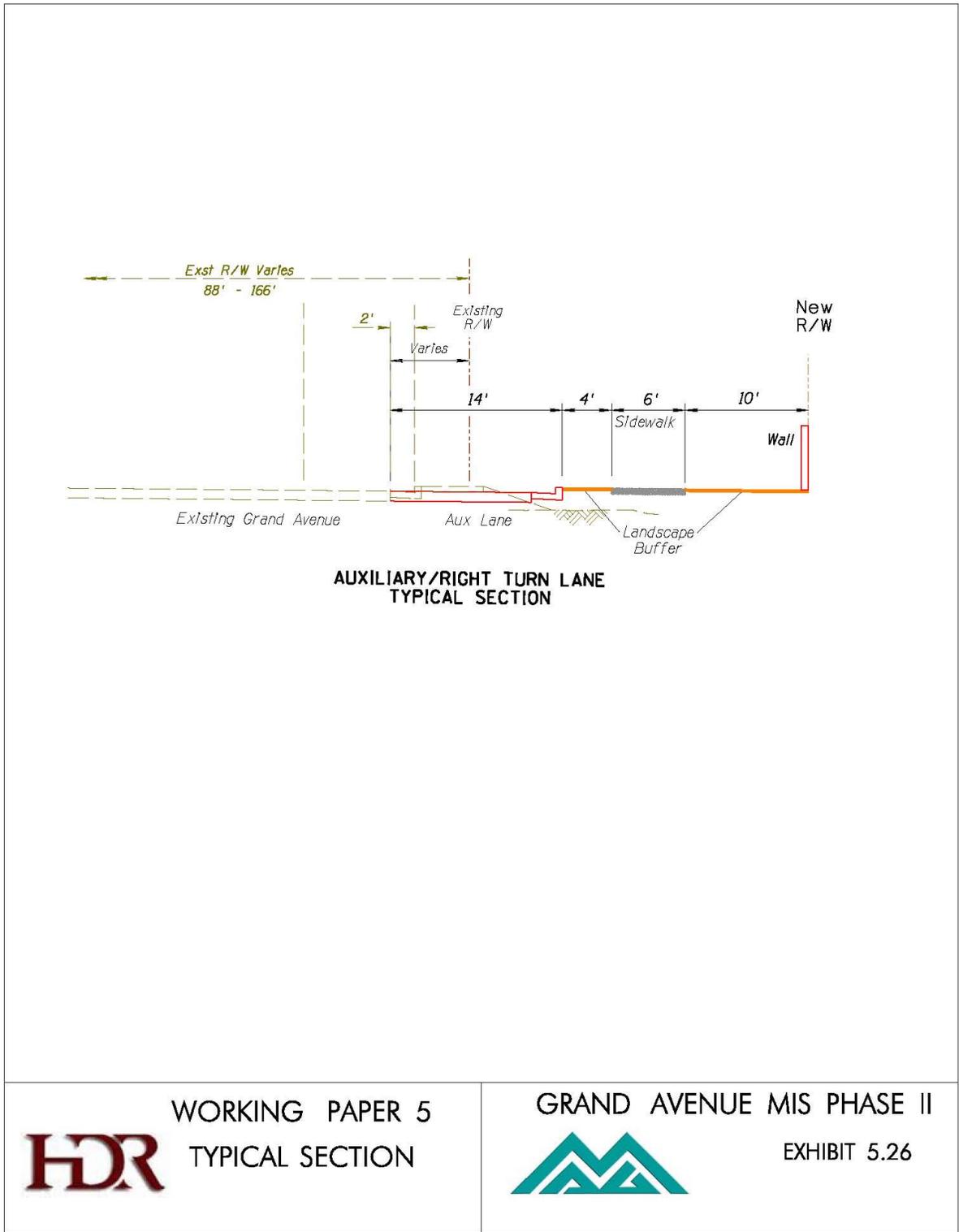
One of the goals of the Agency Steering Group is to build upon the improvements identified in the original *Grand Avenue MIS* and move Grand Avenue toward the status of an Enhanced Arterial/Limited Expressway. The steering group identified access management as the prime method to achieving this goal. The access management strategies applied in this Study include:

- Closing select median crossovers to reduce turning movements across Grand Avenue
- Reconfiguring minor collector intersections to right-in/right-out
- Removing unused driveways and curb cuts
- Constructing right-turn only and auxiliary lanes to remove the turning traffic from the through lanes of Grand Avenue (See Exhibit 5.26)
- Purchasing groups of parcels impacted by the addition of auxiliary lanes and reconfiguring access to streets other than Grand Avenue

### Median Closures

There are a total of 85 median crossovers on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue. Of those, 42 provide access to local streets, 33 provide access to individual properties and 10 provide for possible u-turns. The proposed plan displayed in Exhibits 5.27 through 5.38 includes the closing of 18 of the 85 median breaks. The majority of the closures (12) are due to the fact that the left-turn bays fall where there are either no access points off of Grand Avenue or where

**Exhibit 5.26 Right-Turn Lane/Auxiliary Lane Typical Section**



**HDR** WORKING PAPER 5  
TYPICAL SECTION

GRAND AVENUE MIS PHASE II  
 EXHIBIT 5.26

there is already access to the property from a local street. The remaining closures (6) occur at minor collector streets and would coincide with raised medians restricting the collector to right-in and right-out access.

Estimated Cost (2005 \$) = \$900,000

### **Right-In and Right-Out Restrictions**

Removing left-turns onto Grand Avenue from arterial and collector streets can improve safety at the intersections. Ten intersections have been identified for possible restriction to right-in right-out only access. At Orangewood Avenue, Grand Avenue traffic is still able to turn left, but traffic from Orangewood Avenue is only permitted to make a right turn onto Grand Avenue. All of the locations except Butler Drive and Orangewood Avenue are also locations where median break removals are proposed.

Locations of right-in and right-out only access:

- Butler Drive ([Exhibit 5.30](#))
- Orangewood Avenue ([Exhibit 5. 31](#))
- 63<sup>rd</sup> Avenue ([Exhibit 5.31](#))
- 56<sup>th</sup> Avenue ([Exhibit 5.32](#))
- Missouri Avenue ([Exhibit 5. 34](#))
- 37<sup>th</sup> Avenue ([Exhibit 5.35](#))
- 24<sup>th</sup> Avenue ([Exhibit 5. 37](#))
- Monte Vista Road ([Exhibit 5.38](#))
- 21<sup>st</sup> Avenue ([Exhibit 5. 38](#))
- 20<sup>th</sup> Avenue ([Exhibit 5. 38](#))

Estimated Cost (2005 \$) = \$550,000

### **Driveway/Curb Cut Closures**

The project team identified a total of 312 driveway or curb cuts between SR 101L and 19<sup>th</sup> Avenue on Grand Avenue. The proposed plan displayed in [Exhibits 5.27 through 5.38](#) includes the closing of 110 of the 312 driveways. The majority of the closures (60) are proposed because the existing driveway or curb cut has been blocked by the property owner. The other major reason for closure is duplicate access to the same property. This accounts for approximately 35 of the proposed closures. The remaining 15 closures occur at locations that provide multiple accesses to currently unoccupied property.

Estimated Cost (2005 \$) = \$1,545,000

### **Right-Turn Only/Auxiliary Lanes**

In addition to restricting access through median and driveway closures, adding exclusive right-turn and auxiliary lanes may improve operations by removing turning traffic from the through

lanes of Grand Avenue. Auxiliary lanes are proposed for stretches of Grand Avenue with a high density of driveways. In other locations where there is a large right-turn movement, exclusive right-turn lanes and acceleration lanes have been proposed to allow easier entrance and exit to Grand Avenue.

There are three proposed locations for exclusive right-turn lanes and eight proposed locations for auxiliary lanes shown on Exhibits 5.27 through 5.38.

Proposed locations for exclusive right-turn lanes include:

- Mobile Manor, 62<sup>nd</sup> Avenue alignment (northwest bound lanes) (Exhibit 5.32)
- Circle K and Myrtle Avenue (northwest bound lanes) (Exhibit 5.32)
- 33<sup>rd</sup> Avenue (northwest bound lanes) (Exhibit 5.36)

Proposed locations for auxiliary lanes include:

- 91<sup>st</sup> Avenue to 83<sup>rd</sup> Avenue (southeast bound lanes) (Exhibits 5.27 and 5.28)
- Butler Drive to Royal Palm Drive (northwest bound lanes) (Exhibits 5.30 and 5.31)
- 56<sup>th</sup> Avenue to 55<sup>th</sup> Avenue (northwest bound lanes) (Exhibits 5.32 and 5.33)
- 53<sup>rd</sup> Avenue to Bethany Home Road (northwest bound lanes) (Exhibit 5.33)
- Missouri Avenue to 43<sup>rd</sup> Avenue basin (northwest bound lanes) (Exhibit 5.34)
- 42<sup>nd</sup> Avenue to 36<sup>th</sup> Avenue (northwest bound lanes) (Exhibit 5.35)
- 35<sup>th</sup> Avenue to 29<sup>th</sup> Avenue (northwest bound lanes) (Exhibit 5.36)
- 24<sup>th</sup> Drive to 21<sup>st</sup> Avenue (northwest bound lanes) (Exhibits 5.37 and 5.38)

Exhibit 5.26 displays a typical 14-foot wide right-turn or auxiliary lane. The typical section identifies other improvements proposed in this Study including a 6-foot wide sidewalk, a 4-foot wide landscape buffer between the sidewalk and Grand Avenue and a 10-foot wide landscape buffer between the sidewalk and adjacent parcels.

### **Access Reconfiguration for select parcels adjacent to Grand Avenue**

The *Grand Avenue DCR* specifically identified a number of potential parcels or groups of parcels within the City of Glendale for which to reconfigure access to the local streets. The City of Glendale has \$10,000,000 of available funding to apply towards the purchase of the parcels identified on Exhibits 5.31 through 5.34. The parcels or groups of parcels include:

- A parcel just north of Northern Avenue bounded by Grand Avenue on the south and west and public land on the north and east
- A group of parcels bounded by Northern Avenue on the north, 65<sup>th</sup> Avenue on the east, and Grand Avenue on the south and west
- A group of parcels bounded by the Northern/Orangewood detention basin on the north, 63<sup>rd</sup> Avenue on the east, and Grand Avenue on the south and west
- A parcel at the northeast corner of 61<sup>st</sup> Avenue and Myrtle Avenue bounded by Grand Avenue on the south and west

- A group of parcels bounded by Lamar Road on the north, 57<sup>th</sup> Avenue on the east, and 57<sup>th</sup> Drive/Grand Avenue on the south and west
- A parcel north of Bethany Home Road adjacent to the 51<sup>st</sup> Avenue overpass bounded by Grand Avenue on the south and west
- A parcel bounded by Missouri Avenue on the north, private property on the east, and Grand Avenue on the south and west

This Study identifies these parcels as total takes, which would allow potential redevelopment opportunities for the City of Glendale. Reconfiguration of access from Grand Avenue to the local streets meets the intent of the access management goals identified in this Study by removing access points from these parcels to Grand Avenue.

### **5.2.9 Safety**

As discussed in Chapter 3, one of the most important issues along Grand Avenue is safety. In addition to vehicular safety along and across Grand Avenue, bicycle and pedestrian safety is of utmost importance. A number of comments from previous public and municipal input referenced right-turn lanes, traffic signal improvements, intersection improvements and pedestrian/ bicycle crossings as necessary safety improvements for the Grand Avenue corridor. Dedicated right-turn lanes can have an impact on safety by removing the turning traffic from the higher speed through traffic. In Section 5.1.8, numerous right-turn/auxiliary lanes for the corridor were suggested especially in areas with numerous driveways between the major intersections. Traffic signal improvements including synchronization and possible removal, as discussed in Section 5.1.6, could increase the safety of the corridor. Intersection improvements including realignment of the 39<sup>th</sup> Avenue/Grand Avenue, 37<sup>th</sup> Avenue/Grand Avenue, 31st Avenue/Osborn Road and 23<sup>rd</sup> Avenue/Encanto Boulevard intersections, as detailed in Section 5.1.5, could increase safety by eliminating the skew of the intersecting roadways. Several pedestrian/bicycle crossings are identified in the next section and were evaluated as part of this Study to determine an implementation strategy.

Implementation of the improvements discussed above could have a positive impact on the future safety of Grand Avenue.

### **5.2.10 Bicycle and Pedestrian Requirements**

Non-motorized modes of transportation generally include pedestrians, bicyclists, and other forms of travel such as equestrians (not allowed for in this project), skateboarding and in-line skating. Facilities for each mode must meet basic safety criteria when sharing a corridor such as Grand Avenue with other modes of transportation such as railroad and vehicular traffic.

Further elements such as personal security, comfort, and interest should be considered in areas designated as pedestrian-friendly such as those within ¼ mile of pedestrian generators including transit stops, schools, concentrations of employment or residence, public facilities, and shopping destinations.

As discussed in Chapter 3 and shown in Exhibit 3.17, the MAG Bikeways Map (2005) shows no facilities on Grand Avenue. However, several existing facilities cross or are immediately adjacent to Grand Avenue.

The RTP identified a potential future corridor along the BNSF railroad parallel to Grand Avenue, and a potential future bike route on Grand Avenue from Wickenburg to 7<sup>th</sup> Avenue/Van Buren Street.

As discussed in Chapter 3 and shown in Exhibit 3.26, the MAG 2000 Pedestrian Plan does not identify Grand Avenue as an important pedestrian facility. However, high latent demand facilities do cross Grand Avenue and many improvements are being made in the grade separation crossings to address needs at these locations.

Also on Exhibit 3.26, existing facilities are shown on Grand Avenue itself.

Typically, in a pedestrian-friendly area, pedestrians and bicyclists have separate facilities. Where this is not possible and/or numbers of this type of user are expected to be low, they may share a single 8-foot to 12-foot wide paved multiuse path.

## **PURPOSE**

The purpose of this Study is to identify where pedestrian friendly routes are needed in the corridor and to establish facility guidelines for these and other multimodal paths that share the corridor.

## **ISSUES**

The general public, the Agency Steering Group, and other agencies list requirements in chapter 4. The specific requirements are shown on Exhibits 5.39 through 5.43.

In addition, there are two types of locations where the corridor must have pedestrian-friendly facilities – pedestrian generator locations and at intersections of Grand Avenue where pedestrians would cross. These are shown on the exhibits as well.

### **Pedestrian/Bicycle Generator Locations**

Within ¼ mile of pedestrian generators, the pedestrian facilities must be safe, fully accessible and comfortable. Bicycle facilities can extend the range to 1 mile. Bicycle and pedestrian generators and their full or ¼-mile accompaniment are identified on Exhibits 5.39 through 5.43.

Schools - High schools, middle/junior high and elementary schools within the ¼-mile walking distance are pedestrian generators as are institutions of higher learning.

Concentrations of Employment - According to Exhibit 2.12 in Chapter 2, employment densities are low (2000-4000 per mile), and will remain low in the future even though they are increasing.

Note: highest concentration densities are more in the 8000+ range, such as in downtown Phoenix. This generator is not mapped.

Transit stops - Grand Avenue is used by express buses. No stops are on the corridor.

Specialty and Convenience Retail - There are no concentrations of specialty stores that would attract pedestrians on the corridor. Although both Peoria and Glendale downtowns are within the ¼ -mile walking distance of the corridor, they do not extend to the opposite side of Grand Avenue, limiting the reason to cross. Convenience retail can be found at a number of places on the corridor itself.

Public Buildings - Glendale City Hall, on Glendale Avenue, is a pedestrian generator, and serves residences across Grand Avenue.

Recreation Areas - There are several parks near the schools in Peoria that may serve residences north and south of Grand Avenue, necessitating crossing. These are labeled as generators.

Recreation Corridors - The Grand Canal is currently listed as an unpaved multiuse trail, and crosses Grand Avenue. It is listed as a pedestrian generator. Bike lanes and bike routes on streets are also listed as generators.

### **Intersections**

All intersections, whether in the bicycle/pedestrian-friendly area or not, should provide a way for pedestrian and bicyclists to safely access and cross Grand Avenue. This includes grade separated and at-grade crossings. At a minimum, this includes:

- Two ramps at each corner, in accordance with ADA Best Management Practices, including the 4-foot x 4-foot rest pad and truncated dome warning strip
- Audible signals
- Crossing buttons not more than 18 inches from the edge of the sidewalk
- Marked crosswalks that are parallel to the direction of travel
- Median refuge area that would fit a bicycle perpendicular to the direction of the roadway travel
- Visibility to all crossing traffic

Areas that have been discussed for enhanced pedestrian/bicycle access should also include all of the following:

- Large queuing areas
- Shade
- Enhanced visibility of street signs for non-motorized users
- Ready recognition of main/minor path (this could include special paving and wayfinding signage)

Enhancements for expected high-volume crossings or areas with concentrations of special users such as schoolchildren could also include:

- Grade separations
- Countdown signals
- Flashing in-pavement lights
- Advance warning of pedestrian crossing

Intersection enhancements should be studied in more detail to determine the need for improvements at specific intersections along the corridor. This Study only provides guidance for design of future intersection enhancements.

### **Proposed Corridor Facilities**

Facilities for the non-motorized user along Grand Avenue could consist of a combination of the following to provide near-continuous access along the non-railroad side of Grand Avenue:

- Attached sidewalk
- Detached sidewalk
- Multiuse paths (crossing Grand Avenue only)
- Potential grade separations for pedestrian/bicycle use

The estimated cost for providing attached/detached sidewalks is included in the overall costs for community mitigation and auxiliary lane improvements.

The estimated cost for pedestrian/bicycle grade separations is approximately \$2,000,000 per grade separation.

### **5.2.11 Transit Requirements**

The Bus Rapid Transit (BRT) alternative for this Study addresses a new form of regional bus service on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue.

#### **Characteristics of BRT**

BRT is a form of advanced bus service which combines the advantages of rail transit with the flexibility of buses. It can operate in exclusive right-of-way, high occupancy vehicle (HOV) lanes, and mixed traffic on urban arterials. BRT uses intelligent transportation systems technology, transit signal priority, rapid and convenient fare collection, and integration with existing and future land use to optimize bus system performance. By requiring dedicated right-of-way only where congestion is encountered, BRT provides maximum flexibility in using the existing roadway network and serves a variety of travel patterns.

The characteristics of a BRT system include high frequency of service and a simple route structure. The system can utilize on-board or platform fare collection and offers station amenities similar to rail. Station design remains consistent regardless if the bus is operating in exclusive

right-of-way or mixed traffic. The vehicles used in the BRT system are steered low-floor buses with multiple entry and exit doors level with station platforms to facilitate rapid boarding. Together, these characteristics allow BRT to provide a reliable and consistent travel time through a corridor.

The characteristics of the Grand Avenue BRT alternative are as follows:

- Serves the Grand Avenue corridor as directly as possible
- Accessible via park-and-rides and local bus service
- Operates at relatively high speeds using HOV lanes, queue jumps, and traffic signal priority.
- Provides connections to future light rail and future bus service
- Uses “unique” vehicles with low floors and multiple doors for rapid boarding

Park-and-rides are a key component of the Grand Avenue BRT alternatives. Utilization of these park-and-ride facilities would be dependent on a number of factors, including the availability of BRT service and the proximity to Grand Avenue and major arterials. The MAG Park-and-Ride Study (2001) identified the following characteristics of successful park-and-ride lots:

- High level of bus service (service every 15 minutes or less during peak periods).
- Location within close proximity of a freeway or light rail line (1 mile or less).
- Access to HOV lanes for at least a portion of the bus trip to the final destination.
- Bus service available over at least a three hour period in morning and evening peak periods.
- Visible from adjacent arterials (to facilitate marketing and patron safety).
- Parking costs at the destination(s) served by the park-and-ride are substantially higher than the roundtrip bus fare.

These and other characteristics were considered in the development and evaluation of the Grand Avenue BRT alternatives.

### **Conceptual BRT Alternatives**

The design flexibility of BRT allows for the development of two conceptual alternative scenarios for Grand Avenue: Advanced BRT and Limited BRT. Advanced BRT is the most comprehensive and includes dedicated busways or HOV lanes. Limited BRT is less comprehensive and includes “spot” improvements which improve transit speed and reliability at specific points of congestion. The characteristics of the Advanced BRT and Limited BRT alternatives are described in the sections below.

#### **Advanced BRT**

The Advanced BRT alternative involves the conversion of Grand Avenue into a high capacity transit corridor. This alternative is characterized by a dedicated busway or HOV lane, in-line

stations, park-and-rides with direct access, and traffic signal priority. Advanced BRT service includes all-day, two-way operations with a higher concentration of service in the peak hour.

### *Roadway Cross-Section*

Dedicated right-of-way would be implemented for BRT on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue. There are three options for implementing dedicated right-of-way for BRT.

- *Exclusive busway in the median of Grand Avenue.* An exclusive busway would offer the best speed and reliability for BRT and would be a continuous improvement from one end of the corridor to the other that would utilize direct access ramps for buses. The busway would be barrier separated and would be the most expensive of the three options because it would require a complete reconstruction of Grand Avenue and right-of-way acquisition.
- *Exclusive HOV lane in the inside travel lane on Grand Avenue.* This option involves an arterial HOV lane that would be shared by both BRT and carpools. It would function similar to an HOV lane on a freeway that allows continuous movement to and from the HOV lane. This option would require direct access ramps to avoid the weave through general purpose traffic lanes when buses are entering or exiting Grand Avenue.
- *Semi-exclusive Business Access and Transit (BAT) lane in the outside travel lane on Grand Avenue.* This option involves the conversion of the outside travel lane into a BAT lane that allows BRT to operate in conjunction with single occupant vehicles making right turns into businesses. This option would have the lowest speed and reliability improvements but would be the lowest cost alternative since no new right-of-way or direct access ramps would be needed.

### *Stations and Park-and-Rides*

BRT stations would be located at park-and-rides, activity centers, and bus transfer points throughout the corridor. The type of station would vary based upon the operational configuration of the roadway. For example, an exclusive busway would serve park-and-rides through direct access ramps but may serve bus transfer locations with a station directly adjacent to Grand Avenue. On the other hand, a BAT lane would circulate through a park-and-ride and serve bus transfer locations on-street.

### *Queue Jumps/Transit Signal Priority*

Two forms of transit priority treatments would be included on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue: transit signal priority (TSP) and queue jumps. TSP would be used at the major at-grade arterial intersections throughout the corridor to give BRT vehicles a time advantage when approaching a signal. Bus detection technology at selected signalized intersections would be installed to inform the signal of the approaching vehicle and hold the green light to allow it to pass through the intersection. Queue jumps would allow BRT vehicles to pass known congestion points by giving the bus exclusive right-of-way at the intersection only. Queue jumps can be combined with TSP to give green light time to the bus prior to general purpose traffic. These

queue jumps would not be necessary should the Advanced BRT alternative include an exclusive busway for BRT on Grand Avenue since the bus would be operating in its own right-of-way.

### *Operating Characteristics*

The Advanced BRT alternative implements high capacity transit service in the corridor and therefore includes two-way operations with a higher concentration of service in the peak hour. This service would operate on weekdays from approximately 5 a.m. to midnight with 10 minute service in the peak and 15-30 minute service in the off-peak.

### **Limited BRT**

The Limited BRT alternative implements “spot” improvements along Grand Avenue which improve transit speed and reliability at specific points of congestion. This alternative does not include an HOV lane or dedicated busway but does increase the capacity of the existing system by adding park-and-rides, queue jumps, and traffic signal priority. Limited BRT service includes all-day, two-way operations with a high concentration of service in the peak hour in the peak direction only.

### *Roadway Cross-Section*

The Limited BRT alternative would operate in mixed traffic except at known congestion points where queue jumps would be installed to allow BRT vehicles to pass other automobiles. These queue jumps would typically be located at the remaining at-grade arterial intersections and would be the only locations where additional right-of-way would be needed. This operating configuration would have a smaller improvement for speed and reliability than a dedicated busway or HOV lane but is also less expensive to implement.

### *Stops and Park-and-Rides*

The Limited BRT alternative would function differently than the Advanced BRT alternative in that stop locations would be located more frequently and not just at station locations. In general, stops would be located at the one-mile arterial and provide transfers to local bus routes. However, these transfers often prove difficult for passengers because of the six-legged intersections along Grand Avenue.

### *Queue Jumps/Transit Signal Priority*

Similar to the Advanced BRT alternative, TSP and queue jumps would be included for the Limited BRT alternative on Grand Avenue between SR 101L and 19<sup>th</sup> Avenue. TSP would be used at the one-mile arterial intersections throughout the corridor to give BRT vehicles a time advantage when approaching a signal. Bus detection technology at selected signalized intersections would be installed to inform the signal of the approaching vehicle and hold the green light to allow it to pass through the intersection. Queue jumps would allow BRT vehicles to pass known congestion points by giving the bus exclusive right-of-way at the intersection only. Queue jumps can be combined with TSP to give green light time to the bus prior to general purpose traffic.

### *Operating Characteristics*

The Limited BRT alternative includes two-way operations with a higher concentration of service in the peak hour in the peak direction. This service would operate on weekdays from approximately 5 a.m. to midnight with 15 minute service in the peak and 30 minute service in the off-peak.

### **Recommended BRT Alternative**

The recommended BRT Alternative for Grand Avenue between SR 101L and 19<sup>th</sup> Avenue is a combination of the Advanced BRT and Limited BRT Alternatives described in the previous section. Based on the input of the Agency Steering Group, dedicated right-of-way for BRT in the Grand Avenue corridor is not feasible at this time because of cost and right-of-way constraints. However, the BRT Alternative would still include some aspects of the Advanced BRT concept, including the development of station and park-and-ride facilities and transit signal priority at key intersections. The recommended BRT Alternative is illustrated in Exhibits 5.45 through 5.50 and described in the sections below.

### **BRT Route Description**

Grand Avenue BRT service would originate at a regional park-and-ride facility in Peoria at 91<sup>st</sup> Avenue and Cactus Road, adjacent to Grand Avenue and SR 101L. From this location BRT would operate on Grand Avenue until 83<sup>rd</sup> Avenue, where the bus would enter downtown Peoria to serve the existing park-and-ride at Peoria Avenue and Jefferson Street. An alternative to this scenario would be to serve a future BRT station along the Grand Avenue frontage following the potential grade separation at 83<sup>rd</sup> Avenue and Peoria Avenue. After leaving downtown Peoria, BRT would operate non-stop on Grand Avenue until 57<sup>th</sup> Drive, where BRT would turn north to serve a transit center and park-and-ride in downtown Glendale. BRT would re-enter Grand Avenue at 57<sup>th</sup> Drive and continue until 37<sup>th</sup> Avenue, where the bus would exit the roadway to serve a park-and-ride on the north side of Grand Avenue west of 35<sup>th</sup> Avenue. In the outbound direction, the bus would serve an on-street station on the north side of Grand Avenue. BRT would then continue on Grand Avenue until 19<sup>th</sup> Avenue, where the bus would turn south to serve the State Capitol and downtown Phoenix.

### *Roadway Cross-Section*

The recommended BRT Alternative would operate in mixed traffic along Grand Avenue and would exit the roadway when necessary to serve station and park-and-ride locations. The recommended BRT does not include dedicated right-of-way for transit. The roadway cross-section would not be modified for transit.

### *Stations and Park-and-Rides*

Station and park-and-ride locations for the recommended BRT Alternative are listed in Exhibit 5.44 and described below.

## Exhibit 5.44 Grand Avenue BRT Station/Park-and-Ride Locations

Station	City	Park-and-Ride	Bus Transfers
Grand Avenue and SR 101L	Peoria	Yes	SR 101L Express
Downtown Peoria	Peoria	Yes	106, 83 (Future)
Downtown Glendale	Glendale	Yes	24, 51, 59, 70, 570, GUS
Grand Ave and 35 <sup>th</sup> Ave	Phoenix	Yes	35, 41
19 <sup>th</sup> Ave (State Capitol)	Phoenix	No	1, 19, 27, RAPID, downtown express routes, DASH

### *Grand Avenue and SR 101L Park-and-Ride*

The proposed park-and-ride would be located on one of three parcels adjacent to the intersection of 91<sup>st</sup> Avenue and Cactus Road. The existing parcels are occupied by industrial and commercial uses and would accommodate at least 500 parking spaces. There would be no median breaks on 91<sup>st</sup> Avenue so left turn movements for buses would occur at the signalized intersection at Cactus Road. All three park-and-ride site locations would facilitate transfers between Grand Avenue BRT and future SR 101L express bus service.

### *Downtown Peoria BRT Station*

There is an existing park-and-ride in downtown Peoria at the intersection of 84<sup>th</sup> Avenue and Jefferson Street that has less than 100 parking spaces in two separate lots. The proposed BRT station could be at this location or along the Grand Avenue frontage following the potential grade separation of Grand Avenue under 83<sup>rd</sup> Avenue and Peoria Avenue. The BRT station would facilitate transfers between Grand Avenue BRT and the Route 106 (Peoria) and future Route 83 (83<sup>rd</sup> Avenue).

### *Downtown Glendale Transit Center/Park-and-Ride*

The proposed transit center would be located north of Grand Avenue on 57<sup>th</sup> Drive. The transit center would be served by Routes 24 (Glendale), 51 (51<sup>st</sup> Avenue), 59 (59<sup>th</sup> Avenue), 70 (Luke Link), 570 (Glendale Express), and GUS (Glendale Urban Shuttle). Access to the transit center would be from the signalized intersection of Grand Avenue and 57<sup>th</sup> Drive, just east of the Grand Avenue grade separation under 59<sup>th</sup> Avenue and Glendale Avenue. The City of Glendale is working to identify an adjacent parcel that could accommodate a 300 space park-and-ride.

### *Grand Avenue and 35<sup>th</sup> Avenue Park-and-Ride*

The proposed park-and-ride would be located north of Grand Avenue on the west side of 35<sup>th</sup> Avenue. This parcel is currently occupied by a mix of low density industrial and commercial land uses and would accommodate 500 parking spaces. This park-and-ride would be served by Grand Avenue BRT and Routes 35 (35<sup>th</sup> Avenue) and 41 (Indian School Road). It would also solve an existing transfer problem between the Routes 35 and 41 that is created by the existing Indian School Road overpass. Currently, transit passengers are required to walk up to a half-mile to make this connection. A park-and-ride at this location would consolidate the services of all three routes at one location. Inbound Grand Avenue BRT would access the site via the signal at

37<sup>th</sup> Avenue while the outbound BRT service would stop on-street on the north side of Grand Avenue west of 35<sup>th</sup> Avenue.

#### *19<sup>th</sup> Avenue (State Capitol) Station*

This proposed BRT station would be located on 19<sup>th</sup> Avenue near the State Capitol between Washington Street and Jefferson Street and would facilitate transfers to Route 1 (Washington/Jefferson/ASU), 19 (19<sup>th</sup> Avenue), 27 (27<sup>th</sup> Avenue), RAPID, all downtown express routes, and DASH. This station location would be served by a future grade separation at 19<sup>th</sup> Avenue and McDowell Road.

#### *Transit Signal Priority*

The recommended BRT Alternative would include transit signal priority (TSP) improvements on Grand Avenue at the following intersections:

- 91<sup>st</sup> Avenue
- 75<sup>th</sup> Avenue
- Northern Avenue
- Bethany Home Road
- 35<sup>th</sup> Avenue

TSP would be used at these intersections to give BRT vehicles a time advantage when approaching a signal. Bus detection technology at these intersections would be installed to inform the signal of the approaching vehicle and hold the green light to allow it to pass through the intersection.

#### *Operating Characteristics*

The recommended BRT Alternative includes two-way operations in the Grand Avenue corridor. Service would operate on weekdays from 5 a.m. to midnight with 15 minute frequency in the peak and 30 minute frequency in the off-peak. Weekend service would operate from 6 a.m. to midnight with 30 minute frequency.

### **BRT Operating and Capital Costs**

This section calculates the total operating and capital costs to implement the recommended BRT Alternative.

#### *BRT Operating Costs*

The total annual transit operating cost for the recommended BRT Alternative is approximately \$2.7 million. This assumes service from Grand Avenue and SR 101L to the State Capitol and downtown Phoenix, which is distance of approximately 18 miles. Operating costs were calculated using a cost per mile \$4.91, which is the current contracted rate for the City of Phoenix.

### *BRT Capital Costs*

The total capital cost to implement the recommended BRT Alternative is approximately \$23.4 million. The unit costs for the BRT Alternative are based on information used by Valley Metro for capital improvement programming.

### **Summary**

The recommended BRT Alternative for this Study includes improvements from both the Advanced BRT and Limited BRT concepts. The recommended BRT Alternative is summarized below:

- Includes all-day, two-way service in the corridor with 15 minute frequency in the peak and 30 minute frequency in the off-peak.
- Includes three (3) park-and-rides, two (1) BRT stations without park-and-rides, and one (1) transit center.
- Includes transit signal priority improvements at five (5) intersections on Grand Avenue.
- The total estimated annual transit operating cost in 2005 \$ is \$2.7 million.
- The total estimated capital cost in 2005 \$ is \$23.4 million.

### **5.2.12 Goods Movement**

Rail-based goods movement along Grand Avenue has been a major source of revenue for the BNSF Railroad for many years. However, the at-grade railroad crossings contribute to significant delays on the intersecting roadways and have been the source of complaints for many years. With the implementation of Option 4 – Alternating Grade Separations from the *1999 Grand Avenue MIS (ADOT 2003)*, and grade separations identified in this Study, local travelers would be able to choose from up to six grade separations of the railroad, three in the north/south direction and three in the east/west direction. These improvements make goods movement easier and safer for BNSF by removing significant traffic volumes from the railroad crossings. Grand Avenue also remains a heavy-use freight corridor due to the numerous industrial land uses along the corridor. Implementation of additional grade separations and access management strategies along Grand Avenue should decrease travel time in the corridor and facilitate freight movement.

### **5.2.13 Community Mitigation**

#### **Purpose**

Community mitigation addresses existing and proposed features to make them more visually acceptable, more comfortable, and more pleasing primarily for a vehicular audience. The techniques that can be used to mitigate the effects of the corridor on the surrounding communities are:

- Beautify (improve on something already there, make more pleasing)
- Disguise (to make look like something else generally considered more pleasing)
- Screen (block view of unaesthetic object with something more pleasing)
- Remove and Replace (with something more pleasing)

As discussed in Chapter 4, there are existing and proposed streetscape elements in the corridor that could be mitigated with these techniques including billboards, railroad right-of-way, adjacent land uses, aboveground utilities, grade separation structures, hardscape (paving, walls, fences), lighting, signage and landscaping. As shown in Exhibit 5.51, each element of the streetscape shows options for treatment to make a more pleasing whole.

### Exhibit 5.51 Streetscape Treatment Options

EXISTING AND PROPOSED ELEMENTS	Beautify	Disguise	Screen	Remove & Replace
Billboards				
Railroad				
Image and Character of Adjacent Land Uses				
Aboveground Utilities				
Grade Separation Structures				
Hardscape (walls, paving, fences)				
Lighting				
Signage				
Site Furniture, Posts, Poles				
Landscape Areas				

When beautifying an element such as those shown above, a designer can either “make a statement” by providing a distraction OR “blend in” with the surrounding context, so as to make the element more invisible to the viewer.

Beautification can be applied, such as a new coat of paint or a fabric wrap, or it could be integrated, such as a formliner application in constructing vertical concrete. We will propose and explore both methods for existing and proposed improvements.

Both applied and integrated beautifications are made stronger when a unifying vision or theme directs them, especially in a corridor that is not directed towards human scale such as this.

### Corridor Vision

The theme or vision for the Corridor should unify it, give an identity to the *entire* Grand Avenue Corridor, from which each community that it passes through can vary to a greater or lesser extent

to establish their own identity. In discussions with Peoria, Phoenix and Glendale representatives in this Study, each community has designated their enhancement areas and/or City boundaries to begin to establish where their community identity should be read, and what it should look like. The areas are identified on Exhibit 5.52 as “Old Town/Pedestrian Friendly” theme areas. As a contrast, a unifying theme would be applied “in-between” these areas, as well as carry elements through the community theme areas.

The vision for the corridor draws from existing themes already expressed on Grand Avenue, in both the adjacent communities’ areas and the corridor itself.

### **RUTHA Vision**

The unifying vision is that of the corridor as it exists now, only made stronger and more simplified. This is the Rail/Utility/Transportation/Historically Industrial/ Agricultural (RUTHA) Corridor. Ideas that express this vision are:

- Large scale infrastructure
- Provide safety-only facilities for pedestrians
- Clean and streamlined elements
- Functional industrial buildings
- Greater than human scale
- Durable, efficient materials
- Geometric curves and angles (not rectilinear)
- Neutral color range with minor accents of “safety” colors
- Smooth, fast movement and flow
- Noise
- Simple textures, lack of ornament
- Clear, bold, communications

To achieve this vision, or “look”, the objectives for each element are to:

- Reduce visual clutter and simplify forms by removing billboards, regulating business signage and roadway edge treatments to one or two palettes.
- Minimize the presence of buildings on the roadway by constructing tall screen walls and setbacks for new buildings.
- Exaggerate the scale of human elements such as signs, walks, plants, walls, fences, lights, plants, etc.).
- Keep remaining corridor infrastructure elements such as the roadway and utilities, but possible refinish them for uniformity.
- Integrate art and graphics that emphasize speed, movement, flow.
- Require uniform business and regulatory sign holders and placement.
- Use wayfinding for auto traffic.
- Use parallel lines in design.
- Space elements formally, and as large as practical, for long distances.

- Use materials with textures that are simple and large, not fine or detailed.
- Use geometric curves and angles.
- Specify Surfaces without excessive ornament or detail.
- Require a color palette that emphasizes white to gray, with accents of safety colors like orange, yellow, and red.
- Use mass plantings of fine textured, non-showy understory plants, and very tall tree elements, linear and repetitive, which stay within the confines of the planters.
- Identify City boundaries and other jurisdictions on the Corridor.

### **Adjacent Communities Vision**

The communities' vision is that of the overpasses as they are being built and planned, only more simplified. The communities of Glendale and Peoria are seeking to bring their commercial downtown areas visibility and their pedestrians comfort as they cross the corridor. The City of Phoenix desires to bring the successful First Fridays arts presence to their portion of the corridor, south of McDowell. Streets crossing Grand Avenue, as expressed by the grade separations and at-grade intersections, will be different as a viewer passes through each community on Grand. This is the Old Town/Pedestrian Friendly (OTPF) Corridor portion of the vision. Ideas that express this vision are:

- Small scale retail and commercial uses
- Human scale, detailed, buildings
- Front doors at right of way
- Durable, indigenous, rich materials
- Grids and rectangles, or curvilinear, informal lines
- Warm and earth colors, extensive materials palette
- Strolling, walking speed
- Fine texture, ornament
- Shade, comfort, multimodal use
- Wayfinding communications, directed at the pedestrian

To achieve this vision, or “look”, the objectives for each element at the crossings are to:

- Focus visual interest to the pedestrian by removing overscale items like the billboards or undergrounding utilities.
- Celebrate building facades by locating them as closely as possible to the right-of-way, with parking or storage behind the building. Buildings should be similar in use and appearance to those in the adjacent downtown areas, including historical references.
- Have corner to front-door access to buildings on the corner. Minimize use of fences or screen walls.
- Design signs, walks, plants, walls, fences, lights, etc. for pedestrian scale, not vehicular.
- Provide shade and comfort facilities at nodes.
- Buffer the pedestrian from vehicular traffic, including trains and noise.

- Screen, beautify or disguise corridor infrastructure elements such as the train tracks, utilities and the road itself.
- Integrate art and graphics that emphasize history and City themes.
- Regulate business sign placement, materials, and size, similar to the requirements in use in the City's downtown areas.
- Use informal curving lines, geometry is not necessary. Grids to reflect downtown blocks are acceptable.
- Space lights, plants, and street furniture is acceptable informally or formally.
- Use materials with rich textures, finely grained, that match the materials being used in the adjacent downtown areas.
- Use ornament and detail on all surfaces. Use City identities and icons such as city seals, logos, colors or the name to identify the City.
- Require a color palette that is composed of colors such as brick reds, dark greens, earth tones that match colors being used in the adjacent downtown areas.
- Emphasize shade, color and accent interest in both tree and understory plant palette. Plantings should be detailed to pedestrian scale, and should relate to or match the theme materials in the adjacent downtown areas.

## **USING THE ELEMENTS TO EXPRESS THE VISION**

The boundaries or transition areas between the Old Town/Pedestrian Friendly and Railroad/Utility/Transportation/Historically Industrial/Agricultural were defined by the Cities in the Study Area. Examples of applying the vision objectives to individual elements are shown, as well as how the unifying portion of the concept might work in an actual streetscape in each community. ADOT has expressed a desire to design and construct these mitigation features provided the municipalities perform and pay for maintenance activities. Further discussion is needed to develop written maintenance agreements between the agencies prior to construction.

### **Locations**

The Cities in the Study have set the boundaries for the Old Town & Pedestrian Friendly or RUTHA visions. They can be found on Exhibit 5.52.

In addition, the City boundaries could be celebrated at 43<sup>rd</sup> and Camelback and Butler Drive.

## **ELEMENTS - RUTHA AREAS**

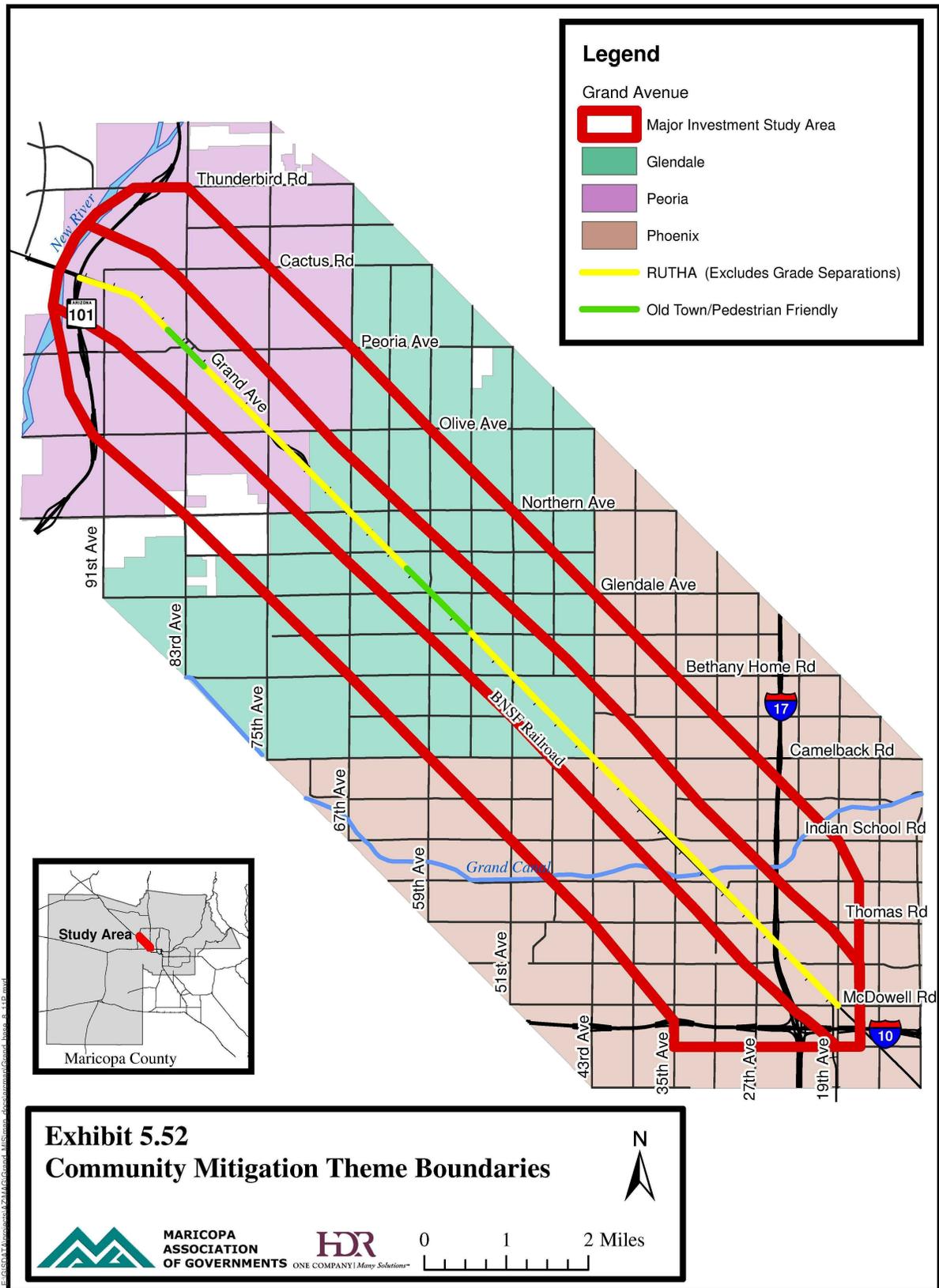
### **Billboards**

Remove when directly affected by proposed improvements along the corridor.

### **Buildings**

If visible, use industrial forms and materials such as metal, brick or block. No ornament or decoration. Limit windows or doors facing Grand Avenue.

# Exhibit 5.52 Community Mitigation Theme Boundaries



## **Railroad**

Celebrate on Grand with interpretive signs. Add vertical edge (3' or less in height) at right-of-way to screen view of their right-of-way from Grand Avenue.

### **Image and Character of Adjacent Land Uses**

Screen undesirable views, including parking lots that front onto Grand Avenue, with tall (8'-10') opaque fence or wall. Give visual clues to driveway edge, and allow limited advertising by appropriately visible signs on the wall; restrict colors and locations.

### **Aboveground Utilities**

Underground as needed for continuity. Leave larger utilities visible. There is a potential for interpretives for the utility company.

### **Grade Separation Structures**

Install with clean lines, no rustication needed in view from Grand Avenue. Use standard street identification, limited and simple plant palette.

### **Hardscape (walls, paving, fences)**

Walls and Fences - On the non-railroad side, install uniformly colored (stain or spray-on painting in color palette) and textured walls and/or fences near edge of sidewalk. Preference is for no columns except at driveway entrances. Columns will be 3'-0" or greater diameter metal posts, extending to wall height or 6"-12" taller. Maximum landscape planter area in front of wall should be 10' wide; if under 2' wide, enlarge sidewalk width and have no planter.

On the railroad side, colored (stain or spray-on painting in color palette) Jersey barriers on the railroad right-of-way line. If there is room in the right-of-way, use plant materials on the Grand Avenue side of the barrier that require minimal irrigation. Use swathes of material in 300' lengths if possible.

Paving - On the non-railroad side, install curb and gutter, attached natural color sidewalk, minimum 8' width.

No sidewalk is to be installed on the railroad side.

### **Lighting**

Use custom street lights, with poles, arms and light fixtures painted "safety colors".

## **Signage**

In conjunction with adjacent owners, develop narrowly standardized signage requirements based on acceptable materials, forms, size, placement, and colors. No commercial signs will be allowed in the right of way.

## **Site Furniture, Posts, Poles**

Site furniture should be very limited in this area. Use appropriate size and scale of posts, poles and other uprights. Posts and poles should not interfere with sight visibility.

## **Landscape Areas**

Use a palette of grasses and shrubs. Limit accents of form or color. In the median, keep the double-palms, spacing at the existing spacing (approximately 50'). On the non-railroad side and in the median, use a large (3/4") screened decomposed material. On the railroad side, use a standard screened decomposed granite material.

## **ELEMENTS – OLD TOWN/PEDESTRIAN FRIENDLY AREAS**

For Glendale, the Old Town/Pedestrian Friendly area would extend on Grand Avenue from the 55<sup>th</sup> and Maryland grade separation to Myrtle Avenue. The remainder of the corridor within Glendale would feature RUTHA elements, except the other grade separation structures themselves over Grand Avenue. Here the RUTHA elements will read through on Grand Avenue itself, while the structure celebrates the adjacent City.

In Peoria, the Old Town/Pedestrian Friendly area would extend on Grand Avenue from Monroe Avenue to 87<sup>th</sup> Avenue, including the future pedestrian crossing at 83<sup>rd</sup> and Peoria. The remainder of the corridor within Peoria would feature RUTHA elements, except the grade separation structure itself at 75<sup>th</sup> and Olive. Here the RUTHA elements will read through on Grand Avenue itself, while the structure celebrates the adjacent City.

In Phoenix, the Old Town/Pedestrian Friendly area would be south of McDowell.

## **Billboards**

Should be removed when possible in Old Town/Pedestrian Friendly areas, otherwise consider screening from sidewalk views.

## **Railroad**

Screen visual and noise with short walls or barrier and vegetation when possible.

## **Image and Character of Adjacent Land Uses**

When possible, revise land uses, lot orientation, access, facades, detailing of buildings to meet retail pedestrian friendly criteria.

## **Aboveground Utilities**

Place underground as many utilities as possible including:

- Overhead lighting power in all existing areas to be replaced by underground power for new street lighting,
- 12 kV on the west side from 87<sup>th</sup> Avenue to 86<sup>th</sup> Avenue,
- 12 kV on the west side from 83<sup>rd</sup> Avenue to 82<sup>nd</sup> Avenue,
- 12 kV on the east side from 67<sup>th</sup> Avenue to Palmaire Avenue,
- 12 kV on the east side from 41<sup>st</sup> Avenue to Indian School Road,
- 12 kV on the east side from 35<sup>th</sup> Avenue to 31<sup>st</sup> Avenue,
- 12 kV on the east side from south of Osborn Road to NW bound on-ramp,
- 12 kV on east side from north of Encanto Boulevard to south of Monte Vista Road.

## **Hardscape (walls, paving, fences)**

On both the non-railroad and railroad sides, use Old Town inspired elements such as pavers, brick or stucco walls, natural concrete, low fences, as directed by individual Cities.

## **Lighting**

Continue use of City standard fixtures, or use RUTHA fixtures with City-selected colors.

## **Signage**

City standards for signs will apply. No signs will be allowed in the right of way.

## **Site Furniture, Posts, Poles**

City standards for these items will apply.

## **Landscape Areas**

Continue the attention to detail that current structures have, expressing each City identity. Use palettes from adjacent downtown areas or established redevelopment guidelines. Involve artists as needed.

## **PROPOSED COMMUNITY MITIGATION FEATURES**

The features discussed above to be incorporated into the potential improvements identified in this Study are shown on [Exhibits 5.53 through 5.59](#) and include:

- Landscaping on non-railroad side of Grand Avenue in 4-foot and 10-foot wide buffer areas.
- Sidewalk on non-RR side along entire length of corridor.
- Median landscaping consisting of low-growing plants where median width allows.

- Screen wall or low wall at new right-of-way line on non-railroad side.
- Landscaping/Screen wall or concrete barrier on railroad side depending on available right-of-way.
- Underground utilities including 12 Kv power and power for overhead lighting.
- New street lighting on both sides along the entire corridor.
- Improved intersection aesthetics including brick pavers in sidewalks.

The total estimated cost (2005 \$) of these improvements is \$28,639,679.

Details of specific design features, such as, landscape buffer widths, sidewalk widths, wall heights, etc., will be addressed by ADOT in a future design concept report.

### **5.2.14 Drainage**

The purpose of this evaluation is to identify existing drainage features, discuss the current status of drainage plans and planned facility development by the Flood Control District of Maricopa County (FCDMC) and Cities within the corridor, and evaluate future drainage concerns at the proposed grade separations.

#### **Existing Drainage Features**

Major drainage documents reviewed for the Study area include:

- Maryvale Area Drainage Master Study (ADMS), Floodplain Mitigation Study (November 1997), Hydrology (February 1997, FCD #93-29, Wood, Patel & Associates, Inc.
- Flood Insurance Rate Maps (FIRM), Map Numbers 04013C1630H, 04013C1640F, 04013C1645G, 04013C2110F, and 04013C2130G. Federal Emergency Management Agency (FEMA), September 30, 2005.
- Final Drainage Reports for Intersection Improvements at Camelback Road/43<sup>rd</sup> Avenue, Maryland/55<sup>th</sup> Avenue, Glendale/59<sup>th</sup> Avenue, Northern/67<sup>th</sup> Avenue, and Olive/75<sup>th</sup> Avenue, Arizona Department of Transportation.
- METRO Area Drainage Master Study (ADMS), Hydrology (estimated completion, March 2006), Mitigation Options (estimated completion, August 2007), FCD, EEC, Inc.

Four of the five grade separations identified in this Study are located within the Maryvale Area Drainage Master Study (ADMS), and the remaining southernmost intersection of 19<sup>th</sup> Avenue/McDowell Road is located within the Cave Creek Wash Floodplain. This intersection is included in the METRO ADMS, which is currently being conducted by the FCDMC. These documents along with phone interviews of other designers, City staff, and FCDMC staff were used to develop an understanding of the drainage situation along the corridor.

The overall flow pattern along the corridor is mainly from north to south and from east to west via a surface flow street system, an underground storm drain system, and regional (FCDMC & ADOT) channels. The storm drain systems, mostly designed for the 2-year storm event and

occasionally for the 10-year storm event, are typically located in the one-mile arterial streets and the half-mile collector streets.

Areas along the Grand Avenue corridor are subject to periodic flooding, typically due to ponding upstream of the elevated railroad embankment. The ponding areas, which have depths ranging from one to four feet, are depicted in both the Maryvale ADMS and the FEMA-defined approximate floodplains. These two do not completely match, because the FEMA work was based on ponding as well as riverine-type flooding, and therefore, the FEMA floodplain is generally continuous along the corridor. The Maryvale ADMS identified ponding areas north and south of Peoria Avenue, north and south of Olive Avenue, south of Northern Avenue, north of Bethany Home Road, north of the Grand Canal, and at Thomas Road. The FEMA FIRM also identifies the Cave Creek floodplain as being 2700 feet wide at the McDowell Road/Grand Avenue intersection.

### **Past, Current and Planned Facility Development**

Several drainage structures including detention/retention/surge basins have been constructed or are planned throughout the Grand Avenue corridor and within the drainage basin to help alleviate flooding, see Exhibit 5.60. Entities that have been involved in the planning and construction of these drainage facilities include the FCDMC, ADOT, and the cities of Peoria, Phoenix, and Glendale.

These drainage facilities are being planned, designed and installed based on the mitigation measures recommended by the Maryvale ADMS. Additional mitigation measures for the area east of I-17 will be recommended by the METRO ADMS, which is scheduled for completion in August 2007. Major facilities that are in the process of being completed are the Bethany Home Outfall Channel, the Bethany Home Storm Drain, and the 27<sup>th</sup> Avenue/Thomas Road detention basin. Facilities that have been completed are the Northern-Orangewood detention basin and the ADOT constructed retention/detention basins located at the Grand Avenue intersections of 75<sup>th</sup> Avenue/Olive Avenue, 67<sup>th</sup> Avenue/Northern Avenue, 43<sup>rd</sup> Avenue/Camelback Road, 35<sup>th</sup> Avenue/Indian School Road, and at the I-17/Thomas Road TI. ADOT is currently constructing an intersection improvement at the 59<sup>th</sup>/Glendale/Grand Avenue intersection, which has a major drainage component. It will consist of an elaborate offsite storm drain system to capture the offsite runoff before it enters the depressed Grand Avenue and a pump station to convey the runoff northwest to discharge into the existing Northern-Orangewood detention basin. It will function as a 10-year facility, but become a 50-year facility when additional upstream drainage facilities are installed.

### **Future Drainage Concerns at Proposed Grade Separations**

The FEMA Flood Insurance Rate Maps and the Maryvale ADMS were reviewed to determine the offsite drainage features at the 5 grade separations identified in this Study. The results of this review are tabulated in Exhibit 5.61.

### Exhibit 5.60 Flood Mitigation Measures, Current and Future

Location		Facility Type	Agency	Status	Type of Protection	Design Year
75th Avenue / Olive Avenue	Grand Avenue intersection	Detention Basin	ADOT	Constructed	Offsite Runoff	100-Year
67th Avenue / Northern Avenue	Grand Avenue intersection	2 Retention Basins	ADOT	Constructed	Onsite Runoff	100-Year, 2-Hour Volume
Northern-Orangewood Detention Basin	65th to 65 <sup>th</sup> Avenue, South side of Northern Avenue	Detention Basin	FCDMC	Constructed	Offsite Runoff	100-Year
59th Avenue / Glendale Avenue	Grand Avenue intersection	Offsite Storm Drain System & Pump Station	ADOT	Under Construction, 2004-2005	Offsite Runoff	Current 10-Year and Future 50-Year Runoff
43rd Avenue / Camelback Road	Grand Avenue intersection	Retention Basins	ADOT	Constructed	On-Site Runoff	100-Year, 2-Hour Volume
35th Avenue / Indian School Road	Grand Avenue intersection	Detention Basin	ADOT	Constructed	Offsite Runoff	unknown
I-17 / Thomas Road TI	I-17 TI	Detention Basin	ADOT	Constructed	Offsite Runoff	Inadequate for 100-Year Event
Thomas Road North & South	26th Avenue / Verde Lane & 27th Avenue / Grand Avenue	Detention Basin	COP	Bid Advertisement-Fall 2005	Offsite Runoff	100-Year
Bethany Home Road Storm Drain	83rd to 75 <sup>th</sup> Avenue	Storm Drain	FCDMC	Bid Advertisement-September 2005	Offsite Runoff	10-Year
Bethany Home Road Storm Drain	75th to 51 <sup>st</sup> Avenue (Grand Avenue intersection)	Storm Drain	Glendale	10-Year CIP	Offsite Runoff	10-Year
Bethany Home Outfall Channel	New River to 83rd Avenue	Channel	FCDMC & ADOT	Constructed	Offsite Runoff	100-Year
Bethany Home Outfall Channel	83rd to 75 <sup>th</sup> Avenue	Channel	FCDMC	Construction in the near future	Offsite Runoff	100-Year
METRO ADMS	I-17 TO 64th St & Salt River to Arizona Canal	to be determined	FCDMC & COP	Complete August 2007	Offsite Runoff	100-Year

## Exhibit 5.61 Offsite Drainage Features at Proposed Grade Separations

Grand Avenue Intersection	FEMA Floodplain	Maryvale ADMS	
		Ponding Area	Major Offsite Flows
83rd Avenue / Peoria Avenue	No	Yes	Yes
67th Avenue / Northern Avenue	Yes	Yes	Yes
51st Avenue / Bethany Home Road	Yes	Yes	Yes
35th Avenue / Indian School Road	No	No	Yes
19th Avenue / McDowell Road	Yes	NA	Yes

All five intersections have major drainage concerns; three have FEMA regulated floodplains and the Maryvale ADMS shows three have ponding and all five have major offsite flows. Improvements that impact FEMA regulated floodplains would require evaluation with a hydraulic model and the potential preparation of a CLOMR (Conditional Letter of Map Revision) for coordination with FEMA. Improvements that include the construction of depressed roadways would require the installation of an elaborate storm collection system for offsite flows, a pump station, and an outfall facility, such as a retention basin and/or an outfall storm drain. Existing storm drain systems would need to be incorporated into the intersection improvement. All intersections would require retention/detention basins sized for onsite runoff. A detailed evaluation of the offsite drainage at each site should be prepared in the future to identify potential cost-sharing opportunities with FCDMC or local municipalities.

### 5.3 Traffic Analysis

MAG has provided a series of model runs to be used as the basis for the traffic analysis. The data used in this report are for the year 2002, which is used to represent the “existing year”, and the year 2030 forecast. The year 2002 volume data was distributed to the existing roadway network. Year 2030 forecasts were developed for two networks, a 2030 Base Network, which includes all projects in the adopted 2003 Regional Transportation Plan except the Northern Avenue “superstreet” and Grand Avenue improvements beyond those currently programmed; and a 2030 Plan Network, which includes the Northern Avenue and Grand Avenue improvements. A comparison of 2002, 2030 Base, and 2030 Plan volumes on Grand Avenue is shown in Exhibit 5.62. The Base network layout is shown in Exhibit 5.63. The Plan Network layout, shown in Exhibit 5.64, includes additional grade separations at Grand Avenue intersection with Northern Avenue, Bethany Home Road, Indian School Road, and 19<sup>th</sup> Avenue. For modeling purposes, the following grade separation assumptions were made in the Plan network: Northern Avenue west connected to Grand Avenue south; Bethany Home Road separated through the intersection; Grand Avenue separated at the Indian School Road intersection; and 19<sup>th</sup> separated through the intersection.

### 5.3.1 Existing and Future Travel Demand and Operations

In this section we will review the existing and future travel demand along Grand Avenue and the major intersecting cross streets. Exhibits 5.65 and 5.66 show the forecast traffic volumes for Grand Avenue and the cross streets for the Base and Plan networks, respectively. In addition, Exhibits 5.65 and 5.66 show intersection level of service along Grand Avenue.

#### Exhibit 5.62 Grand Avenue - Traffic Volumes (Two-Way ADT)

Section	2002 ADT	2030 Base ADT	2030 Plan ADT
SR 101L – 91 <sup>st</sup> Ave	24,600	43,100	43,500
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	23,000	35,700	35,500
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	21,000	45,300	45,700
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	23,000	44,400	41,100
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	24,000	48,300	60,100
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	26,000	48,500	58,700
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	22,300	46,400	55,800
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	29,000	57,500	66,500
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	32,900	51,400	61,400
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	21,700	31,700	38,900

Under the Base 2030 conditions, vehicle-miles of travel on Grand Avenue is forecast to increase 83% from 2002 travel, with volumes increasing from the 20,000 to 30,000 vehicles per day (vpd) range in 2002 to the 45,000 to 50,000 vpd range in 2030. The upgrading of Northern Avenue provided for in the Regional Transportation Plan will result in an additional 12% increase in Grand Avenue travel with volumes in the 55,000 to 65,000 range south of Northern Avenue. North of Northern Avenue, volumes on Grand Avenue are the same in the Base and Plan scenarios.

Exhibits 5.67 and 5.68 show the afternoon and evening peak period arterial street intersections levels of service (as determined by the MAG model which uses a planning level analysis technique) along Grand Avenue. The intersecting streets where the through movement is not provided for via a grade separation is included in the tables.

Exhibit 5.63 2030 Base Network

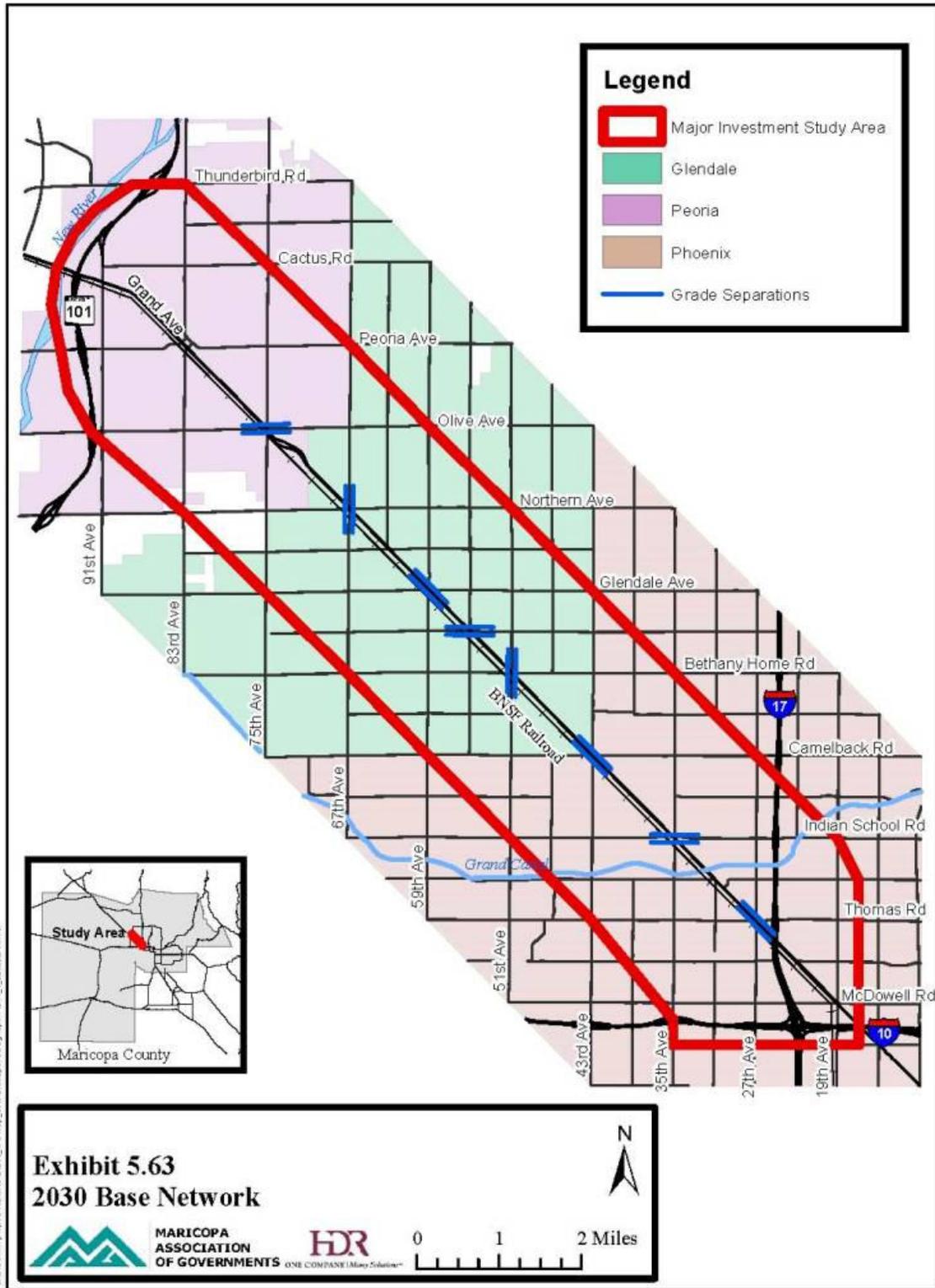


Exhibit 5.64 2030 Plan Network

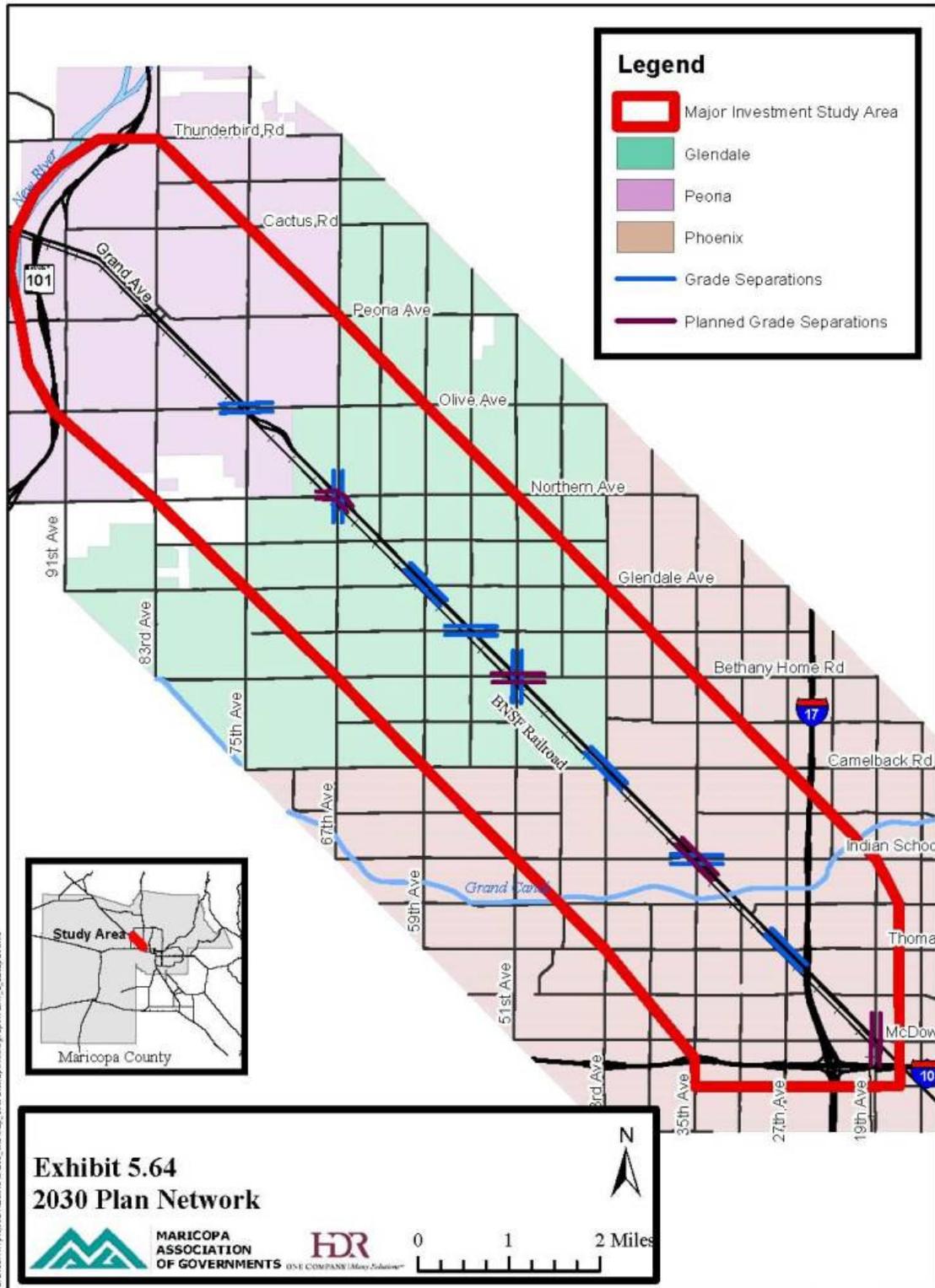


Exhibit 5.65 2030 Base Network Traffic Volumes and Level of Service

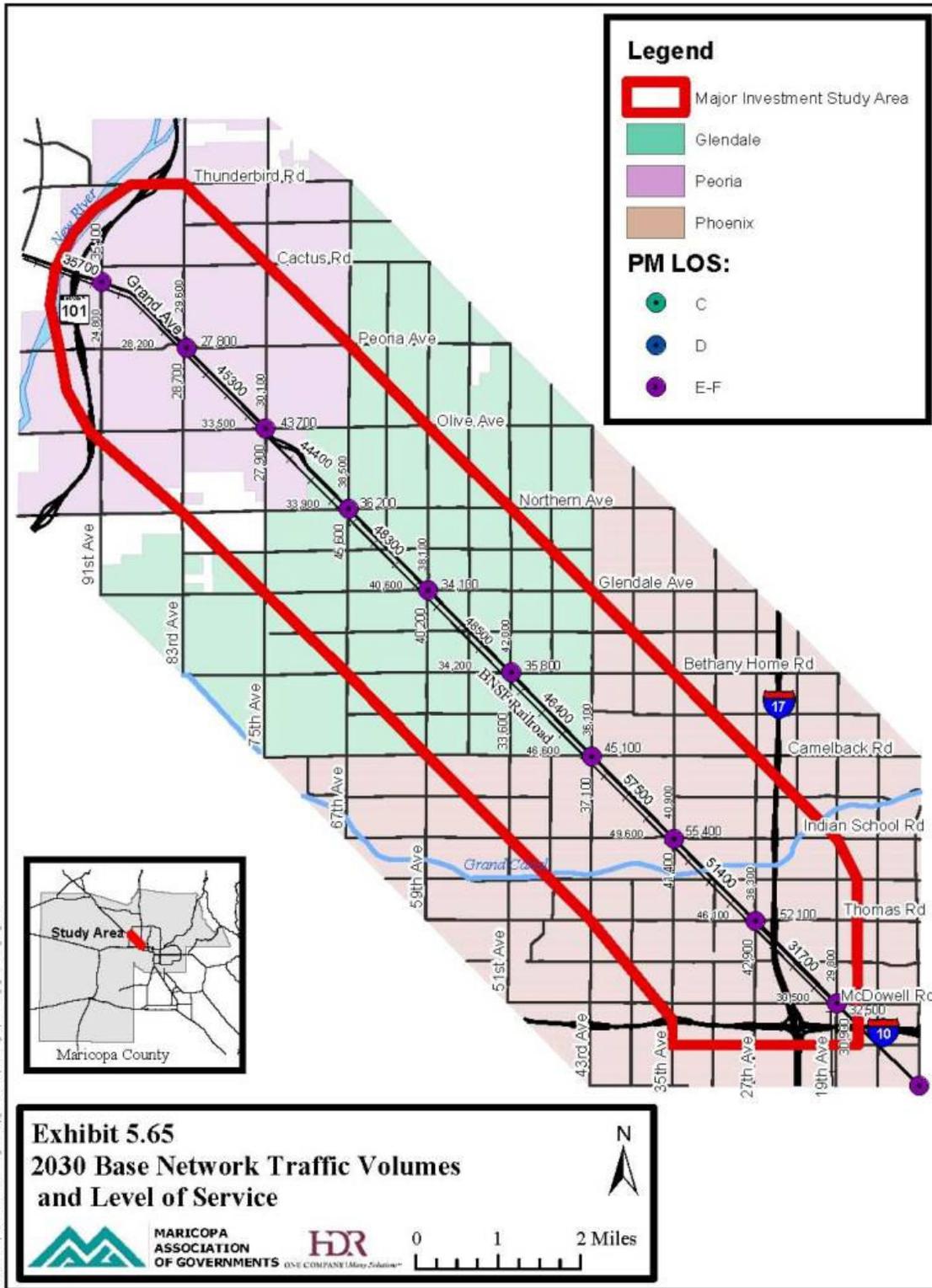
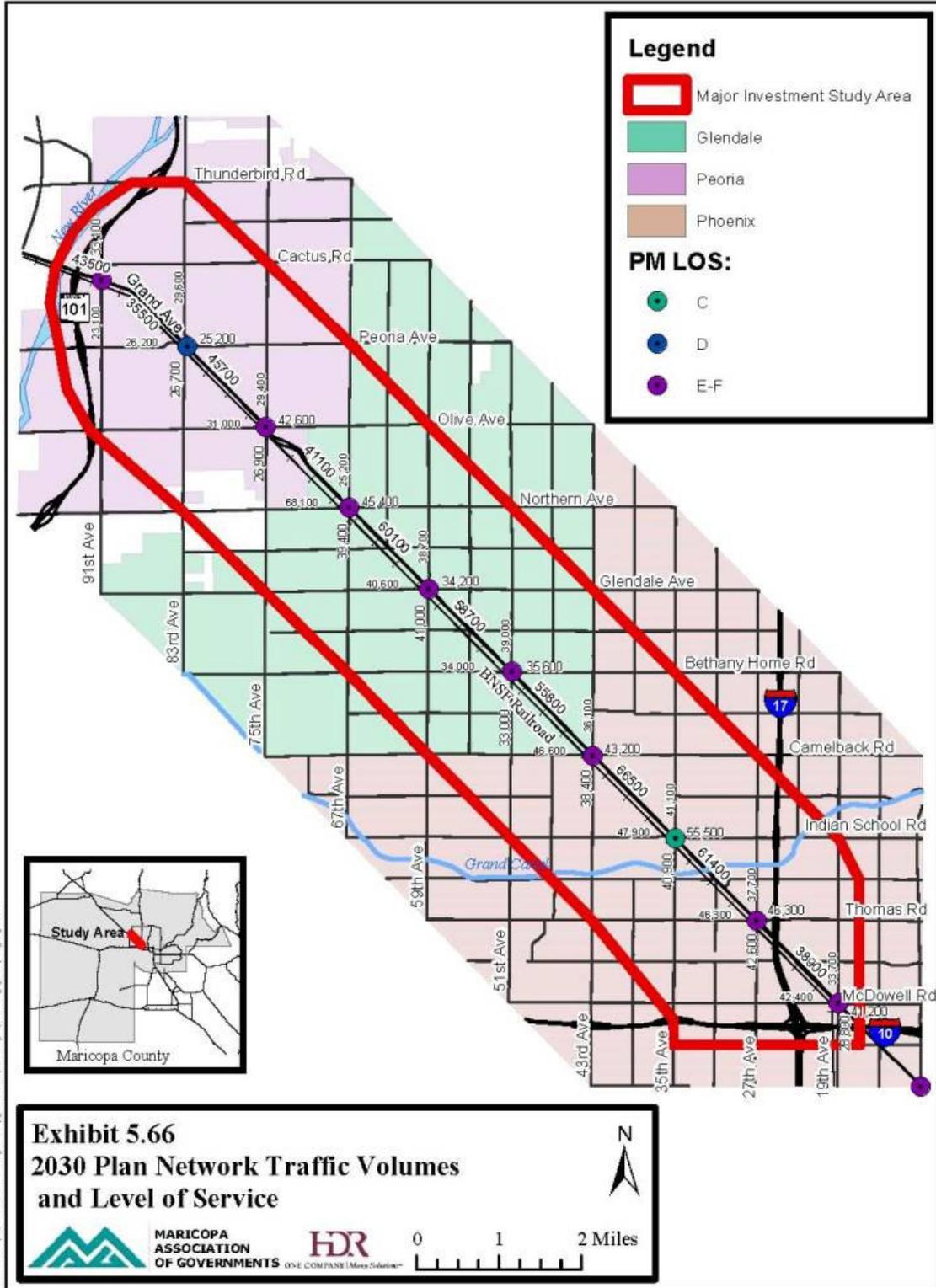


Exhibit 5.66 2030 Plan Network Traffic Volumes and Level of Service



### Exhibit 5.67 Morning Peak Period Level of Service

2002		2030 Base		2030 Plan	
Streets*	AM LOS	Streets*	AM LOS	Streets*	AM LOS
Grand/7th/Van Buren	D	Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F
Grand/19th/McDowell	C	Grand/19th/McDowell	E - F	Grand/McDowell	D
27th/Thomas	C	27th/Thomas	E - F	Grand.27th/Thomas	E - F
Grand/35th	D	Grand/35th	E - F	-	B
Grand/43rd/Camelback	D	43rd/Camelback	E - F	43rd/Camelback	E - F
Grand/51st/Bethany Home	E - F	Grand/Bethany Home	E - F	-	D
Grand/59th/Glendale	D	59th/Glendale	E - F	59th/Glendale	E - F
Grand/67th/Northern	-	Grand/Northern	E - F	Grand/Northern	E - F
Grand/75th/Olive	D	Grand/75th	E - F	Grand/75th	E - F
Grand/83rd/Peoria	C	Grand/83rd/Peoria	C	Grand/83rd/Peoria	C
Grand/91st	B	Grand/91st	D	Grand/91st	D

\*Streets listed are those that do not provide for grade-separated through movements

### Exhibit 5.68 Afternoon Peak Period Level of Service

2002		2030 Base		2030 Plan	
Streets	PM LOS	Streets	PM LOS	Streets	PM LOS
Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F
Grand/19th/McDowell	E - F	Grand/19th/McDowell	E - F	Grand/McDowell	E - F
27th/Thomas	C	27th/Thomas	E - F	Grand.27th/Thomas	E - F
Grand/35th	E - F	Grand/35th	E - F	-	C
Grand/43rd/Camelback	E - F	43rd/Camelback	E - F	43rd/Camelback	E - F
Grand/51st/Bethany Home	E - F	Grand/Bethany Home	E - F	-	E - F
Grand/59th/Glendale	E - F	59th/Glendale	E - F	59th/Glendale	E - F
Grand/67th/Northern	C	Grand/Northern	E - F	Grand/Northern	E - F
Grand/75th/Olive	E - F	Grand/75th	E - F	Grand/75th	E - F
Grand/83rd/Peoria	D	Grand/83rd/Peoria	E - F	Grand/83rd/Peoria	D
Grand/91st	C	Grand/91st	E - F	Grand/91st	E - F

\*Streets listed are those that do not provide for grade-separated through movements

## 6.0 RECOMMENDED IMPROVEMENTS

### 6.1 Introduction

The recommendations covered in this study are directed at the \$151.7 million in estimated funding as described below. A number of other potential projects identified in the study process may be funded from other MAG RTP funding sources including the Streets, Transit, Pedestrian, Bicycle, and ITS programs. It is anticipated that specific funding for these projects will be addressed by those modal programs. Additional projects beyond the 20-year planning period and projects potentially funded by other modal sources are shown in Appendix G.

In 2003, the MAG RTP Highway Program identified \$147 million of funding for Grand Avenue between SR 101L and McDowell Road. For purposes of this Study, the funding was adjusted to \$151.7 million, which includes 2005 cost estimates for the three grade separations identified for this segment in the RTP and inflation of the remaining funding from 2002 to 2005 dollars.

The revised funding allocation by phase is shown below:

- Phase 1 (2006 to 2010) - \$31.1 Million
- Phase 2 (2011 to 2015) - \$21.0 Million
- Phase 3 (2016 to 2020) - \$0.0
- Phase 4 (2021 to 2025) - \$99.6 Million

There were three specific projects identified in the MAG RTP to be constructed in Phase 4 of the RTP. The three projects were:

- A grade separation at the 51<sup>st</sup> Avenue/Bethany Home Road intersection
- A grade separation at the 35<sup>th</sup> Avenue/Indian School Road intersection
- A grade separation at the 19<sup>th</sup> Avenue/McDowell Road intersection

Updated estimates for the three grade separations total \$89.2 million (2005 dollars) of the \$99.6 million available in the revised Phase 4 funding estimate. The remaining funding; \$31.1 million in Phase 1, \$21.0 million in Phase II and \$10.4 million in Phase 4, was identified for additional improvements along Grand Avenue. In addition to this funding, the City of Glendale has approximately \$10 million available to contribute to Phase 1 access management and community mitigation projects within the Glendale City boundaries.

An alternative approach to identifying a funding target was raised during the study process. This methodology would inflate the original \$147 million by an annual rate (3% was suggested) to yield a total of \$160.6 million in 2005 \$'s, as opposed to the \$151.7 million arrived at above. The \$151.7 million was used in the study process, because it is more conservative and because the overall approach to cost increases and inflation has not yet been finalized for the ADOT Freeway/Highway Life Cycle Program.

### 6.2 Description of Recommendations

The following recommendations were derived from information developed during the study process, including input from members of the ASG. A major objective in developing the detailed

recommendations was to improve traffic flow along and across Grand Avenue. The recommended plan addresses four of the most important issues and needs as identified by the ASG, including:

- Grade Separations
- Intersection Improvements
- Access Management
- Community Mitigation

The detailed recommendations for the entire corridor are shown on Exhibits 6.5 through 6.23 at the end of this section.

### **6.2.1 Grade Separations**

There were five grade separation projects identified in the Study process. Two of the five were deemed beyond the scope of this Study.

- Northern Parkway Directional Ramps at Grand Avenue and 67<sup>th</sup> Avenue - project is currently identified in the arterial street portion of the MAG RTP and, therefore, not recommended for Highway Program funding.
- Grand Avenue Under Peoria Avenue and 83<sup>rd</sup> Avenue – completion of the project determined to be beyond the 20-year planning period. Improvements to 83<sup>rd</sup> Avenue/Grand Avenue and Peoria Avenue/Grand Avenue intersections are recommended for funding as an Intersection Improvement. Additional discussions with Peoria staff should occur as part of a future ADOT design concept report to develop detailed improvement plans, which might include phasing for a potential future grade separation.

The remaining three grade separations - Bethany Home Road Under Grand Avenue and 51<sup>st</sup> Avenue, Grand Avenue Under Indian School Road and 35<sup>th</sup> Avenue, and 19<sup>th</sup> Avenue Over Grand Avenue and McDowell Road - are recommended for full funding in Phase 4 of the MAG RTP Highway Program. Each is discussed below.

#### **Grand Avenue/Bethany Home Road/51<sup>st</sup> Avenue**

Bethany Home Road Under Grand Avenue and 51<sup>st</sup> Avenue is the preferred configuration for this intersection as identified in the *Grand Avenue Limited Expressway Design Concept Study in the Glendale Area, 2003 (Grand Avenue DCR)*. This grade separation is recommended for full funding in Phase 4 of MAG RTP Highway Program.

Major features and assumptions of the Bethany Home Road underpass of Grand Avenue and 51<sup>st</sup> Avenue are shown below.

- Improvements will require two new connector roads to reconnect Bethany Home Road with Grand Avenue and 51<sup>st</sup> Avenue.
- Adds two new signals and removes one existing signal on Bethany Home Road.
- Adds one new signal and removes one existing signal on Grand Avenue.
- Requires substantial new right-of-way for new connector roads and detention basins.

- Bethany Home Road would be lowered in it's existing alignment requiring extended closures of Bethany Home Road.
- Some businesses along Bethany Home Road would lose access and may require total right-of-way takes.
- Improvements would require a pump station and detention basin.
- Local roadways needing improvements due to the grade separation should be funded by local funds.
- All landscaping or community mitigation items should be maintained by local forces.

### **Grand Avenue/Indian School Road/35<sup>th</sup> Avenue**

Grand Avenue Under 35<sup>th</sup> Avenue and Indian School Road is the preferred configuration for this intersection. Even though Indian School is currently grade-separated, the existing intersection still operates as a six-legged intersection because of allowed left-turn movements. The Grand Avenue Underpass eliminates the six-legged intersection and the Grand Avenue signal, provides a greater LOS, and provides continuity with the Grand Avenue Overpass at 27<sup>th</sup> Avenue / Thomas Road to the south and the Grand Avenue Overpass at 43<sup>rd</sup> Avenue / Camelback Road to the north.

Major features and assumptions of the Grand Avenue underpass of 35<sup>th</sup> Avenue and Indian School Road are shown below.

- Grand Avenue would be lowered essentially in it's existing alignment requiring extended closure of Grand Avenue.
- Southeast bound Grand Avenue would be relocated to the west to avoid an existing pier for the Indian School Overpass structure.
- 35<sup>th</sup> Avenue would remain as an at-grade, four-legged intersection on a structure over Grand Avenue.
- Access to 35<sup>th</sup> Avenue from Grand Avenue would be via Osborn Road.
- Access to Indian School Road from Grand Avenue would be via 33<sup>rd</sup> Avenue.
- Some businesses along Grand Avenue would lose access and may require total right-of-way takes.
- Local roadways needing improvements due to the grade separation should be funded by local funds.
- All landscaping or community mitigation items should be maintained by local forces.

### **Grand Avenue/McDowell Road/19<sup>th</sup> Avenue**

Nineteenth Avenue over Grand Avenue and McDowell Road is the preferred configuration for this intersection. The 19<sup>th</sup> Avenue Overpass provides greater service benefits to the 19<sup>th</sup> Avenue Flyover Ramps including eliminating the 6-legged intersection and providing a greater LOS for existing traffic; however it has a much greater impact to businesses and the historic neighborhood north of McDowell.

Major features and assumptions of the 19<sup>th</sup> Avenue Overpass of Grand Avenue and McDowell Road are shown below.

- 19<sup>th</sup> Avenue would be relocated to the west of its existing alignment.
- A connector would provide missing movements to and from Grand Avenue and McDowell Road.
- Significant right-of-way acquisition would be required west of 19<sup>th</sup> Avenue.
- Local roadways needing improvements due to the grade separation should be funded by local funds.
- All landscaping or community mitigation items should be maintained by local forces.

## **6.2.2 Intersection Improvements**

Within the Study Area, Grand Avenue is host to over 60 three-, four-, five- and six-legged intersections that are either stop controlled or signal controlled. Of the 60-plus intersections, approximately 65 percent are skewed. The remaining intersections have been reconstructed into perpendicular intersections (such as those in downtown Peoria) or as grade-separations.

The Study team identified five potential candidates for intersection improvements. Of the five intersections, the 31<sup>st</sup> Avenue/Osborn Road intersection and the 19<sup>th</sup> Avenue dual left-turn lanes are recommended for funding with MAG RTP Highway funds. The remaining three intersection improvements could be pursued in the future if additional funding sources are identified.

Two additional intersections were identified following completion of the alternatives analysis phase of the study and are recommended for improvement. The first is the Grand Avenue intersection with Peoria Avenue and 83<sup>rd</sup> Avenue in downtown Peoria. The close proximity of the two traffic signals contributes to congestion in the downtown area. The second is the intersection of Grand Avenue with Myrtle Avenue in downtown Glendale. Additional traffic volume from Northern Parkway coupled with opening of the Grand Avenue underpass will create the need for additional capacity at Myrtle Avenue. The proposed solution is to provide SE bound dual left-turn lanes from Grand Avenue to Myrtle Avenue and to widen Myrtle Avenue from 59<sup>th</sup> Avenue to 62<sup>nd</sup> Avenue. The dual left-turn lane improvements on Grand Avenue will be recommended for RTP Highway Program funds, while improvements to Myrtle Avenue itself, will require other funding sources. The latter improvements are shown in Appendix G, which covers projects beyond the 20-year planning period and projects potentially funded by other sources.

### **Grand Avenue/Peoria Avenue/83<sup>rd</sup> Avenue**

The existing intersection configuration currently has two signals spaced approximately 600 feet apart along Grand Avenue. The northernmost intersection is a four-legged perpendicular intersection of Grand Avenue and Peoria Avenue. The southernmost intersection is a four-legged perpendicular intersection including Grand Avenue and 83<sup>rd</sup> Avenue. Potential improvements to the intersections could include parcel purchase and access reconfiguration, installation of community mitigation features, installation of pedestrian facilities, right-of-way acquisition and intersection reconfiguration. Additional discussions with City of Peoria staff should be planned as part of a future ADOT design concept report to develop detailed improvement plans, which might include phasing for a potential grade separation.

## **Grand Avenue SE bound Dual Left-Turn Lanes at Myrtle Avenue**

Myrtle Avenue has been designated as a gateway street to downtown by the City of Glendale. Due to expected increases in traffic on gateway streets, the City of Glendale has developed conceptual plans to improve the connection to Grand Avenue. To implement the improvements, Grand Avenue would be widened north and south of Myrtle Avenue to add the SE bound dual left-turn lane. The City proposes to exchange right-turn lanes at Myrtle Avenue originally identified in this study for the additional left-turn lane. These changes have been reflected in the study recommendations. The conceptual plan includes the need for additional R/W along the north and east side of Grand Avenue. The analysis prepared for the City of Glendale by URS is included as Appendix I of this report.

## **31<sup>st</sup> Avenue/Osborn Road**

The existing intersection configuration currently has two signals spaced approximately 900 feet apart along Grand Avenue. The northernmost intersection is a five-legged skewed intersection of Grand Avenue, 31<sup>st</sup> Avenue and Osborn Road to the west. The southernmost intersection is a three-legged perpendicular intersection including Grand Avenue and Osborn Road to the east. The recommended realignment would eliminate one of the signals and create a perpendicular four-legged intersection.

Major features and assumptions of the 31<sup>st</sup> Avenue/Osborn Road intersection improvements are shown below.

- Existing Osborn Road north and east of Grand Avenue would end in a cul-de-sac.
- Existing Osborn Road south and west of Grand Avenue would tie into relocated 31<sup>st</sup> Avenue west of the new Grand Avenue intersection.
- 31<sup>st</sup> Avenue would become a right-in, right-out intersection.
- One billboard would require purchase or relocation.
- Significant right-of-way takes east and west of Grand Avenue would be required.
- Possible redevelopment of the parcel southeast of relocated Osborn Road would occur.
- Access management and community mitigation features including landscaping, screen walls, right-turn lane, new street lighting and parcel reconfiguration.
- All landscaping or community mitigation items should be maintained by local forces.

## **19<sup>th</sup> Avenue Dual Left-Turn Lanes**

The existing Grand Avenue/19<sup>th</sup> Avenue/McDowell Road intersection experiences high left-turn movements in the peak periods. Comments from the ASG identified a project to construct dual left-turn lanes on 19<sup>th</sup> Avenue to alleviate some of the delays for travelers trying to access Grand Avenue from northbound 19<sup>th</sup> Avenue. Therefore, funding a portion of this project with MAG RTP Highway funds is recommended. Since this would be an interim project until the 19<sup>th</sup> Avenue overpass was constructed, it is recommended as a Phase 1 project. The analysis prepared for the City of Phoenix by Aztec is included as Appendix J of this report.

Major features and assumptions of the 19<sup>th</sup> Avenue Dual Left-Turn Lane improvements are shown below.

- Significant right-of-way would be required along the west side of 19<sup>th</sup> Avenue coinciding with proposed takes for the 19<sup>th</sup> Avenue Overpass project.
- One billboard may require purchase or relocation.
- Project need is dependent upon timing of funding in relation to the 19<sup>th</sup> Avenue overpass funding.
- Overall intersection delay is significant; however the improvements provide for greater left-turn movements especially to northwest bound Grand Avenue.
- All landscaping or community mitigation items should be maintained by local forces.

### **6.2.3 Access Management and Community Mitigation**

One of the main goals of the ASG was to build upon the improvements identified in the original *Grand Avenue MIS* and move Grand Avenue toward the status of an Enhanced Arterial/Limited Expressway. The steering group identified access management as the prime method to achieve this goal. Access management strategies recommended for consideration in this Study include:

- Closing select median crossovers to reduce turning movements across Grand Avenue.
- Reconfiguring minor collector intersections to right-in/right-out.
- Removing unused driveways and curb cuts.
- Constructing right turn only and auxiliary lanes to remove the turning traffic from the through lanes of Grand Avenue.
- Potentially constructing frontage roads.
- Purchasing groups of parcels impacted by the addition of auxiliary lanes and reconfiguring access to streets other than Grand Avenue.

As noted previously, the ASG identified the need to mitigate the impacts of the corridor on the surrounding community. Community mitigation features that are directly associated with the auxiliary and right-turn lanes include landscaping, pedestrian access, street lighting, utility undergrounding and screen walls. The recommended access management and community mitigation improvements recommended for funding in this 20-year funding cycle are shown in Exhibit 6.1.

## Exhibit 6.1: Access Management and Community Mitigation Improvements

Segment	Access Management Improvements (RTP Phase)	Community Mitigation Improvements (RTP Phase)	Notes
SR 101L to 91 <sup>st</sup> Ave	<ul style="list-style-type: none"> <li>• No recommended improvements</li> </ul>	<ul style="list-style-type: none"> <li>• No recommended improvements</li> </ul>	Improvements identified as part of ADOT project, Grand Ave. – 83 <sup>rd</sup> Ave. to 99 <sup>th</sup> Ave.
91 <sup>st</sup> Ave to 83 <sup>rd</sup> Ave	<ul style="list-style-type: none"> <li>• Auxiliary Lane and related items – 91<sup>st</sup> Ave. to 89<sup>th</sup> Ave., 88<sup>th</sup> Dr. to 83<sup>rd</sup> Ave. (2)</li> <li>• 4 driveway closures (2)</li> </ul>	<ul style="list-style-type: none"> <li>• Non-RR side Landscaping (1)</li> <li>• Non-RR side Sidewalk (1)</li> <li>• Non-RR side Screen wall (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – 87<sup>th</sup> Ave. to 86<sup>th</sup> Ave. (2)</li> </ul>	No driveways from 89 <sup>th</sup> Ave. to 88 <sup>th</sup> Dr.. Working with Peoria, the ADOT DCR process may address a range of access and community mitigation options, including frontage roads and/or pedestrian access.
83 <sup>rd</sup> Ave to 75 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• No recommended improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Non-RR side Landscaping (1)</li> <li>• Non-RR side Sidewalk (1)</li> <li>• Non-RR side Screen wall (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – 83<sup>rd</sup> Ave. to 82<sup>nd</sup> Ave. (1)</li> </ul>	Existing landscaping on non-RR side from Mountain View Rd. to 79 <sup>th</sup> Ave., some existing median landscaping
75 <sup>th</sup> Ave to 67 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• Parcel purchase and access reconfiguration – north of Northern fronting Grand Avenue (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Street Lighting (both sides) (1)</li> </ul>	Improvements from 71 <sup>st</sup> Ave. to Royal Palm Dr. not recommended for funding in the 20-year planning period.
67 <sup>th</sup> Ave to 59 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• Parcel purchase and access reconfiguration - 67<sup>th</sup> Ave. to 65<sup>th</sup> Ave., 65<sup>th</sup> Ave. to 63<sup>rd</sup> Ave., NE corner of 61<sup>st</sup> /Myrtle (1)</li> <li>• Reconfigure Access – NE and SE corner, Orangewood Ave. &amp; 63<sup>rd</sup> Ave. (1)</li> <li>• Rt-in/Rt-out – Orangewood Ave., 63<sup>rd</sup> Ave. (1)</li> <li>• 7 driveway closures (1)</li> <li>• 2 median closures – Orangewood Ave./63<sup>rd</sup> Ave. &amp; 62<sup>nd</sup> Ave. (1)</li> <li>• 1 Rt. Turn Lane – Mobile Manor (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Non-RR side Landscaping (1)</li> <li>• Non-RR side Sidewalk (1)</li> <li>• Non-RR side Screen wall (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – 67<sup>th</sup> Ave. to Palmaire Ave. (1)</li> </ul>	Full-length improvements end at 60 <sup>th</sup> Ave. due to existing Grand Ave. underpass improvements.
59 <sup>th</sup> Ave to 51 <sup>st</sup> Ave	<ul style="list-style-type: none"> <li>• Parcel purchase and access reconfiguration - 57<sup>th</sup> Dr. to 57<sup>th</sup> Ave., parcel west of 51<sup>st</sup> Ave overpass (1)</li> <li>• Remove Access – 57<sup>th</sup> Ave. and Ocotillo Rd. (1)</li> <li>• Rt.-in/Rt.-out – 56<sup>th</sup> Ave. (1)</li> <li>• Median closure – 56<sup>th</sup> Ave. (1)</li> <li>• Auxiliary Lane – 53<sup>rd</sup> Ave. to 52<sup>nd</sup> Ave. (1); 55<sup>th</sup> Ave. to 56<sup>th</sup> Ave. (1)</li> <li>• 21 driveway closures (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Non-RR side Landscaping (1)</li> <li>• Non-RR side Sidewalk (1)</li> <li>• Non-RR side Screen wall (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> </ul>	Full-length improvements begin at 57 <sup>th</sup> Dr. due to existing Grand Avenue underpass improvements.

**Exhibit 6.1 Access Management and Community Mitigation Improvements (cont.)**

Segment	Access Management Improvements (RTP Phase)	Community Mitigation Improvements (RTP Phase)	Notes
51 <sup>st</sup> Ave to 43 <sup>rd</sup> Ave	<ul style="list-style-type: none"> <li>• Rt.-in Rt.-out – Missouri Ave. (1)</li> <li>• Auxiliary Lane – Missouri Ave. to on-ramp (1)</li> <li>• 4 median closures – 3 in front of school and basin, 1 at 47<sup>th</sup> Ave. &amp; Missouri Ave. (1)</li> <li>• 3 driveway closures (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Non-RR side Landscaping (1)</li> <li>• Non-RR side Sidewalk (1)</li> <li>• Non-RR side Screen wall (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> </ul>	Full length improvements end at 43 <sup>rd</sup> Ave. on-ramp due to existing Grand Ave. overpass improvements.
43 <sup>rd</sup> Ave to 35 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• 4 median closures – 40<sup>th</sup> Ave., near 39<sup>th</sup> Ave., 37<sup>th</sup> Ave., near 36<sup>th</sup> Ave. (1)</li> <li>• Rt.-turn lane – 39<sup>th</sup> Ave. (1)</li> <li>• Rt.-in/Rt.-out – 37<sup>th</sup> Ave. (1)</li> <li>• 23 driveway closures (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Sidewalk Only – 41<sup>st</sup> Ave. to 36<sup>th</sup> Ave. (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – 41<sup>st</sup> Ave. to Indian School Road (2)</li> </ul>	<p>Full length improvements begin at 43<sup>rd</sup> Ave. off-ramp due to existing Grand Ave. overpass improvements and end at Indian School Rd. on-ramp.</p> <p>Other improvements identified but not recommended for funding in the 20-year planning period due to funding constraints.</p>
35 <sup>th</sup> Ave to 27 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• Parcel purchase &amp; access reconfiguration – SW corner 31<sup>st</sup> Ave./Grand Ave. (2)</li> <li>• 2 Rt.-turn lanes – 33<sup>rd</sup> Ave., realigned Osborn Rd (1)</li> <li>• Rt.-in/Rt.-out – 31<sup>st</sup> Ave. (1)</li> <li>• 2 median closures – near canal crossing, 31<sup>st</sup> Ave. (1)</li> <li>• Remove Rd. – Osborn (1)</li> <li>• 12 driveway closures (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Sidewalk Only – 29<sup>th</sup> Ave. to Weldon Ave. (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – 35<sup>th</sup> Ave. to 31<sup>st</sup> Ave., Osborn Rd. to NW bound on-ramp (2)</li> </ul>	Other improvements identified but not recommended for funding in the 20-year planning period due to funding constraints.
27 <sup>th</sup> Ave to 19 <sup>th</sup> Ave	<ul style="list-style-type: none"> <li>• Reconfigure access – 21<sup>st</sup> Ave. to 20<sup>th</sup> Ave. (1)</li> <li>• 4 Rt.-in/Rt.-out – 24<sup>th</sup> Ave., Monte Vista, 21<sup>st</sup> Ave., 20<sup>th</sup> Ave. (1)</li> <li>• Rt.-turn lane – Encanto (1)</li> <li>• 5 median closures – 24<sup>th</sup> Dr., 24<sup>th</sup> Ave., Monte Vista, 21<sup>st</sup> Ave., 20<sup>th</sup> Ave. (1)</li> <li>• 21 driveway closures (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Sidewalk Only – 24<sup>th</sup> Ave. to 24<sup>th</sup> Dr. (1)</li> <li>• Median Landscaping (1)</li> <li>• RR-side Landscape/Barrier (4)</li> <li>• Street Lighting (both sides) (1)</li> <li>• Utility Undergrounding – north of Encanto Blvd. to south of Monte Vista Rd. (2)</li> </ul>	<p>Full length improvements begin at 24<sup>th</sup> Dr. due to existing Grand Ave. overpass improvements.</p> <p>Other improvements identified but not recommended for funding in the 20-year planning period due to funding constraints.</p>
<p>General Notes: 1) If limits for each specific improvement are not shown, it can be assumed that the improvements extend for the entire limits. 2) All community mitigation improvements should be maintained by local forces. 3) Improvements identified between 91<sup>st</sup> Ave. and 83<sup>rd</sup> Ave. should be coordinated with ADOT's Grand Ave. widening project to identify potential installation of low-cost items related to improvements in this study.</p>			

**6.3 Implementation Plan**

The Study team evaluated a broad range of projects for the corridor and narrowed down the list to those recommended in the previous section. An implementation plan for the recommended projects

was developed with respect to the phased funding constraints identified in the MAG RTP Highway Program. The phase 1, 2 and 4 implementation plans with estimated program costs are shown in Exhibits 6.2 through 6.4. Phase 3 of the MAG RTP Highway Program has no money programmed for Grand Avenue (SR 101L to McDowell Road) improvements; therefore an implementation plan is not shown for this phase. Below is a summary of the estimated funding available by phase.

<u>MAG RTP Highway Program</u>	<u>Millions</u>
Phase 1	\$31.1
Phase 2	\$21.0
Phase 3	\$ 0.0
Phase 4	<u>\$99.6</u>
Total RTP Funding Available	\$151.7
City of Glendale Funding	\$10.0

Note: The total estimated cost of the recommended projects is equal to the total funding projected to be available. Slight differences in available funding versus cost by phase can be addressed by the future cash flow management process. Additional projects beyond the 20-year planning period and projects potentially funded by other modal sources are shown in Appendix G. Preliminary cost estimate worksheets for the recommended improvements are shown in Appendix H.

### Exhibit 6.2: Phase 1 (2006-2010) Recommended Implementation Plan

Segment	Item of Work	Estimated 2005 Cost
91 <sup>st</sup> Ave to 83 <sup>rd</sup> Ave	Access Management and Community Mitigation Improvements	\$941,000
83 <sup>rd</sup> Ave to 75 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$1,706,000
75 <sup>th</sup> Ave to 67 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$1,514,000
67 <sup>th</sup> Ave to 59 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$15,584,000
59 <sup>th</sup> Ave to 51 <sup>st</sup> Ave	Access Management and Community Mitigation Improvements	\$7,239,000
51 <sup>st</sup> Ave to 43 <sup>rd</sup> Ave	Access Management and Community Mitigation Improvements	\$6,166,000
43 <sup>rd</sup> Ave to 35 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$1,844,000
35 <sup>th</sup> Ave to 27 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$1,222,000
27 <sup>th</sup> Ave to 19 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$2,029,000
Grand Ave / Myrtle Ave	Intersection Improvements (SE bound Dual Left-Turn Lanes)	\$1,219,000
19 <sup>th</sup> Ave / McDowell Rd	Intersection Improvements	\$1,472,000
<b>Total Phase 1 2005 Cost Estimate</b>		<b>\$40,936,000</b>
<b>Estimated MAG RTP Highway Program Phase 1 Funding Available</b>		<b>\$31,100,000<sup>1</sup></b>
<b>City of Glendale Funding Available</b>		<b>\$10,000,000</b>
<sup>1</sup> – Phase 1 money not available until FY 2010		

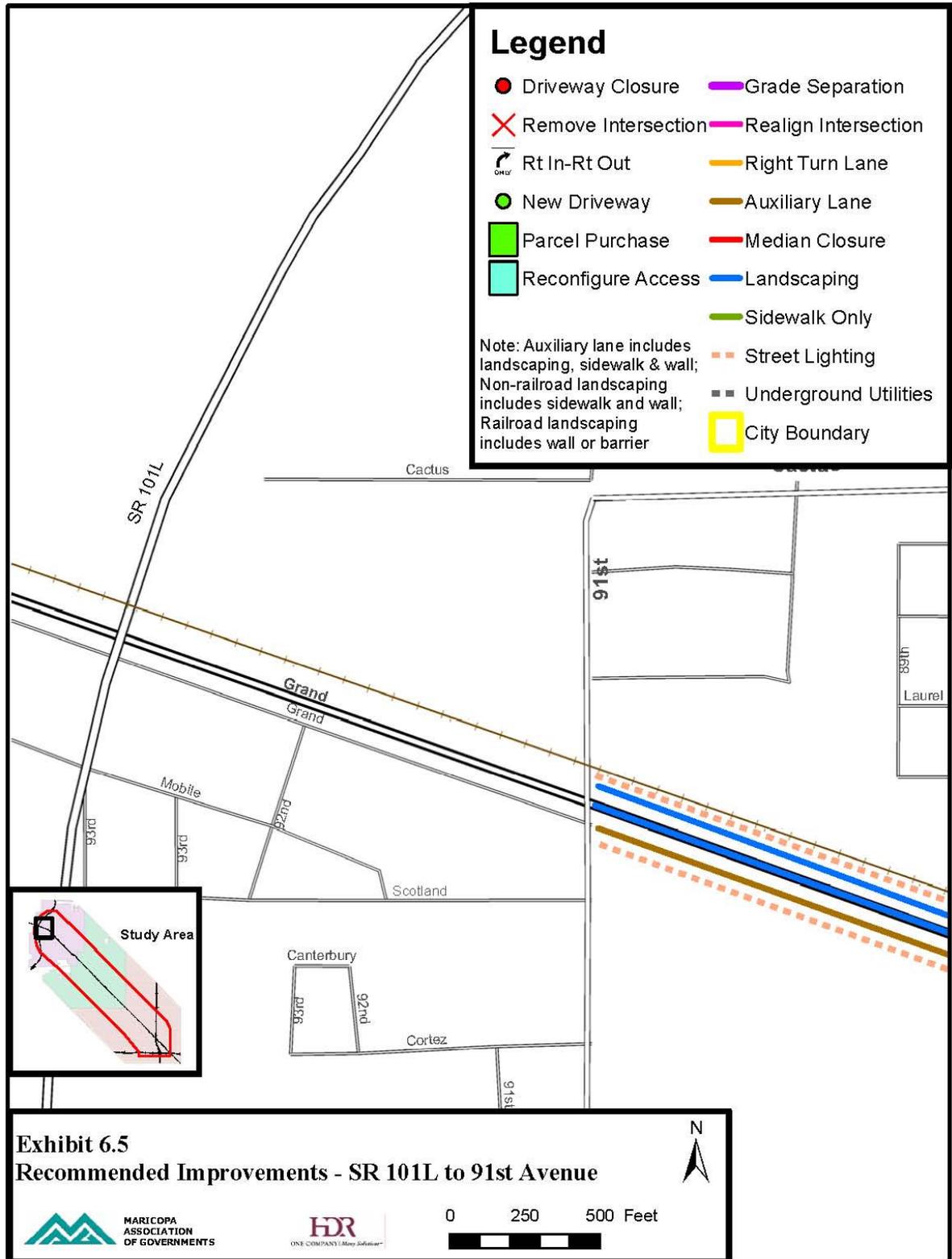
### Exhibit 6.3: Phase 2 (2011-2015) Recommended Implementation Plan

Segment	Item of Work	Estimated 2005 Cost
91 <sup>st</sup> Ave to 83 <sup>rd</sup> Ave	Access Management and Community Mitigation Improvements	\$8,774,000
43 <sup>rd</sup> Ave to 19 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$5,249,000
31 <sup>st</sup> Ave / Osborn Rd	Intersection Improvements	\$7,250,000
	<b>Total Phase 2 2005 Cost Estimate</b>	<b>\$21,273,000</b>
	<b>Estimated MAG RTP Highway Program Phase 2 Funding Available</b>	<b>\$21,000,000</b>

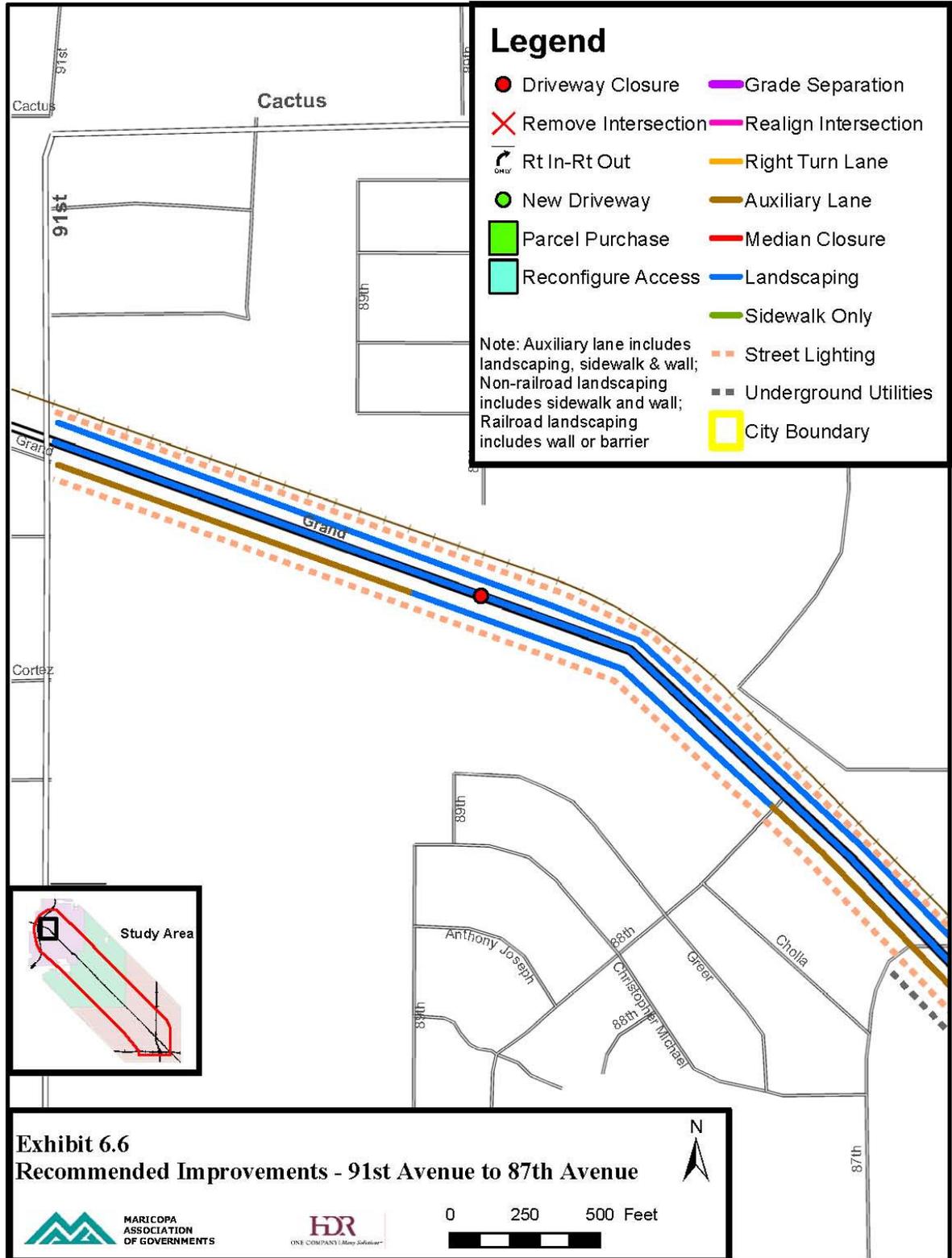
### Exhibit 6.4: Phase 4 (2021-2025) Recommended Implementation Plan

Segment	Item of Work	Estimated 2005 Cost
91 <sup>st</sup> Ave to 19 <sup>th</sup> Ave	Access Management and Community Mitigation Improvements	\$5,353,000
Peoria Ave / 83 <sup>rd</sup> Ave	Intersection Improvements <sup>1</sup>	\$5,000,000
51 <sup>st</sup> Ave / Grand Ave	Bethany Home Road Underpass	\$32,694,000
35 <sup>th</sup> Ave/ Indian School	Grand Avenue Underpass	\$37,472,000
Grand Ave / McDowell Rd	19 <sup>th</sup> Avenue Overpass	\$18,972,000
	<b>Total Phase 4 2005 Cost Estimate</b>	<b>\$99,491,000</b>
	<b>Estimated MAG RTP Highway Program Phase 4 Funding Available</b>	<b>\$99,600,000</b>
<sup>1</sup> – Detailed plans should be developed as part of future design concept report, in association with City of Peoria staff.		

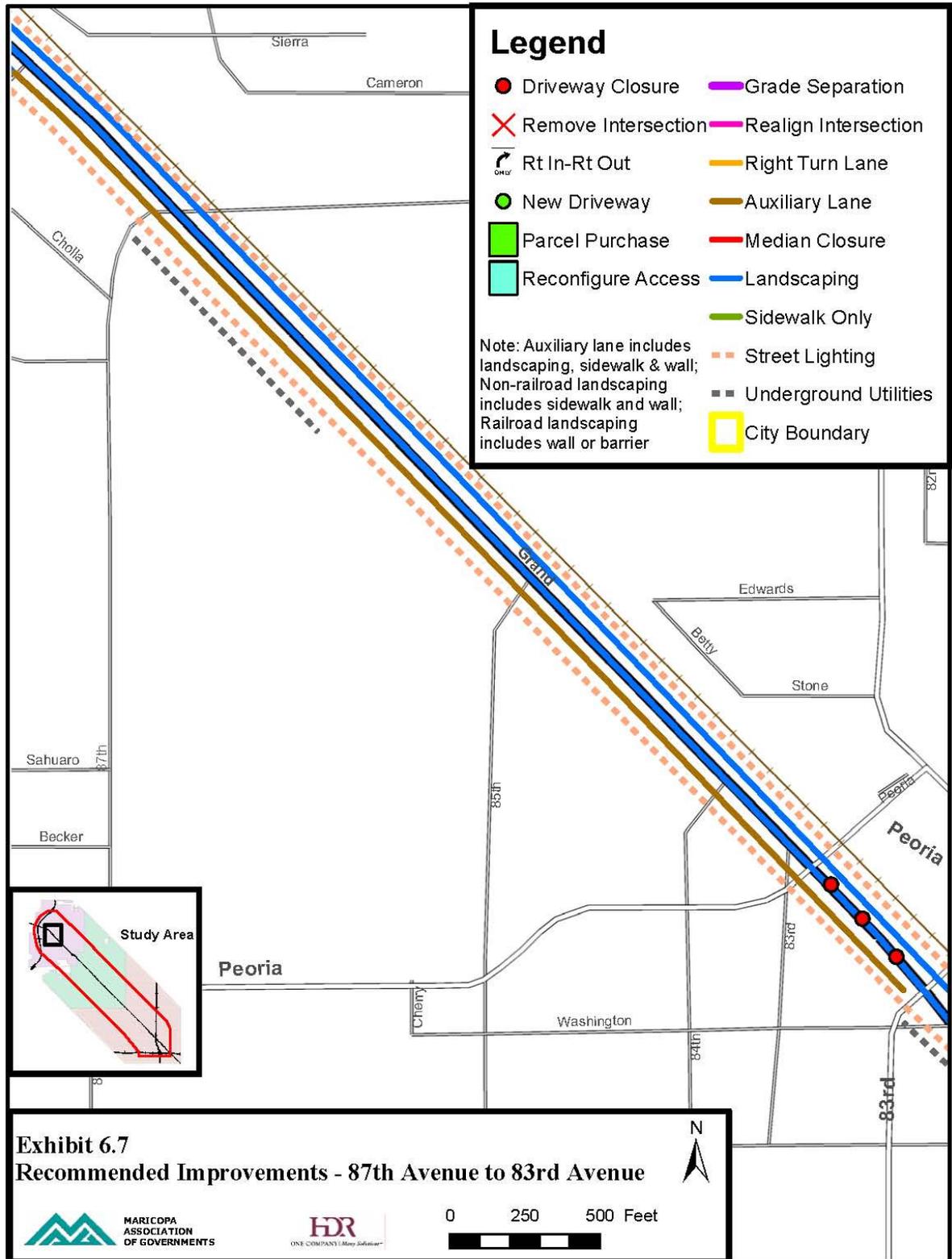
## Exhibit 6.5: Recommended Improvements - SR 101L to 91st Avenue



## Exhibit 6.6: Recommended Improvements - 91st Avenue to 87th Avenue



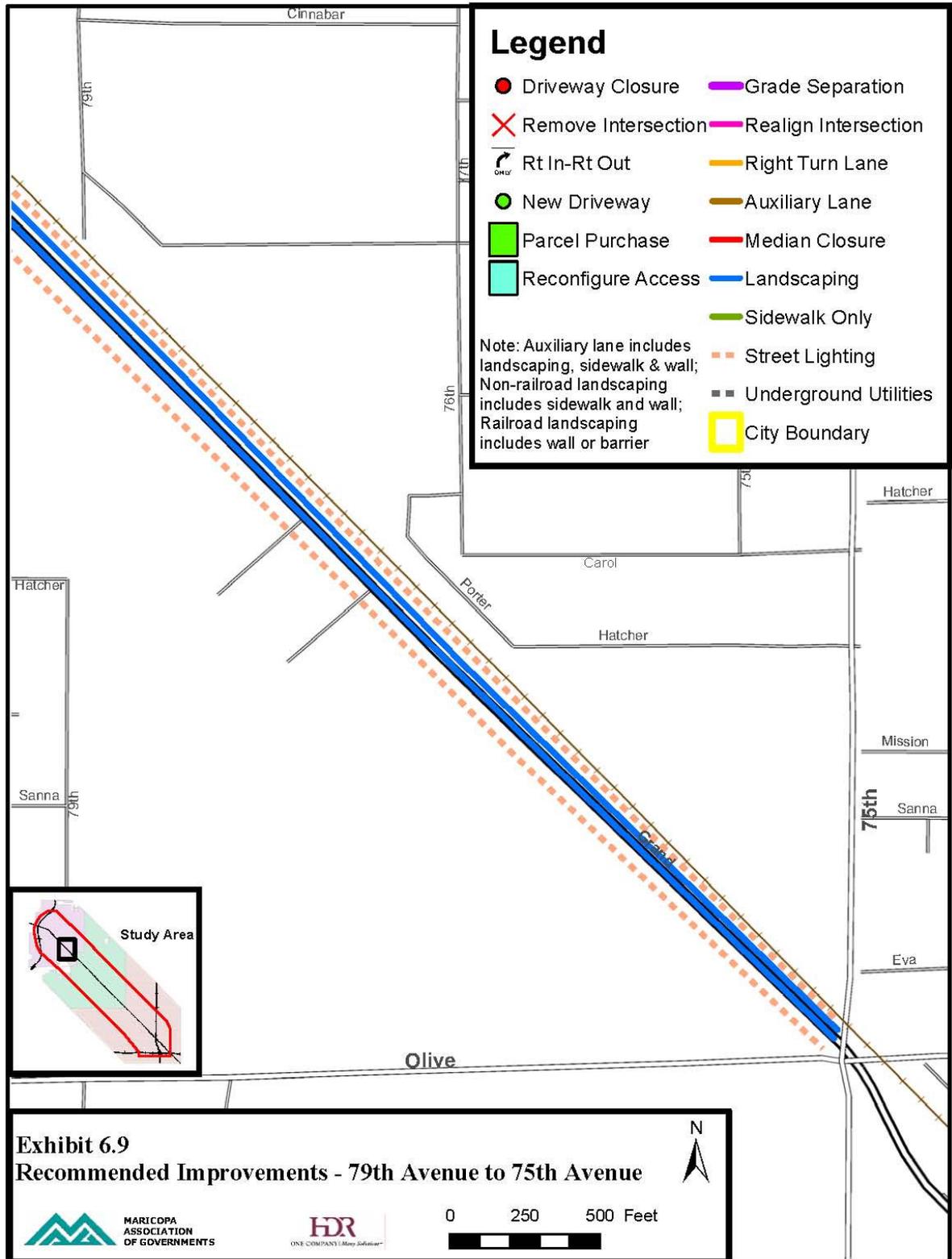
## Exhibit 6.7: Recommended Improvements - 87th Avenue to 83rd Avenue



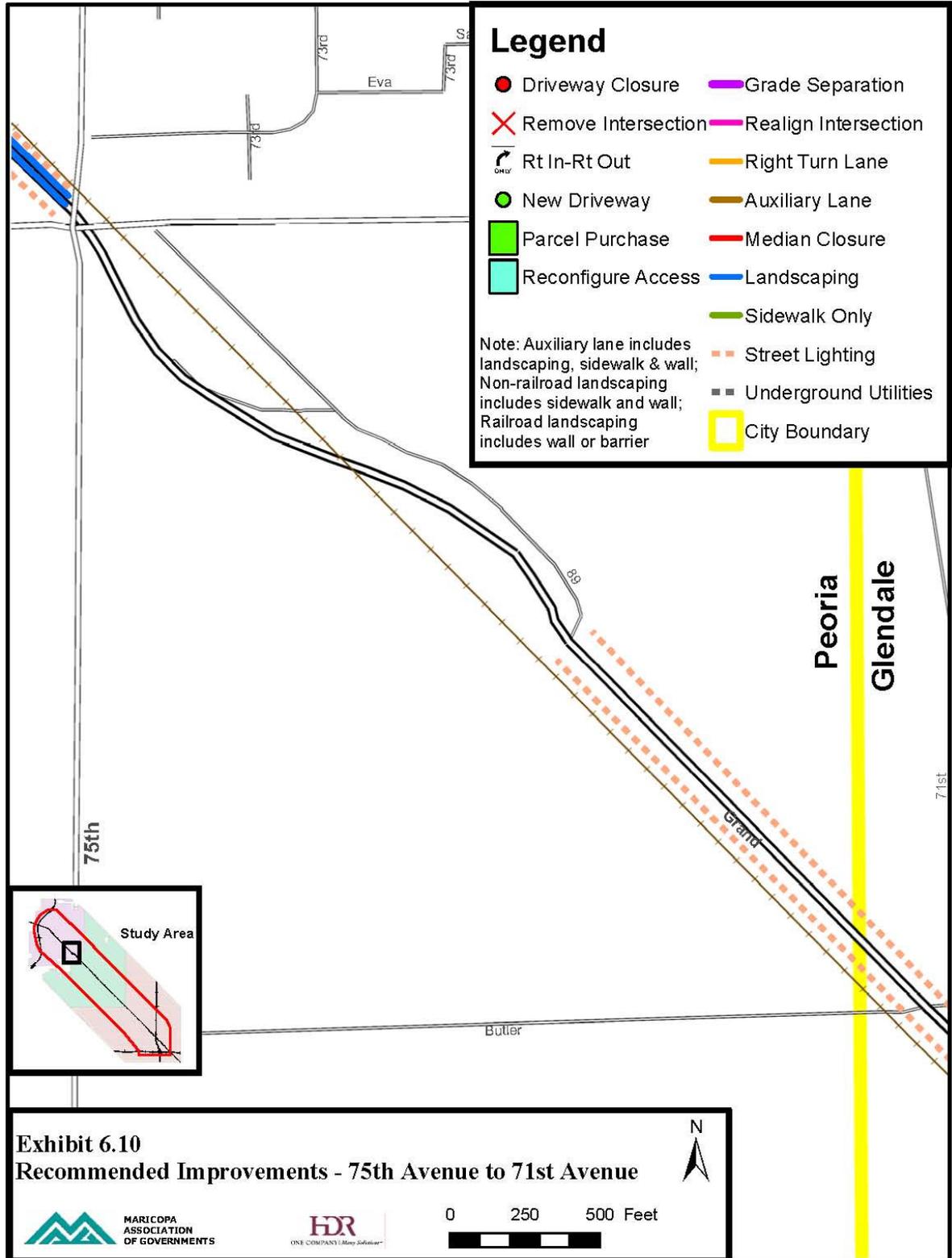
## Exhibit 6.8: Recommended Improvements - 83rd Avenue to 79th Avenue



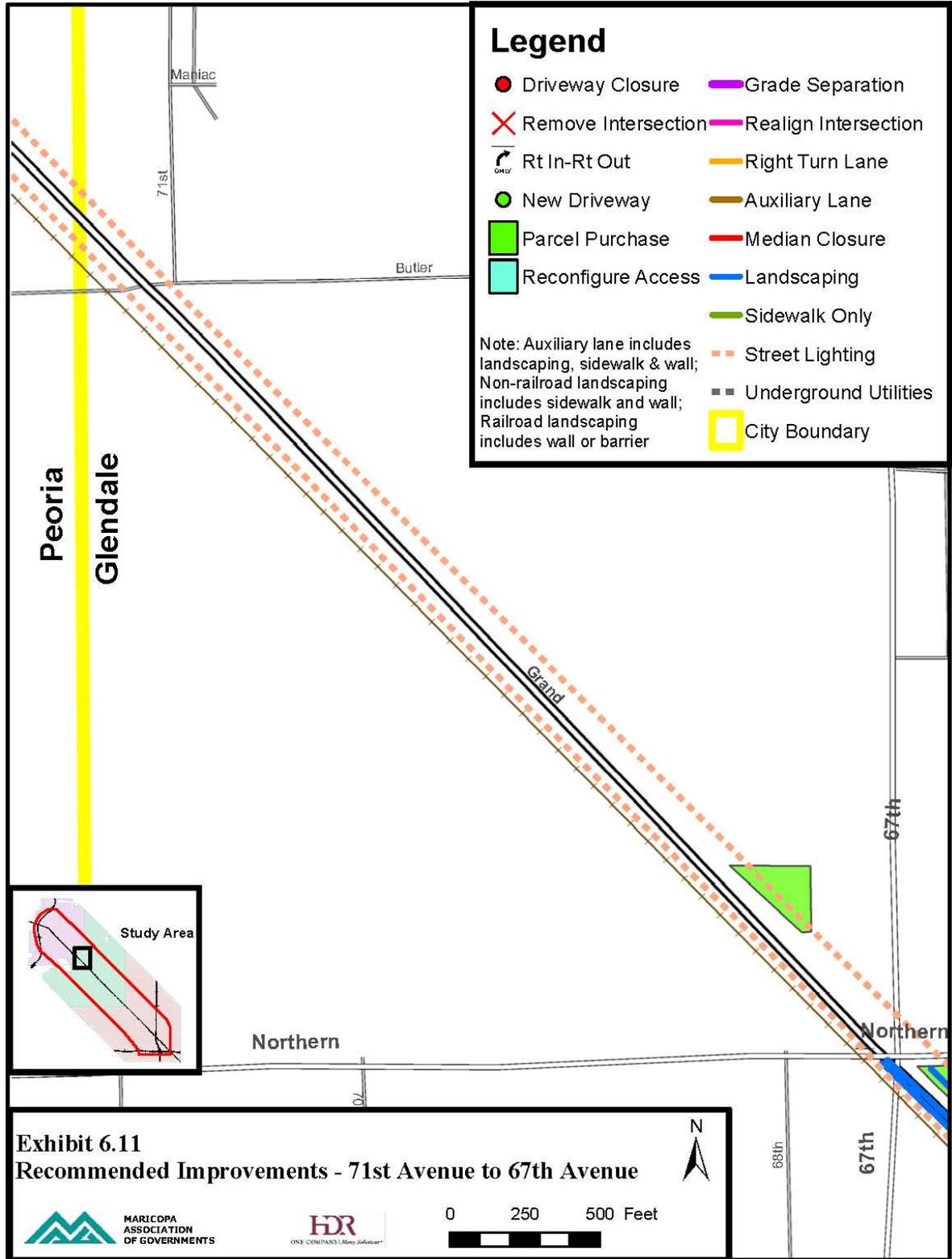
## Exhibit 6.9: Recommended Improvements - 79th Avenue to 75th Avenue



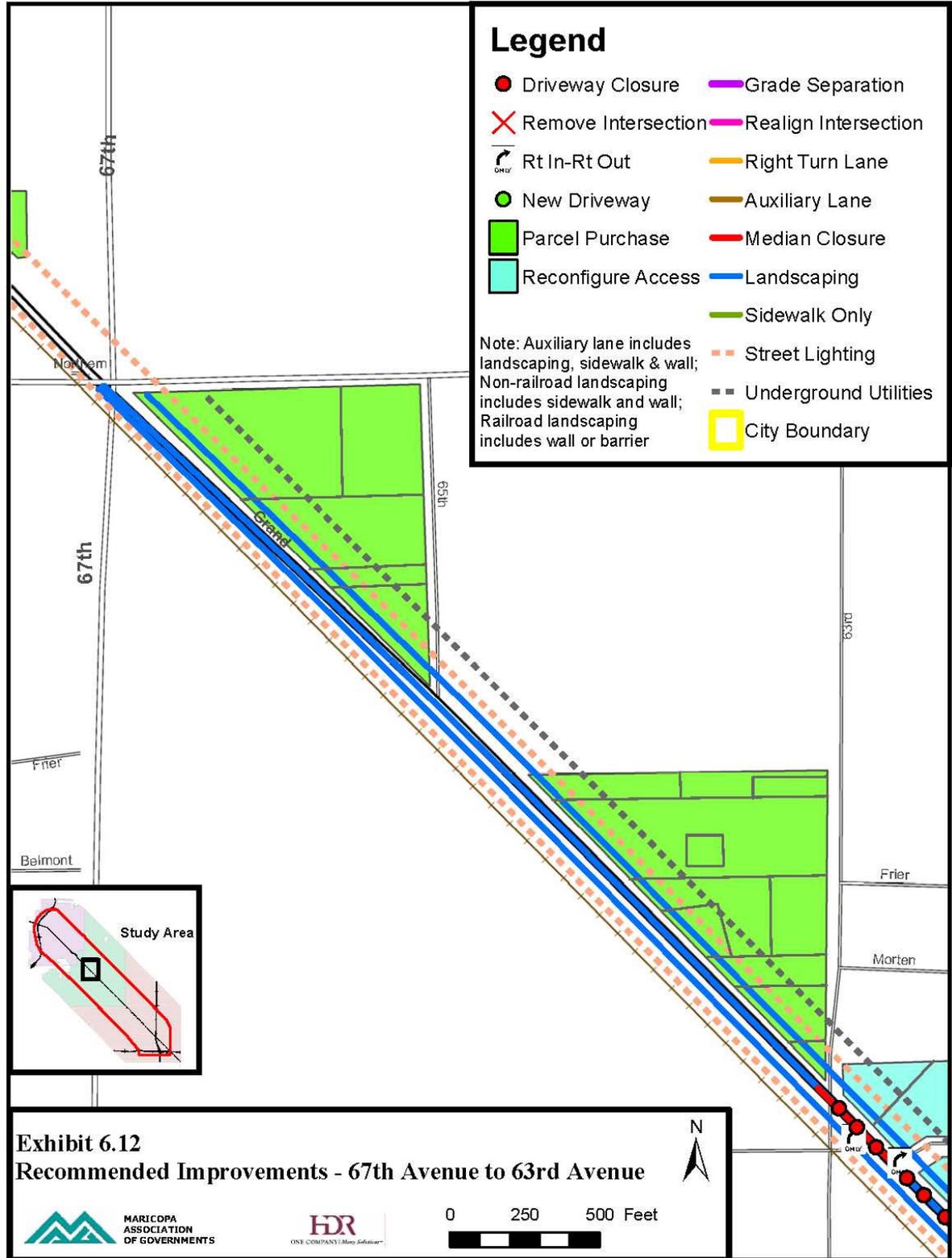
# Exhibit 6.10: Recommended Improvements - 75th Avenue to 71st Avenue



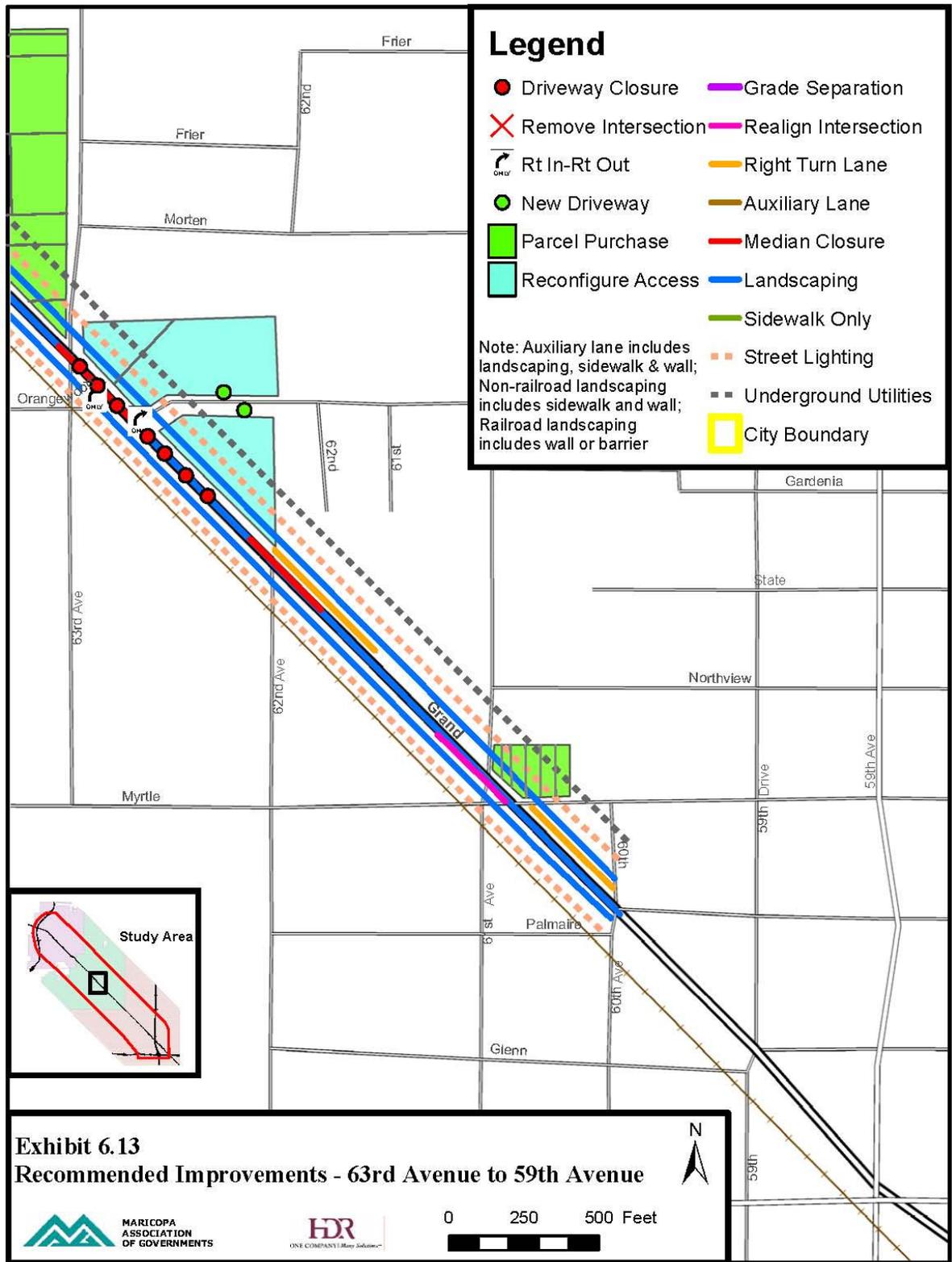
# Exhibit 6.11: Recommended Improvements - 71st Avenue to 67th Avenue



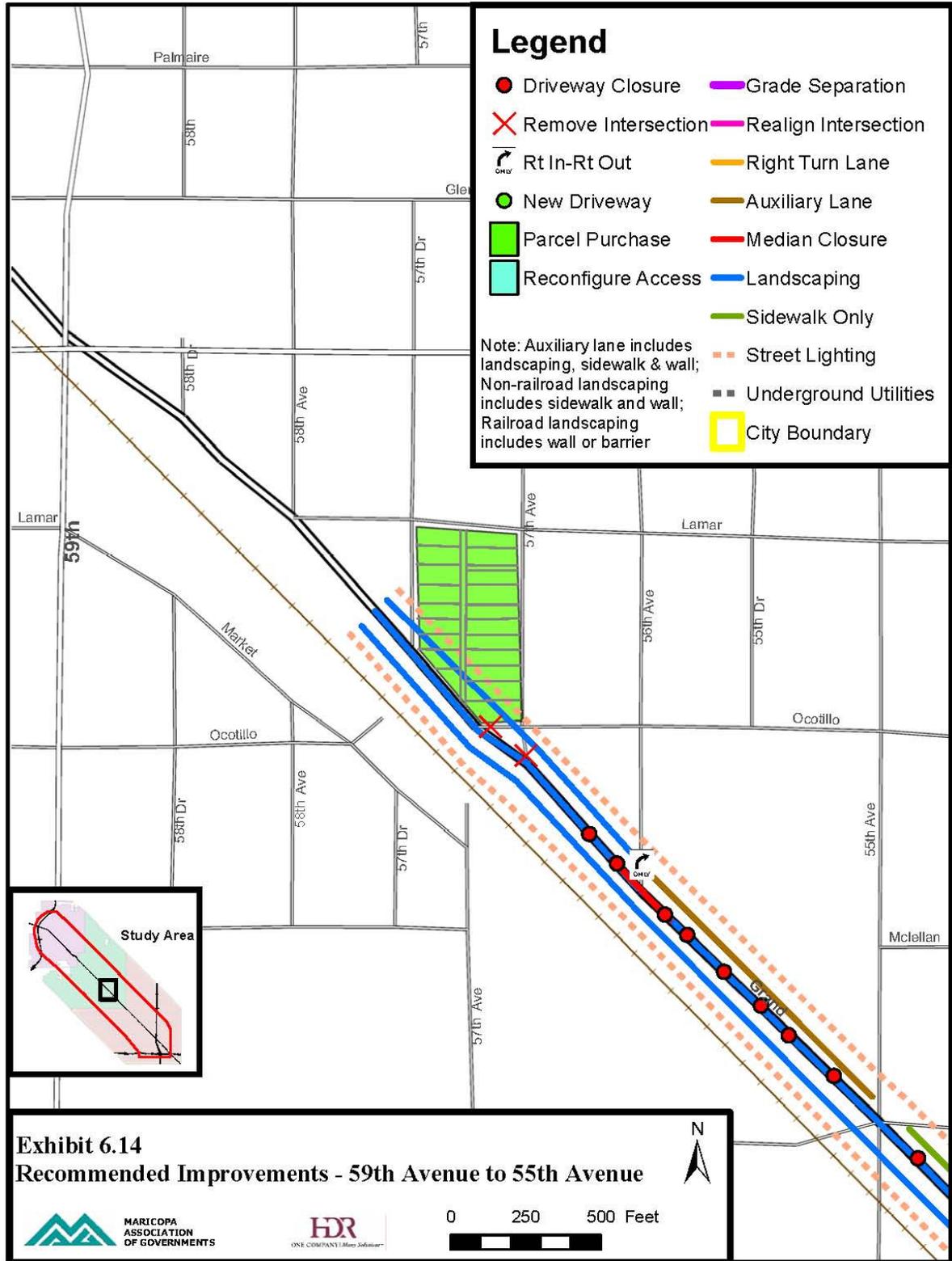
## Exhibit 6.12: Recommended Improvements - 67th Avenue to 63rd Avenue



# Exhibit 6.13: Recommended Improvements - 63rd Avenue to 59th Avenue



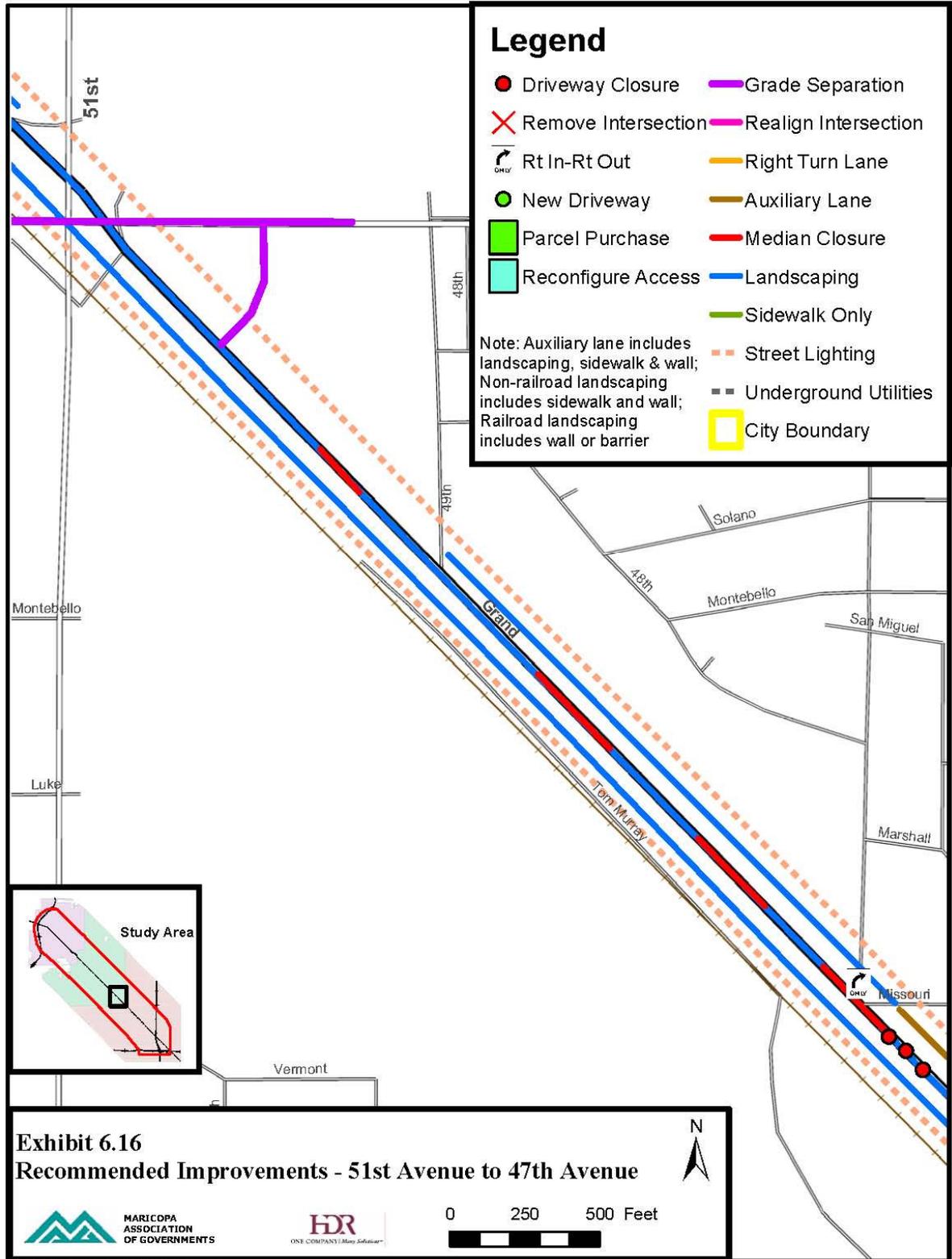
## Exhibit 6.14: Recommended Improvements - 59th Avenue to 55th Avenue



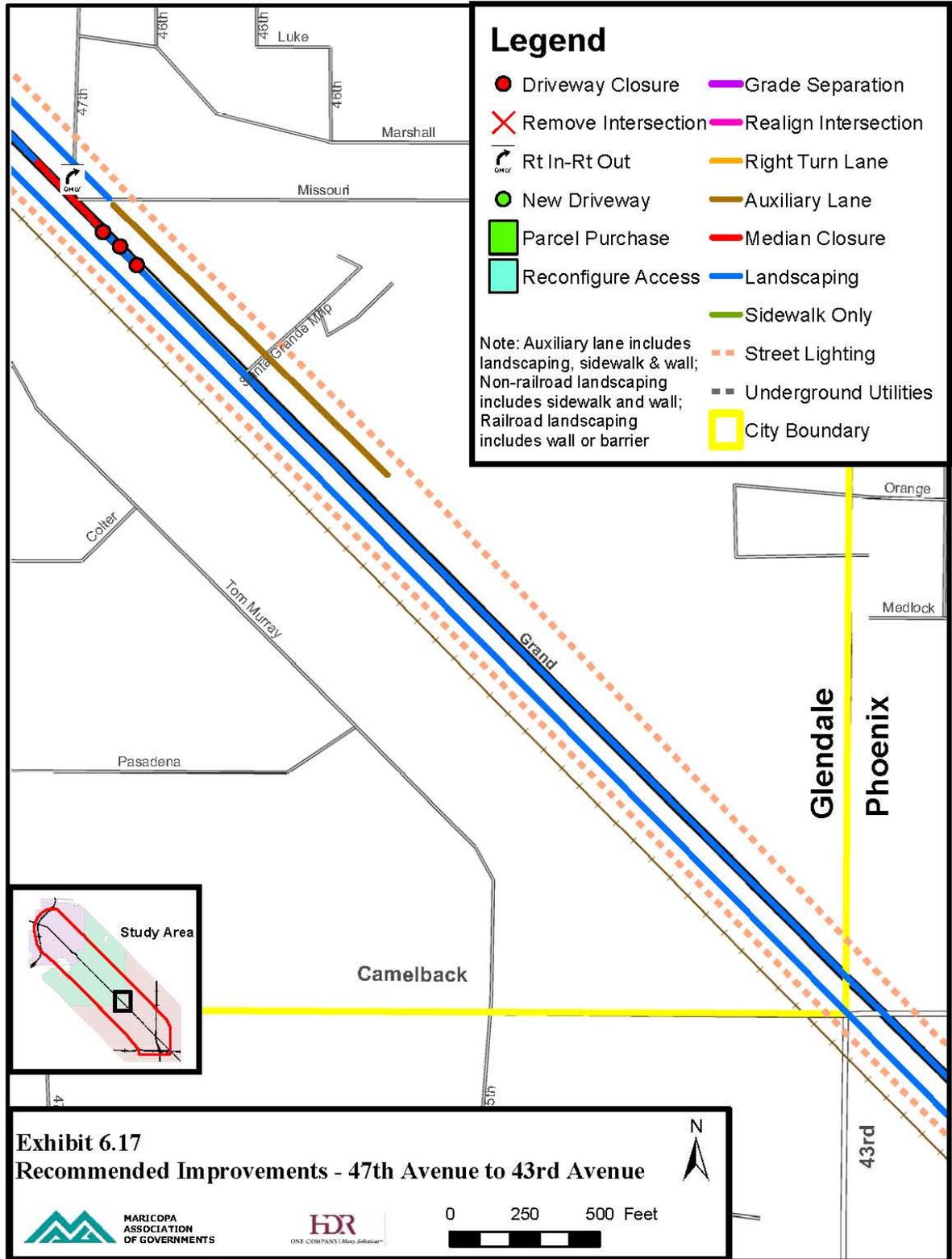
## Exhibit 6.15: Recommended Improvements - 55th Avenue to 51st Avenue



## Exhibit 6.16 Recommended Improvements - 51<sup>st</sup> Avenue to 47<sup>th</sup> Avenue



# Exhibit 6.17 Recommended Improvements - 47th Avenue to 43rd Avenue



# Exhibit 6.18 Recommended Improvements - 43<sup>rd</sup> Avenue to 39<sup>th</sup> Avenue

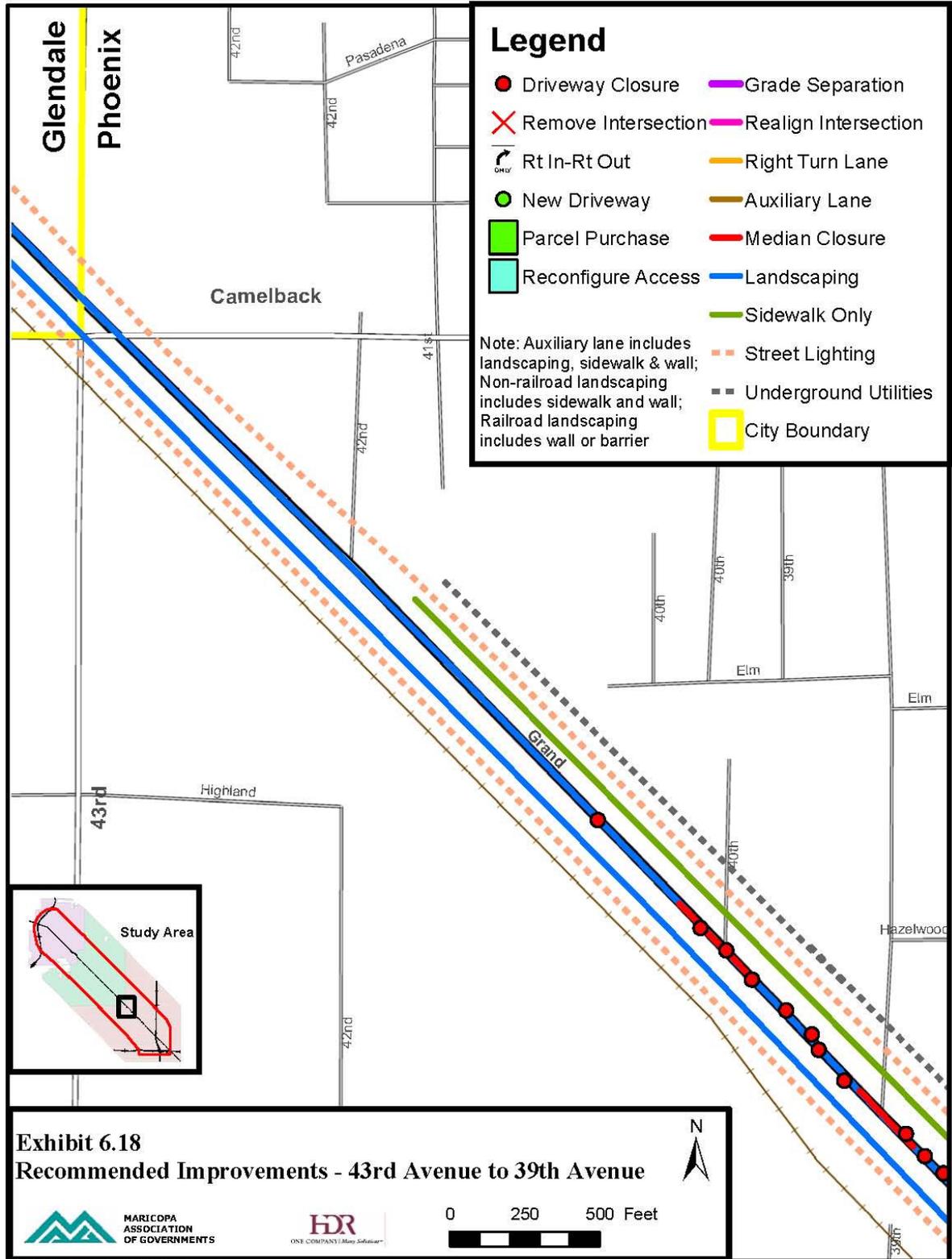
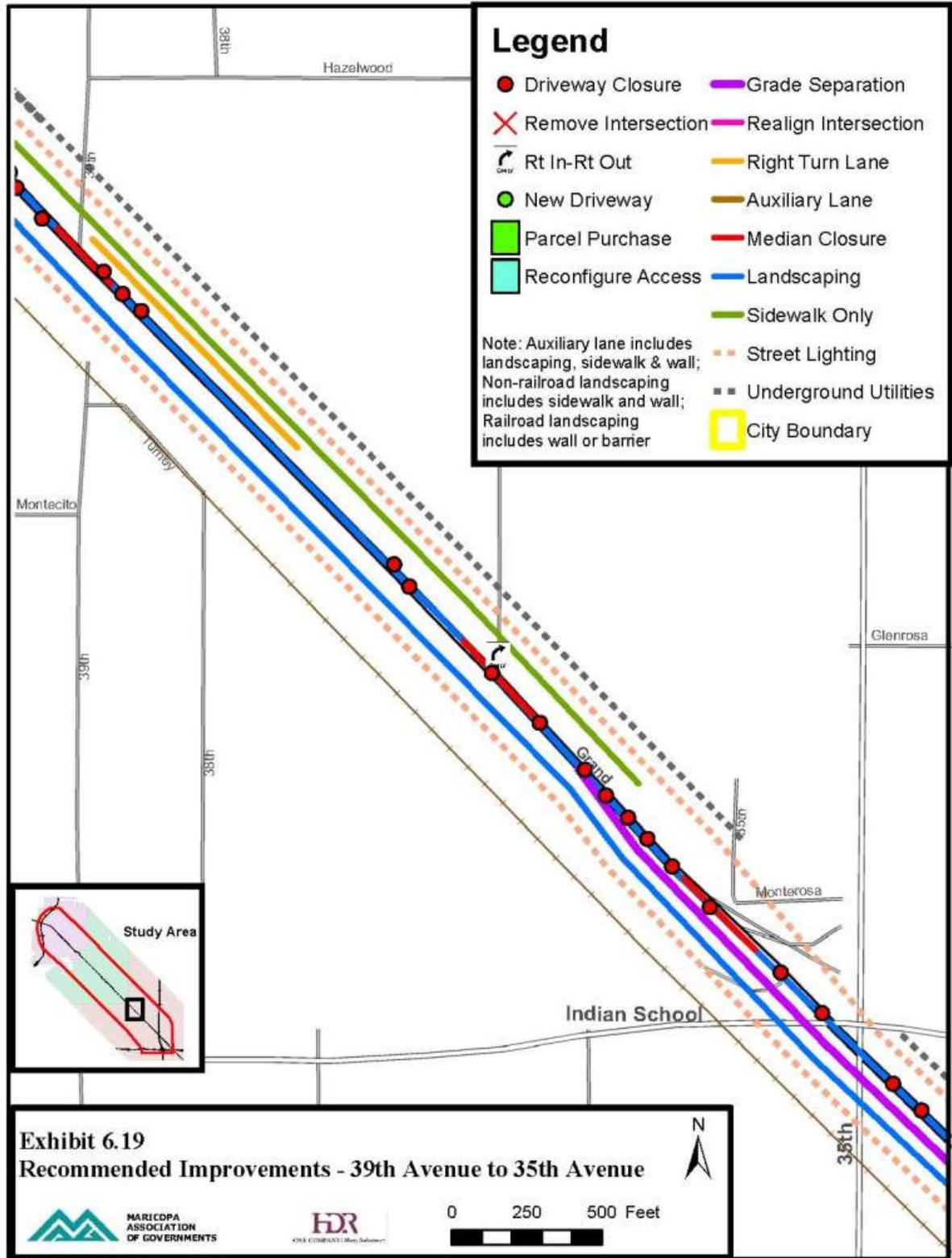
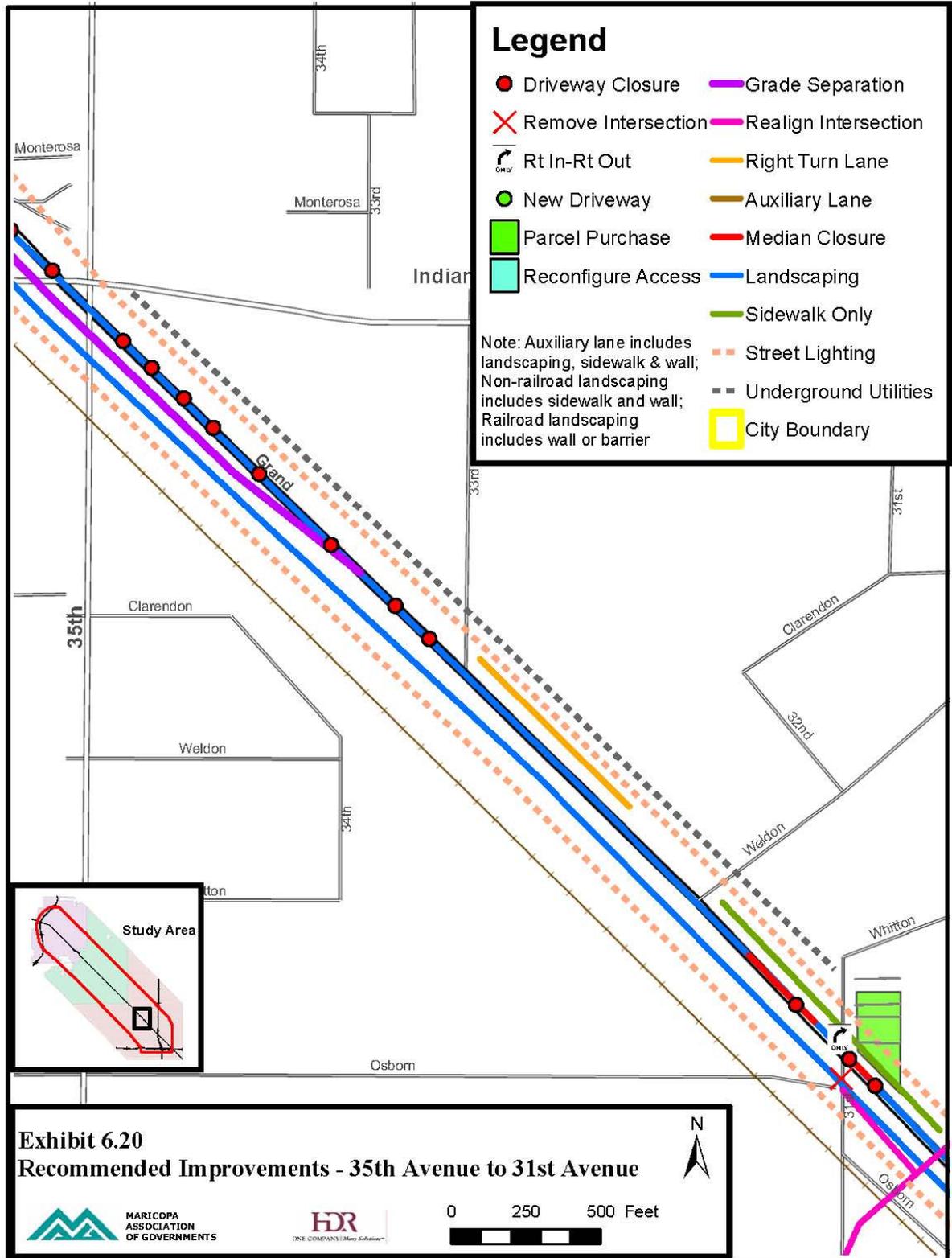


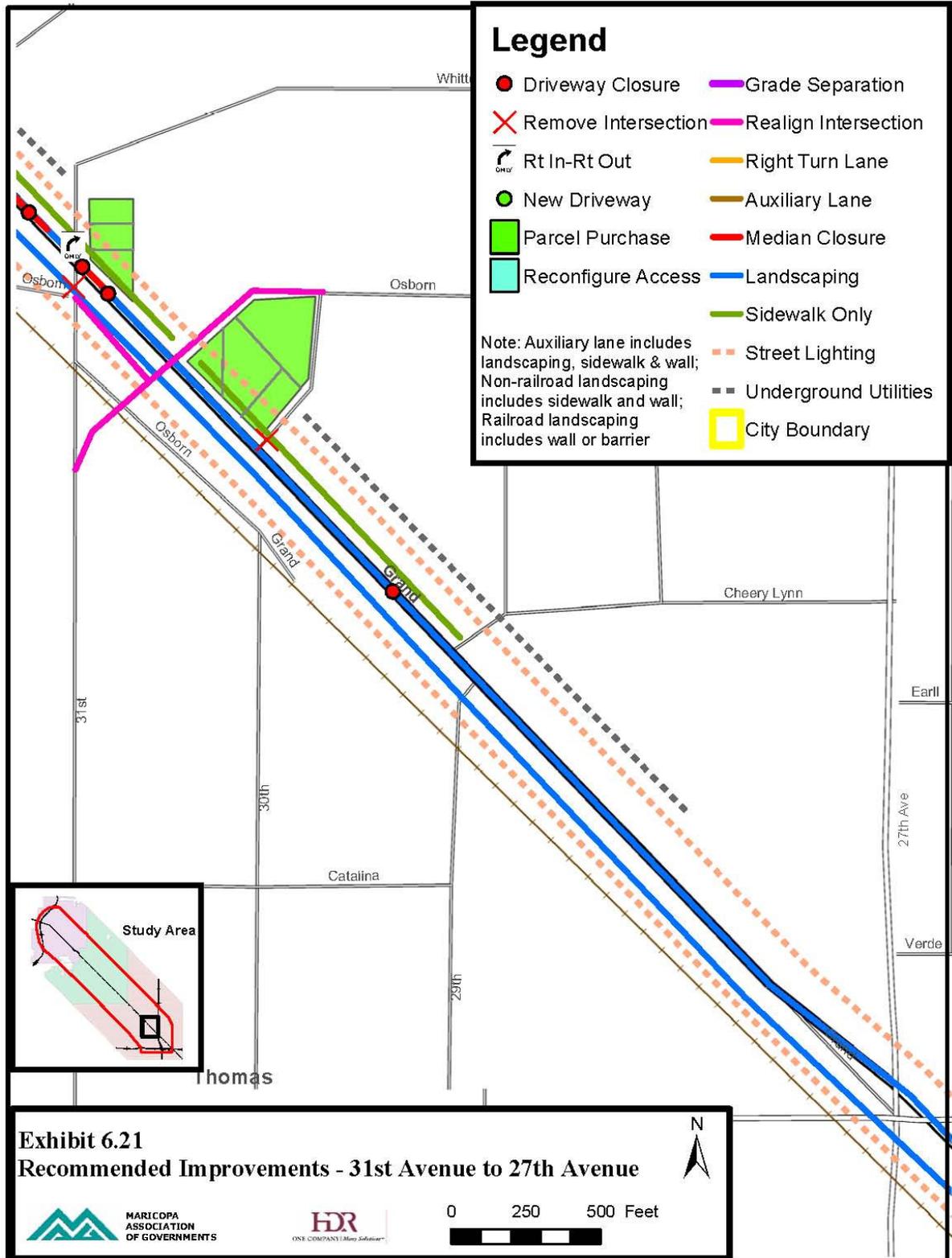
Exhibit 6.19: Recommended Improvements - 39th Avenue to 35th Avenue



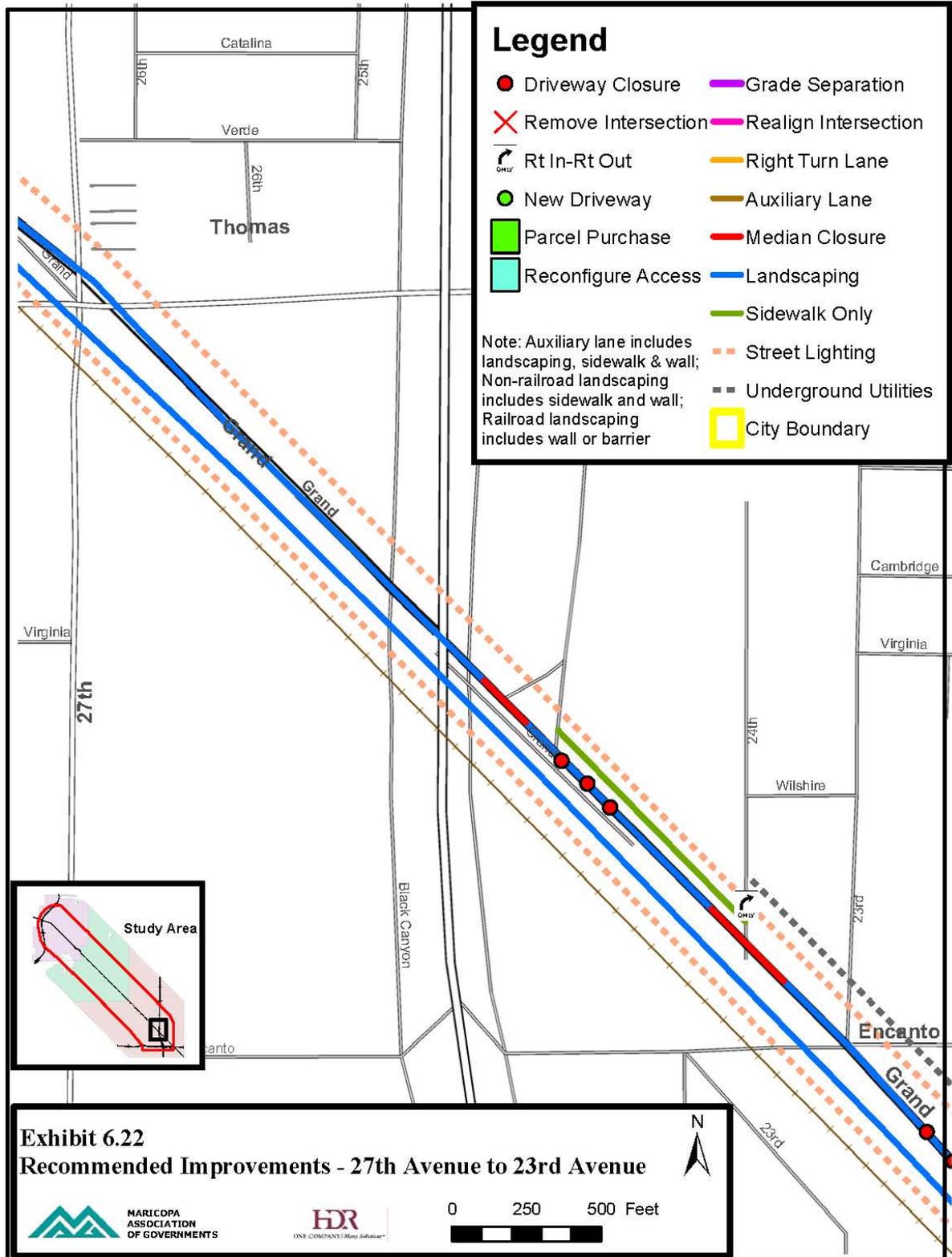
## Exhibit 6.20: Recommended Improvements - 35th Avenue to 31st Avenue



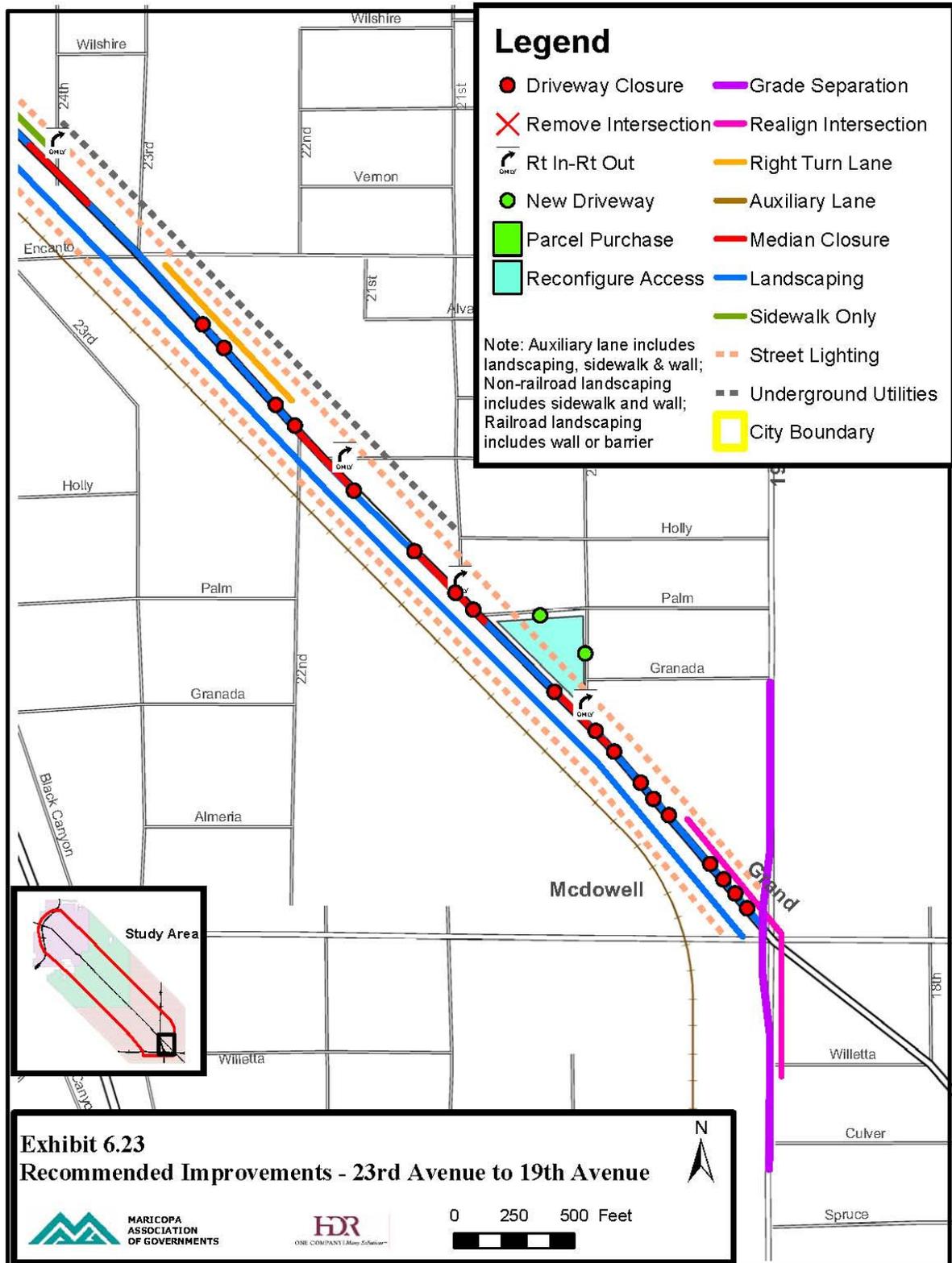
## Exhibit 6.21: Recommended Improvements - 31st Avenue to 27th Avenue



## Exhibit 6.22: Recommended Improvements - 27th Avenue to 23rd Avenue



**Exhibit 6.23: Recommended Improvements - 23rd Avenue to 19th Avenue**



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## 7.0 REFERENCES

Arizona Department of Transportation (ADOT), "Guidance on Title VI and Environmental Justice," Environmental Planning Section, July 30, 1997.

Council of Environmental Quality, "Environmental Justice: Guidance under the National Environmental Policy Act," Executive Office of the President, December 1997

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Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," February 11, 1994, 59 Federal Register at 7630

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U.S. Department of Transportation's Proposed Order on Executive Order 12898, "Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," Department of Transportation, July 27, 1995.

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# APPENDIX A

## Related Studies, Plans and Programs

## RELATED STUDIES, PLANS, AND PROGRAMS

An initial step in the Phase II Major Investment Study for Grand Avenue was to review documents related to the corridor. The purpose of this working paper is to present that documentation.

The next section of this paper includes, for each document reviewed:

- The study name, author, client, and date published,
- The purpose of the study,
- The published results of the study, and
- Information contained in the study as it relates to the Grand Avenue study corridor between 19<sup>th</sup> Avenue and SR 101L.
- 
- The studies are presented in chronological order, with the most recently completed studies presented first.
- 

### Study Review

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#### Grand Avenue Limited Expressway Design Concept Study for the Glendale Area, Final Report

Author: URS Corporation  
Client: City of Glendale Transportation Department  
Date: December 4, 2003

#### Purpose:

Following the approval of the Glendale Onboard Transportation Program by Glendale voters in November 2001, the City of Glendale initiated the study of Grand Avenue between 43<sup>rd</sup> Avenue / Camelback Road to 71<sup>st</sup> Avenue / Butler Avenue. While ADOT was in the process of constructing five grade separations along Grand Avenue within the City of Glendale, the City was interested in planning new projects in between the overpasses that would enhance access control and provide for beautification along Grand Avenue.

#### Results:

The study resulted in the following major design features along Grand Avenue:

- Northern Parkway traffic interchange
- Bethany Home Road and 51<sup>st</sup> Avenue grade separation structure
- Access control along Grand Avenue
- Grand Avenue signage
- Downtown access improvements

- Beautification along Grand Avenue

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

All information presented in this report is related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L. Key highlights include:

- Bethany Home Road underpass. 51<sup>st</sup> Avenue will be grade separated over Grand Avenue. Grand Avenue will remain at-grade and Bethany Home Road will be depressed under Grand Avenue. Connector roadways will be constructed to allow access among the three arterials. No traffic signals will be required at the junction of the three roadways.
- Closure of various intersection streets, alleys and unused driveway entrances along Grand Avenue to improve access control to the east of Grand Avenue (to the west, the BNSF railroad tracks limit most access except at mile and one-half mile intervals).
- The proposed Grand Avenue underpass at 59<sup>th</sup> Avenue and Glendale Avenue will substantially alter the manner in which vehicles enter downtown Glendale. 57<sup>th</sup> Drive and Myrtle Avenue will be used for this access from Grand Avenue, north and south of the underpass.
- The addition of dedicated right-turn lanes along northwest-bound Grand Avenue.
- Eight existing median openings along Grand Avenue have been identified for closure.
- Limiting the movements for streets that intersect Grand Avenue to right-in / right-out only.
- Beautification and landscaping along Grand Avenue medians and railroad right-of-way.
- Purchase of billboards along Grand Avenue for removal.
- Underground the existing electrical lines that run along the east side of Grand Avenue.
- Installation of new street lighting along Grand Avenue, both at new grade separations as well as between them to provide for a more uniform appearance as well as improve the aesthetics.

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### **MAG Regional Freeway Bottleneck Study, Draft**

Author: HDR Engineering  
Client: Maricopa Association of Governments (MAG)  
Date: December 3, 2003

#### **Purpose:**

The primary purpose of the Regional Freeway Bottleneck Study was to identify and evaluate solutions in bottleneck locations on the existing MAG regional freeway system. A secondary purpose was to research long-range capacity enhancement techniques for the freeway system. Grand Avenue was not included in the analysis.

**Results:**

Both I-17 and I-10 at the east end of the Grand Avenue corridor were identified as bottleneck locations. SR 101L on the west end of the study corridor was not identified as a bottleneck location.

Improvements suggested for I-10 included re-striping the section through the deck park tunnel to four lanes plus an auxiliary lane. General widening, possibly through double-decking, was suggested for I-17.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L**

Other than the I-10 and I-17 improvements mentioned above, the Regional Freeway Bottleneck Study does not contain any information related to Grand Avenue.

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**Regional Transportation Plan**

Author: HDR Engineering, Inc.  
Client: Maricopa Association of Governments (MAG)  
Date: November 25, 2003

**Purpose:**

The Regional Transportation Plan (RTP) is a comprehensive, performance based, multi-modal and coordinated regional plan for Maricopa County, covering fiscal years (FY) 2005 through 2026. MAG as the designated Metropolitan Planning Organization (MPO) for the region develops the fiscally constrained RTP in accordance with federal, state and local requirements (which include air quality-related elements). A key related requirement is that, before they can be implemented, all regionally significant and/or federally funded transportation improvement projects, as well as any regionally significant transportation projects requiring federal approval(s), must be identified in the MAG Transportation Improvement Program (TIP), projects in which must be consistent with the RTP. Any proposed transportation improvement projects for Grand Avenue that meet these criteria therefore must be identified in the TIP and be consistent with the RTP before they can be implemented.

**Results:**

The RTP identifies regional improvements related to freeways, streets, transit, airports, bicycle and pedestrian facilities, freight, safety, special needs transportation, and demand and system management over a twenty-two year planning horizon. It specifies planning concepts and funds major improvement projects for Grand Avenue. Funding is generally allocated over four phases: (1) FY 2005-2010, (2) FY 2011-2015, (3) FY 2016-2020, and (4) FY 2021-2026.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The RTP states, “Grand Avenue south of SR 74 is generally planned as a partially controlled access facility. Based on the results of the recently completed MAG Grand Avenue Northwest Corridor Study, it is further defined as an enhanced arterial / limited expressway between SR 101L and SR 303L. The section south of SR 101L is a partially controlled access facility (expressway or limited expressway) and may be further defined following the completion of a Major Investment Study that is in process for this corridor. Additional project details will also be determined in this study.”

For reference, the RTP provides \$103 million in funding for Grand Avenue between SR 101L and SR 303L. This is allocated as \$39 million in Phase I and \$64 million in Phase II. The RTP does not specify how the funding is to be sub-allocated in this section. The Grand Avenue Northwest Corridor Study (reviewed as part of this Working Paper) provides recommendations that total \$107 million to \$131 million. Decisions for allocating funding for this section of Grand Avenue will be made following the completion of required design studies.

For the section of Grand Avenue in the study area, the July 2003 Life Cycle Certification as incorporated into the RTP includes roughly \$54 million in projects for projects in FY 2005 and later. This includes \$17.2 million in right-of-way acquisitions and \$36.7 million for construction. Grade separations at 59<sup>th</sup> Avenue / Glendale Avenue and 67<sup>th</sup> Avenue / Northern Avenue are scheduled for completion in FY 2006 and 2005 respectively. Grade separations being constructed and scheduled for completion by late 2004 are at 43<sup>rd</sup> Avenue / Camelback Road, 51<sup>st</sup> Avenue / Bethany Home Road, 55<sup>th</sup> Avenue / Maryland Avenue, and 75<sup>th</sup> Avenue / Olive Avenue. A grade separation at 27<sup>th</sup> Avenue / Thomas Road was completed in June 2003. Ramps connecting to SR 101L from 91<sup>st</sup> Avenue have also been completed. The portion of these projects that fall within the RTP’s time period are included in the Plan, but are called out separately.

The portion of Grand Avenue between 19<sup>th</sup> Avenue and SR 101L received \$147 million in funding in the RTP. This funding is divided between general improvements (widening, beautification, access control, etc.) and construction of grade separations. The improvement projects are funded in Phase 1 (\$30M), Phase 2 (\$20M), and Phase 4 (\$3M). This schedule allows the City of Glendale to match their local funds with the funds from the Plan. The remaining \$94 million funds the construction of structures at 19<sup>th</sup> Avenue / McDowell Road (\$38.5M), 35<sup>th</sup> Avenue / Indian School Road (\$38.5M), and 51<sup>st</sup> Avenue / Bethany Home Road (\$17M), all in Phase 4.

Two other large projects were included in the RTP that will have an impact to Grand Avenue. The first project, the Northern Avenue Parkway, involves improvements to Northern Avenue that will make it a controlled access roadway including grade separations and direct connections to Grand Avenue, SR 101L, and SR 303L. Northern Avenue intersects Grand Avenue at 67<sup>th</sup> Avenue. The second project, El Mirage Road, will impact Grand Avenue between Paradise Lane and Thunderbird Road, where Grand Avenue is spanned by a structure. El Mirage Road intersects Grand Avenue between Greenway Road and Thunderbird Road near the BNSF Railroad.

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## **East-West Mobility Study**

Author: Entranco, Inc.  
Client: Maricopa Association of Governments (MAG)  
Date: 2003

### **Purpose:**

The East-West Mobility Study was initiated to analyze the need and possible alternatives for the improvement of east-west travel through a portion of north-central Maricopa County. The study area for the East-West Mobility Study is located in north-central Maricopa County and is bounded on the north by Thunderbird Road/Waddell Road, on the west by SR 303L, on the south by Northern Avenue, and on the east by State Route 51.

Current traffic conditions were determined by a thorough review of existing traffic data and transportation studies. Data pertaining to transit, bicycle, and pedestrian facilities were also reviewed and analyzed. Socio-economic data, such as the number of residential homes and the aggregate amount of non-residential development, were gathered for use in MAG's travel demand model.

Future-year traffic conditions were also analyzed to determine if and where transportation improvements will ultimately be needed. The model was then run, generating traffic volumes along significant roadways throughout the study area. Trends in traffic growth were analyzed to determine if and where transportation improvements will be needed.

The 2002 Long-Range Transportation Plan (LRTP) was assumed to be in place for the 2020 time frame and was included in the traffic model used in the study. In addition to projects in the LRTP, a range of other projects was considered in the analysis of potential mobility improvements for the study area.

### **Results:**

Projects were assembled into six potential "Strategy Packages", which are macro concepts that represent a broad approach to improving mobility. Individual projects support each package concept by either increasing roadway capacity or by optimizing existing roadway capacity.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L**

The East/West Mobility Study assumed the implementation of recommended improvements in the previous Grand Avenue MIS and the Grand Avenue Northwest Corridor Study (both of which are reviewed as part of this Working Paper and will also be taken into account in this study).

## Final Design Concept Report for Northern Parkway, Volumes I and II

Author: URS Corporation  
Client: City of Glendale Transportation Department  
Date: October 1, 2003

### Purpose:

The voters of the City of Glendale approved the upgrading of Northern Avenue to Northern Parkway from Grand Avenue to SR 303L (12.5 miles). The proposed Northern Parkway will be a super street with grade-separated intersections at major cross streets to eliminate the major traffic signals on Northern Parkway. Free-flow traffic connections are planned at freeways and expressways, including SR 303L, SR 101L and Grand Avenue. The purpose of this study was to develop and evaluate various concepts for the upgrading of Northern Avenue.

### Results:

The planned roadway is a “super street” that would double the capacity of a typical arterial, due primarily to the provision of grade-separated intersections at the major intersecting arterials. Northern Parkway would have signalized intersections at minor streets to allow access to and from neighborhoods and commercial areas, but no left turns would be permitted from Northern Parkway.

The proposed roadway would provide three lanes of travel in each direction with a continuous right-turn lane or auxiliary lane between grade-separated intersections. A raised median would be provided and broken only at the signalized intersections.

Grade-separated intersection (Northern Parkway overpasses unless noted otherwise) are planned at the following nine locations:

- Sarival Avenue
- Reems Road
- Litchfield Road
- Dysart Road
- El Mirage Road
- 103<sup>rd</sup> Avenue (Northern Parkway underpass)
- 91<sup>st</sup> Avenue
- 83<sup>rd</sup> Avenue
- 75<sup>th</sup> Avenue

Signalized intersections are planned at the following eight locations:

- Bullard Road
- Between Litchfield Road and Dysart Road
- 111<sup>th</sup> Avenue

- 107<sup>th</sup> Avenue
- 99<sup>th</sup> Avenue (realigned to the west)
- Peoria Crossings Shopping Center
- 87<sup>th</sup> Avenue
- 79<sup>th</sup> Avenue

A special grade separation is planned for Grand Avenue, which will provide free flow movements between the west leg of Northern Parkway and the southeast leg of Grand Avenue. The study assumes that Grand Avenue will be upgraded to a super street or a limited expressway. In addition, a diamond interchange is planned at SR 101L and a three-leg directional interchange is planned at SR 303L. Northern Parkway will terminate at SR 303L.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The upgrading of Northern Avenue to Northern Parkway has its eastern terminus at Grand Avenue, and the proposed connection between the two facilities is an important factor to consider in the development of this MIS. The recommended option for the connection to Grand Avenue is a median-to-median flyover ramp. The cross section includes a 6-foot inside shoulder, one 12-foot lane and a 10-foot outside shoulder in each direction. Grand Avenue would need to be widened to accommodate the flyover ramp and substantial additional right-of-way would be required for this widening. The ramp has the potential to be re-stripped for two lanes in each direction should the need arise in the future.

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### **Northwest Area Transportation Study, Draft Executive Summary**

Author: Parsons Brinckerhoff  
Client: Maricopa Association of Governments (MAG)  
Date: July 2003

#### **Purpose:**

This study was initiated as one of three area studies to provide background information and input that would be used in the creation of the MAG Regional Transportation Plan (RTP). The area of study within this report is in the northwest portion of the Maricopa County region.

The goal of the Northwest Area Transportation Study was to identify transportation needs within the study area and to develop a prioritized list of major transportation projects to address those needs. The study developed recommendations for project priorities based on their anticipated contribution to the long-term effectiveness of the regional system.

## **Results:**

The criteria used in the assessment and ranking of projects placed an emphasis on projects that carry major volumes of regional traffic, close critical gaps, or offer alternatives to single occupant travel in heavily congested corridors.

The Northwest Area Transportation Study identified Grand Avenue as an Arterial Roadway Corridor, subject to further study to identify additional project needs. The list of key recommended projects from the Northwest Area Transportation Study, not all of which are funded in the RTP, includes:

- Grade separations or improvements for Northern Avenue, 51<sup>st</sup> Avenue and 35<sup>th</sup> Avenues.
- High capacity transit service on Grand Avenue, 59<sup>th</sup> Avenue, Glendale Avenue, and Bell Road.
- Improvements to I-17, I-10, SR 101L and SR 303L (widening & HOV connections).
- Northern Avenue Superstreet.
- Wickenburg Bypass – long sought commercial traffic bypass of Wickenburg downtown.
- Peoria Avenue crossing of the Agua Fria River.

Recommendations for major transit projects or services were taken from the High Capacity Transit Study and Regional Transit System Study that were conducted concurrently with the Northwest Area Transportation Study.

## **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

Additional key projects identified for further study:

- Grand Avenue MIS – currently underway to further refine the corridor.
- Northern Avenue Superstreet – City of Glendale concept for enhancing east-west capacity.
- BNSF – downtown Phoenix to SR 303L commuter rail / bus rapid transit.
- Glendale Avenue – light rail transit extension.
- 59<sup>th</sup> Avenue – Bell Road to I-10 West light rail transit / bus rapid transit.

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## **Regional Transit System Study**

Author: LKC Consulting Service, Inc.  
Client: Regional Public Transportation Authority (RPTA) – Valley Metro  
Date: July 2003

**Purpose:**

The Regional Transit System Study was developed to investigate a multi-modal transit plan for Maricopa County and northern Pinal County to be implemented by year 2030. The study evaluated all modes of public transit other than fixed-guideway / high capacity transit to determine how best to meet current and future transportation needs.

**Results:**

The study was intended to review all needs for transit service in the Phoenix region. It contained a number of different service types designed to serve different markets, and included:

- Local transit service
  - Fixed route local service
  - Circulator / shuttle service
- Rural / non-fixed route service
- Regional transit service
  - Regional local routes
  - Arterial regional service
  - Expressway regional service
  - Commuter vanpool service
- Paratransit
  - ADA – paratransit
  - Senior paratransit
- Transit Demand Management (TDM)
- Capital projects

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The study did find that there is a need in 2030 for additional transit along the Grand Avenue corridor, especially in the cities of Phoenix and Glendale. In terms of local transit in 2030, Grand Avenue was included as a local fixed route with one park-and-ride (Glendale Avenue) and two transit centers (Glendale Avenue and Peoria Avenue) between I-17 and SR 101L. Grand Avenue itself was also identified as a regional expressway route both within and outside our study area.

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**High Capacity Transit Plan, Executive Summary**

Author: IBI Group  
Client: Maricopa Association of Governments (MAG)  
Date: June 30, 2003

**Purpose:**

The High Capacity Transit Plan presents a network of new transit services designed to meet the growing travel demand in Maricopa County. This long-range study considered projected travel demand in the MAG region with a forecast horizon year of 2040, at which time the MAG region is expected to have a population greater than 7 million residents. The recommendations contained in the report were to be incorporated into the development of the Regional Transportation Plan (RTP). The report focused on identifying proven transit technologies that are capable of meeting the long-range and short-range levels of travel demand within Maricopa County.

**Results:**

The High Capacity Transit Study reviewed the entire MAG region and indicated potential routes for services including commuter rail, light rail transit, dedicated bus rapid transit, and express bus rapid transit. It includes three commuter rail lines along existing Union Pacific Railroad and Burlington Northern Santa Fe (BNSF) Railroad routes, over ten potential extensions of the Valley's light rail system (or installation of dedicated bus rapid transit), and express bus service on every major freeway, including SR 101L, 202L and 303L.

The report represents the culmination of a process that identified 29 potential high capacity transit corridors throughout Maricopa County. The study further refines the corridors and evaluates them against each other to determine which corridors were best suited to serve the growing demand for transportation capacity in Maricopa County.

The immediate action items identified by the report are:

- Refined prioritization of corridors in the RTP.
- Relocation of the BNSF freight facilities.
- Begin negotiations with Union Pacific.
- Develop a specific commuter rail network plan.
- Perform detailed Major Investment Studies on early implementation corridors.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The report considers three main types of high capacity transit: commuter rail, light rail and bus rapid transit. With respect to Grand Avenue and the facilities it comes in contact with between 19<sup>th</sup> Avenue and SR 101L, the major topic to note is that the BNSF line that parallels Grand Avenue is included as a potential commuter rail corridor. In addition, both Glendale Avenue and 59<sup>th</sup> Avenue are included as potential light rail transit (LRT) or dedicated bus rapid transit (BRT) routes, with a major connection proposed at the six-legged intersection of Grand Avenue, Glendale Avenue and 59<sup>th</sup> Avenue. The study also includes express BRT along SR 101L.

Of particular interest to the Grand Avenue corridor is the following:

“BNSF has been considering the relocation and consolidation of several freight rail facilities in downtown Phoenix to sites north of the BNSF mainline north of the existing intermodal facility in El Mirage.”

The “Phasing and Prioritization” section of the report includes six (6) corridors, broken down by Short-Term (0 – 15 years), Medium-Term (15 – 30 years) and Long-Term (30 – 40 years), that will likely have an impact on the Grand Avenue Major Investment Study:

- BNSF (Downtown Phoenix to Bell Road), Short-Term
- Glendale Avenue (I-17 to SR 101L), Short-Term
- 59<sup>th</sup> Avenue (Glendale Avenue to I-10 West), Medium-Term
- BNSF (SR 303L to Bell Road), Medium-Term
- 59<sup>th</sup> Avenue (Bell Road to Glendale Avenue), Long-Term
- Bell Road (59<sup>th</sup> Avenue to SR 303L), Long-Term

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### **Factors Influencing Light Rail Station Boardings in the United States, Preliminary Draft**

Author: Michael Kuby, Anthony Barranda, and Christopher Upchurch  
(Department of Geography, Arizona State University)  
Client: Unknown – research paper  
Date: January 21, 2003

#### **Purpose:**

The purpose of this research paper was to investigate the factors that contribute to higher light rail ridership. The paper notes that critics question how successful light rail can be in low-density, automobile-oriented, polycentric US cities with smaller downtowns while proponents counter that sufficient numbers of homes and workplaces have convenient access to stations via walking, park-and-ride, or bus to develop feasible corridors connecting major residential areas with suburban concentrations of employment and the central business district (CBD).

#### **Results:**

The paper looked at data on average weekday boardings for the year 2000 at 268 stations in nine US cities representing a variety of urban settings. The results showed the importance of land use and accessibility. Employment, population, and percent renters within walking distance, as well as bus lines, park-and-ride spaces, and centrality were all significant.

The paper found that proponents hope light rail will gain moderate ridership, marginally reduce congestion and air pollution, promote infill development, and provide an alternative with higher capacity than buses along busy corridors. In addition to the factors mentioned above, the paper also found that proximity to international borders and airports is a relevant factor, as well as the location of terminal and transfer stations and the type of climate the facility will be located in.

## **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

No part of Grand Avenue is included in the study area for this report, and thus none of the information is directly relevant.

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### **Grand Avenue Northwest Corridor Study; SR 303L to SR 101L, Final Executive Summary**

Author: URS Corporation  
Client: Maricopa Association of Governments (MAG)  
Date: January 2003

#### **Purpose:**

The Grand Avenue Northwest Corridor Study encompasses an 11.5-mile segment of Grand Avenue (US 60) between SR 303L and SR 101L, passing through the communities of Surprise, Peoria, El Mirage, Youngtown, Sun City West, and Sun City. The purpose of the study is to determine the long-term needs (year 2025 horizon) of the highway corridor and establish a plan for meeting those needs. Although the primary focus of the study was on highway needs, consideration was also given to transit, pedestrians, bicyclists, electric carts and special needs of the elderly and physically challenged.

#### **Results:**

Long-term roadway needs were identified through consultation with the public and agency stakeholders as well as through analyses and field review by the project team. The following long-term needs and concerns were identified:

- Widening Grand Avenue to six (6) lanes and adding some turn lanes at intersections would enable most intersections to operate satisfactorily at LOS D.
- Provide grade separations with the railroad to serve the two major hospitals in the area.
- The safety and appearance of the drainage channel along the south side of Grand Avenue east of Bell Road was identified as a concern. Landscaping and lighting were also identified.
- Signal timing and the absence of modern traffic control and ITS.
- The absence of continuous arterial streets in the general study area.
- There are no provisions for pedestrians along Grand Avenue except in front of some commercial areas.
- Crossing Grand Avenue and the railroad is very difficult due to the distance and the absence of designated walkways.
- Current transit service in the area is limited to dial-a-ride systems operated in each community, with very limited service by the metropolitan bus service primarily due to lack of funding.

The action elements of the recommendations were grouped into three priority categories.

- Priority One
  - Construct Grand Avenue as a six-lane roadway with raised medians and where possible 10-foot shoulders (available for bicyclists). This requires the development of a DCR and environmental documentation. Also includes signal-timing study, railroad crossing evaluation, and ITS “SMART” Corridor.
  - Conduct a study to determine the most appropriate action to provide emergency vehicle service across the railroad to the two major hospitals.
  - Further evaluate the proposed El Mirage / Thompson Ranch Road grade separation and extension southward.
  - Identify a funding source for the advancement of the transit system.
- Priority Two
  - Once funding is identified, develop and integrate dial-a-ride system with extension of the metropolitan bus system along arterials.
  - Local communities should encourage and financially participate in the development of the non-motorized transportation and recreation corridors along the rivers.
- Priority Three
  - Further studies should be conducted to help further define the four additional grade separations that were suggested.

The study also generated a number of other recommendations within the corridor including transit improvements, pedestrian improvements, bicycle improvements and electric cart improvements. Three potential grade separations were also included, but would need detailed engineering, cost analyses, and impact assessments before a final decision is made.

#### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The Study identified commuter rail as a potential future option. In addition, ITS implementation on Grand Avenue as a “SMART” Corridor from downtown Phoenix to SR 303L is recommended.

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#### **Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study**

Author: Pharos Corporation  
Client: Burlington Northern Santa Fe (BNSF) Railroad  
Date: 2003

**Purpose:**

The Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study was developed with two sets of objectives in mind, one pertaining to objectives of the general public and the other pertaining to objectives of BNSF. The study presented information on existing train traffic in the corridor as well as periods of high congestion. It also investigates the possible relocation of the Mobest (19<sup>th</sup> Avenue and I-10) and Intermodal Hub (Grand Avenue and Glendale Avenue) to an area north and west of the El Mirage Automotive Facility.

**Results:**

All results presented in the Grand Avenue Corridor BNSF Relocation Analysis and Commuter Rail Study are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The study found that Maricopa County had the largest population growth (numeric change) of the ten largest gaining counties between April 2000 and July 2001. It also noted that along Grand Avenue, the duration of congestion during peak periods was above 60 minutes at most of the six-leg intersections along which the BNSF railroad travels.

The study presented the existing train traffic between El Mirage and Glendale and Glendale and Phoenix for all hours of the day and each day of the week, including inbound and outbound trains during the AM and PM peak periods. It then presented a possible solution to the study's objectives that included relocating both BNSF yards northwest of their current location. Based on this relocation, the BNSF would be able to eliminate all inbound and outbound trains along Grand Avenue during the AM and PM peak periods.

Some of the benefits presented in the study include:

- Provide a potential corridor for commuter rail.
- Reduction in crossings blocked during peak commuting periods.
- Improved travel along Grand Avenue and the possibility of signal coordination.
- Reduction in vehicle / train crashes.
- A reduced need for expensive grade separations.

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**West Valley Multi-Modal Transportation Corridor Plan**

Author: Entranco, Inc.  
Client: Maricopa Association of Governments (MAG)  
Date: July 30, 2001

**Purpose:**

The primary purposes of this study are to identify a vision and a master plan for the implementation of a network of multi-modal trail types within the New River and Agua Fria River Corridor. This will include defining special acquisition needs and developing an implementation strategy for the development of the entire trail system.

**Results:**

The study developed a 42-mile long potential trail system that incorporates elements suitable for bicyclists, pedestrians, equestrians, physically challenged persons and other non-motorized trail uses. It spans from its northern-most point in Anthem at the New River Gateway Node to its southern-most point along the Gila River in Goodyear at the Tres Rios Recreations Transition.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

There is only one location at which the New River and Lower Agua Fria River Corridor comes in contact with our study area, and it is identified in this report as a conflict area, where Grand Avenue and the BNSF Railroad intersect with the New River. At this location, the New River and Lower Agua Fria River trail will require an underpass facility. The report notes that the local jurisdiction (City of Peoria) will need to coordinate efforts with several agencies in order to develop a trail underpass facility at this location. All other recommendations within this report fall outside our study area.

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**The Grand Vision: Grand Avenue Image Improvement Study, Final Report**

Author: Todd & Associates, Inc.

Client: City of Glendale

Date: May 2001

**Purpose:**

The Grand Avenue Image Improvement Study was initiated to identify design opportunities and concepts for improving Grand Avenue's overall visual image throughout the City of Glendale. The project had three main objectives:

1. To identify community issues, needs, constraints and opportunities relative to the existing and desired image of the Grand Avenue corridor.
2. To identify and evaluate potential design ideas and improvement alternatives.
3. To formulate a recommendation for a comprehensive plan and multi-year phased program to improve Grand Avenue's image and function.

## **Results:**

The study was broken down into five main areas; Analyze, Understand, Ideas, Select, and Implement. Within the Ideas area, four key elements were looked at through which the recommendations were made. These included Visual / Aesthetic, Land Use and Economic Development, Transportation, and Historic and Cultural Resources. The results of the study were broken down into three types: Policy, Program and Physical.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

#### *Policy*

- Adopt design guidelines for the Grand Avenue Corridor
- Adopt a public art master plan for Grand Avenue.
- Establish an improvement district along sections of the Grand Avenue Corridor to highlight the importance of Grand Avenue, identify its boundary, and provide additional marketing, renovation, and maintenance funds.

#### *Program*

- Schedule regular trash and debris pickup along Grand Avenue.
- Establish a working relationship with the railroad.
- Collaborate with ADOT to visually enhance the road improvements and overpasses.

#### *Physical*

- Install landscape treatments along the edges of Grand Avenue, such as street trees and shrubs. Landscape the medians along Grand Avenue.
- For continuity along the Corridor, develop uniform streetlights, traffic controls, and light posts, with the possibility of incorporating art into these elements.
- Create a larger bridge, or deck, at 59<sup>th</sup> Avenue and Glendale to provide greater pedestrian connections across Grand Avenue to the east and west sides of downtown Glendale.
- Provide pedestrian-oriented improvements enhancing convenience, comfort, safety, and accessibility. Provide a continuous detached sidewalk along the east side of Grand Avenue (minimum width of six feet).
- Build pedestrian overpasses at strategic locations along Grand Avenue. Possible locations would be at the Palmaire and Lamar alignments where Grand Avenue will be partially depressed.
- Make all bus stops ADA accessible and provide permanent shade, seating and trash containers.
- Preserve buildings that relate to the auto-influenced development of the post war period such as motor courts, gas stations, etc., as well as buildings and landmarks that relate to Glendale's agricultural past such as farmhouses and outbuildings.

## **MAG ITS Strategic Plan Update**

Author: Kimley-Horn and Associates, Inc.  
Client: Maricopa Association of Governments (MAG)  
Date: April 2001

### **Purpose:**

The purpose of this study was to update the original ITS Strategic Plan completed in 1995. Both the original and the update provide guidance for the region on consistent implementation of ITS (Intelligent Transportation Systems) technologies along freeways and major arterials, including the use of variable message signs, closed-circuit television cameras, ramp meters and detectors all integrated by a regional communications network.

### **Results:**

All results presented in the MAG ITS Strategic Plan Update are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The following recommendations were included as part of this report:

- Regional ITS Architecture
  - USDOT-adopted ITS standards should be used where available.
  - MAG should consider ITS as a planning element in all future transportation planning activities.
- ITS Implementation Plan
  - Locally significant ITS projects should address local needs and support regional objectives.
  - All ITS projects implemented in the MAG region should be consistent with the regional architecture that has been adopted by the MAG ITS Committee.
  - The MAG ITS Committee should request additional funding from the MAG Regional Council to assist in implementing the projects in the ITS Implementation Plan.

Within the MAG ITS Strategic Plan, Grand Avenue is designated as a “SMART” Corridor.

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## **MAG Park-and-Ride Study, Final Report**

Author: KJS Associates, Inc.  
Client: Maricopa Association of Governments (MAG)  
Date: January 2001

**Purpose:**

In January 2000, MAG embarked on this study to identify a regional system of park-and-ride lots to support the regional express bus system, carpooling, and vanpooling.

**Results:**

The recommended system includes ten sites for near-term development (five years) and ten sites for long-term development. Additional recommendations address design guidelines and criteria for lot development, a management and operations plan for the lots, and programming and implementation strategies.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

Two sites were identified that are in close proximity to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L. The first site, located at 91<sup>st</sup> Avenue and Olive, located approximately 2 miles west of Grand Avenue. The park-and-ride lot is programmed for the near-term and will have a capacity of 442 parking stalls.

The second site identified is located at 59<sup>th</sup> Avenue and Myrtle Avenue, located approximately ¼ mile north of Grand Avenue. The park-and-ride lot is programmed for the long-term and will have a capacity of 613 spaces (including 70 existing spaces).

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**Regional Off-Street System (ROSS) Plan**

Author: RBF Consulting  
Client: Maricopa Association of Governments (MAG)  
Date: January 2001

**Purpose:**

The purpose of this report was to provide guidance to MAG member agencies in creating an off-street non-motorized transportation system. The study focuses on potential corridors that form the backbone of a regional off-street system of routes. The study identifies issues associated with paths/trails and non-motorized transportation, identifies corridors that could be used for paths/trails in the MAG region and provides design guidelines for paths/trails.

**Results:**

All results presented in the Regional Off-Street System Plan are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The key purpose to this report was to ensure the residents of the MAG region have safe, convenient access to an attractive, shared-use, non-motorized transportation system that provides a viable alternative to driving for local trips. The report contains several recommendations that MAG will either take action on, or support, depending on the agency in charge. Many of the recommendations deal with policy issues.

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### **Pedestrian Plan 2000**

Author: The Planning Center  
Client: Maricopa Association of Governments (MAG)  
Date: December 1999

#### **Purpose:**

In 1998, the MAG Regional Council adopted a work program that specifically directed the production of an update to the 1993 Pedestrian Plan. This update outlines programs and actions to promote better pedestrian accommodation throughout the Region's transportation system.

#### **Results:**

All results presented in the Pedestrian Plan 2000 are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The key purpose to this report was to:

1. Provide guidance for future targeted activities and programs that will result in increasing the number of people in the Region who walk instead of drive single-occupancy vehicles (SOV).
2. Identify potential capital investment projects that will contribute to an expanded, safer, and improved environment for walking in the Region.
3. Identify actions and policies that will help the group use existing and potential opportunities and bypass existing and potential constraints to increasing the number of people who walk instead of drive SOV in the Region.
4. Provide guidance for evaluating potential projects on a regional basis.

The report contains several recommendations that MAG will either take action on, or support, depending on the agency in charge. Many of the recommendations deal with policy issues.

## **Grand Avenue Major Investment Study (MIS)**

Author: URS Greiner Woodward Clyde  
Client: Arizona Department of Transportation (ADOT)  
Date: September 1999

### **Purpose:**

The purpose of this study was to refine and evaluate the options selected in the previous report (*Grand Avenue Corridor Study; Beardsley Canal to 7<sup>th</sup> Avenue / Van Buren Street*) and to select a preferred option. As compared with the previous report, the focus of this study was narrowed to the 12 miles between I-17 and SR 101L. After the conclusion of this study, the preferred option was to move into engineering and environmental documentation, final design and then construction.

### **Results:**

All results presented in the Grand Avenue Major Investment Study are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The report concluded with a recommendation to use portions of both Option 4 (alternating grade separations) and Option 5 (limited expressway). The Grand Avenue Steering Committee adopted the following in August 1999:

“The Grand Avenue Steering Committee recommends that Option 4 with modifications be implemented in the Grand Avenue Corridor. The modifications to Option 4 are to use Option 5 concepts at the 43<sup>rd</sup> / Camelback intersection and at the 59<sup>th</sup> / Glendale intersections. This recommendation allows Grand Avenue to be further upgraded to expressway standards by elimination of access and construction of additional grade separations along Grand Avenue as indicated in the MAG Long-Range Plan.”

The study found that both options would meet the project objective of eliminating six-legged intersections, but that Option 4 would do far more to eliminate at-grade railroad crossings and would cost less.

The final recommendations included grade separations at the following eight intersections, with six from Option 4 and two from Option 5:

1. 27<sup>th</sup> Avenue / Thomas Avenue (Option 4)
2. 91<sup>st</sup> Avenue / SR 101L (Option 4)
3. 51<sup>st</sup> Avenue / Bethany Home Road (Option 4)
4. 43<sup>rd</sup> Avenue / Camelback Road (Option 5)
5. 55<sup>th</sup> Avenue / Maryland Avenue (Option 4)
6. 75<sup>th</sup> Avenue / Olive Avenue (Option 4)

7. 67<sup>th</sup> Avenue / Northern Avenue (Option 4)
8. 59<sup>th</sup> Avenue / Glendale Avenue (Option 5)

The recommendations eliminate all existing seven six-legged intersections and provide four new grade separations with the railroad. Three of the grade separations occur on Grand Avenue itself.

The present study is being conducted as a follow up to this MIS.

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## **Grand Avenue Major Investment Study (MIS), Environmental Overview**

Author: Logan Simpson Design, Inc.  
Client: Arizona Department of Transportation (ADOT)  
Date: September 1999

### **Purpose:**

The purpose of this environmental overview was to describe the existing environment of the Grand Avenue (I-17 to SR 101L) Major Investment Study (MIS) corridor based on available data, and to identify the potential environmental concerns for any future roadway improvements. The Environmental Overview describes the study corridor in terms of its socioeconomic, physical and natural, and cultural resource context. The study corridor includes portions of the cities of Phoenix, Glendale and Peoria.

### **Results:**

All results presented in the Environmental Overview are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

Existing land uses within the Grand Avenue study corridor include industrial, commercial, residential, agricultural, public / quasi-public, and undeveloped. In general, the percentage of elderly and mobility disability populations within the study corridor is comparable to those populations represented in Maricopa County. Other communities of concern, including minority, low income and female head of household represent a greater population percentage within the study corridor when compared to Maricopa County percentages.

Urban and suburban environments in the Phoenix metropolitan area support a variety of native wildlife species adapted to urban conditions. These wildlife species utilize minimal habitat by vegetation in home and commercial landscaping, parks, agricultural fields, and roadway plantings. The Arizona Game and Fish Department indicates that two Wildlife species of Special Concern in Arizona (WSCA), the black-bellied whistling duck and the roundtail chub, have been documented as occurring within two miles of the study area. Both species could occur along surrounding waterways, including the Grand Canal.

The Grand Canal is not designed to carry storm flows; however, this canal conveys storm water and may be jurisdictional. Further investigation will be necessary to determine the Section 404 status of this facility. No unique farmlands exist within the corridor, through most lands within the study corridor are classified as prime farmland.

The Grand Avenue study corridor contains a total of 118 hazardous materials sites. Because of the substantial number of listed hazardous material sites within the corridor, an Initial Site Assessment should be conducted to confirm or deny the presence of hazardous materials at specific locations.

Cultural resources identified within the study corridor by previous inventories were summarized. A total of 96 sites have been previously documented within the study corridor. The majority of these sites are historic habitations or other historic structures. The area of highest cultural resource density is located along the southeastern portion of the corridor, with other areas of high density centered along the intersections of Grand Avenue with Glendale Avenue, and Grand Avenue with 83<sup>rd</sup> Avenue.

Identified cultural resources include prehistoric villages, compounds, pit houses, platform and trash mounds, a ball court, burials, storage and roasting pits, canals, agricultural features, artifact scatters, and sites of unknown types. Historic sites are also present within the study corridor. These include structures, foundations, farmhouses, a historic district, and the Grand Avenue Streetcar System.

In addition, four structures within the corridor are listed on the National Registrar of Historic Places (NRHP). Nineteen historic habitations, 21 structures / foundations, the Glendale Municipal Water Works, and one historic district in Peoria are eligible or potentially eligible for listing on the NRHP.

There are a number of Section 4(f) resources within the study area. No Section 6(f) evaluation was undertaken within this study.

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### **Grand Avenue Corridor Study; Beardsley Canal to 7<sup>th</sup> Avenue / Van Buren Street**

Author: URS Greiner  
Client: Maricopa Association of Governments (MAG)  
Date: May 1998

#### **Purpose:**

The purpose of this study was to investigate available options for the improvement of the entire 26-mile length of Grand Avenue from Beardsley Canal west of Sun City West to 7<sup>th</sup> Avenue and Van Buren Street in downtown Phoenix. In total, eight options were investigated that ranged from removal of Grand Avenue from six-legged intersections, to transit along Grand Avenue with reduced all-purpose traffic lanes, and to a full freeway along Grand Avenue.

**Results:**

All results presented in the Grand Avenue Corridor Study are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

**Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

Three options were carried forward for additional study in this report including alternating grade separations, limited expressway and full expressway. These options were considered from I-17 to SR 101L and include interchanges at both of these freeways with Grand Avenue. Included in this study are graphical representations of potential connections to I-17 and SR 101L, as well as conceptual layouts for grade separations. While the report does not present a recommendation as to which option is preferred over the others, it does lay down a framework for additional study.

The study notes that the next step will be to prepare a Major Investment Study (MIS) and an environmental document in compliance with US Department of Transportation procedures to maintain eligibility for federal funds. It goes on to state that the MIS process should fully incorporate highway and transit alternatives, as each of the three options presented in this report included provisions for express bus service, light rail transit, or both. The MIS as recommended in this study has subsequently been completed and is reviewed separately (*Grand Avenue Major Investment Study, September 1999*).

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**Pedestrian Area Policies and Design Guidelines**

Author: Logan Simpson & Dye  
Client: Maricopa Association of Governments (MAG)  
Date: October 1995

**Purpose:**

To better understand the needs and expectations of pedestrians in this region, the Maricopa Association of Governments (MAG) initiated 15 local case studies. This report compiles and presents the data collected.

In 1993, the MAG Regional Council formed the Pedestrian Working Group. The Working Group developed this document to provide a source of information and design assistance to support walking as an alternative transportation mode.

**Results:**

All results presented in the Pedestrian Area Policies and Design Guidelines are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

A total of 19 recommendations are included in the study. The most relevant to the Grand Avenue corridor are listed below:

- Appoint a Pedestrian Coordinator to represent the needs of the pedestrian in all planning and construction projects.
- Use the Manual of Uniform Traffic Control Devices (MUTCD) Pedestrian Warrant system to help determine the need for traffic signals and adequate time to cross streets.
- Assist in achieving air quality standards by reducing trips and cold starts through providing better and more functional pedestrian facilities, walkable routes to work and school, and access to transit.
- Provide walkways adjacent to roadways, but separate them from the curb whenever possible with landscaping, a bike lane, or on-street parking (on streets other than arterials and roads of regional significance).
- Provide shade and sufficient seating at transit stops.
- An update to these guidelines has been proposed for FY 2005.

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### **Grand Avenue Bus Rapid Transit (Summary of Planning Level Concept)**

Author: Unknown – Transmitted via email from the City of Glendale, to MAG, to HDR.  
Client: Unknown  
Date: Unknown

#### **Purpose:**

The purpose of this report is to present a basic summary of the bus rapid transit concept for Grand Avenue that was first developed as part of the West Valley Scenario and has been incorporated into the Northwest Area Transportation Study.

#### **Results:**

All results presented in the Grand Avenue Bus Rapid Transit study are related to Grand Avenue between 19<sup>th</sup> Avenue and SR 101L, and are discussed below.

### **Information Related to Grand Avenue, 19<sup>th</sup> Avenue to SR 101L:**

The bus rapid transit concept on Grand Avenue is a unique hybrid option. It will focus on providing express bus service during peak periods, with travel in both directions, as well as provide limited bus service for the entire day.

It will include the following elements with an estimated capital and operating cost of \$122.5 million:

- On-line Park-and-Ride lots
- On-line stations (transit centers)
- Queue hoppers
- Bus pullouts
- Signal preemption
- Operations

# APPENDIX B

## Environmental Databases

Databases that were consulted include:

1. Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS)
2. CERCLIS sites designated “No Further Remedial Action Necessary” (CERCLIS-NFRAP)
3. National Priority List (NPL)
4. Proposed National Priority List Sites (Proposed NPL)
5. National Priority List Deletions (Delisted NPL)
6. RCRA Corrective Action Activity list (CORRACTS)
7. Resource Conservation and Recovery Information System (RCRIS)
8. RCRIS Treat, Store and Dispose facilities list (RCRIS-TSD)
9. RCRIS Large Quantity Generators list (RCRIS-LQG)
10. RCRIS Small Quantity Generators list (RCRIS-SQG)
11. Emergency Response Notification System (ERNS)
12. Sites and potential sites within the jurisdiction of the Superfund Program Section (AZ SPL)
13. State (of Arizona) Hazardous Waste Sites (SHWS)
14. Leaking Underground Storage Tank Incident Reports (LUST)
15. Underground Storage Tank database (UST)
16. Water Quality Assurance Revolving Fund list (WQARF)
17. Federal Facility Index System (FINDS)
18. PCB Activity Database (PADS)
19. Toxic Chemical Release Inventory System (TRIS)
20. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
21. Toxic Substance Control Act (TSCA) Tracking System (FTTS)
22. Arizona Department of Environmental Quality Chemical Spills and Incidents list (AZ Spills)
23. (Arizona) Water Treatment Facilities list (WWFAC)
24. Drywells databases and various Brownfields databases (DEUR and VEMUR sites)

Additional ASTM Supplemental databases consulted include:

25. Directory of Solid Waste Facilities (SWF/LF)
26. Underground Storage Tanks on Indian Land (INDIAN UST)
27. Leaking Underground Storage Tanks on Indian Land (INDIAN LUST)
28. Consent Decrees (CONSENT)
29. Superfund (CERCLA), Records Of Decisions (ROD)

30. Hazardous Materials Information Reporting System (HMIRS)
31. Material Licensing Tracking System (MLTS)
32. Mines Master Index File (MINES)
33. Liens
34. Federal Superfund Liens
35. Brownfields Sites
36. Indian Reservations
37. Department of Defense Sites (DOD)
38. RCRA Administrative Action Tracking System (RAATS)
39. Toxic Substances Control Act (TSCA)
40. Section 7 Tracking Systems (SSTS)
41. List of Aboveground Storage Tanks (AST)
42. Arizona Department of Defense Sites (AZ DOD)
43. Arizona Airs Database (AZ AIRS)

# **APPENDIX C**

## **Previously Recorded Cultural Resources**

Previously Recorded Cultural Resources				
Site / Property No.	Name / Description	Address / Location	Eligibility Recommendations	Reference
AZ T:12:14 (ASM)	Prehistoric Artifact Scatter	51st / Bethany Home	Unknown	Grafil et. al. 2000
AZ T:12:10 (ASM);				
GA-A1	Las Colinas- large Hohokam site	I-17 to 27th Ave., Van Buren to Thomas	Eligible	Janus Associates, Inc. 1986; Curtis 1989
	Prehistoric Canal	~1/2 mile to NE in N ½ of Section 25, T2N, R2E	Not evaluated	Curtis 1989; Turney Map
	Prehistoric Canal	N ½ of Section 22, T2N, R2E	Not evaluated	Curtis 1989; Turney Map
	Prehistoric Canal	SW ¼ of Section 16, T2N, R2E	Not evaluated	Curtis 1989
	Prehistoric Canal	Within ¼ mile to NE in SE ¼ of Section 31, T2N, R2E	Not evaluated	Curtis 1989; Turney Map
	Prehistoric Canal	Within ¼ mile to NE in W ¼ of Section 31, T2N, R2E and NE ¼ of Section 36, T2N, R2E	Not evaluated	Curtis 1989; Turney Map
	Prehistoric Canal	Vicinity of Grand Ave. and 20th Drive	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and 22nd Avenue	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and 27th Ave	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and 28th Ave	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and 29th Ave.	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and east of 31st Ave.	Not evaluated	SHPO map
	Prehistoric Canal	Vicinity of Grand Ave. and west of 31st Ave.	Not evaluated	SHPO map
	Prehistoric Canal	Grand Ave. and east of 35th Ave	Not evaluated	SHPO map
	Prehistoric Canal	Grand Ave. and 38th Ave	Not evaluated	SHPO map
	Historic Maricopa Canal	Intersection of Sections 25, 26, 35, 36, of T2N, R2E (portion crossing Grand Avenue abandoned between 1904 and 1915)	Not evaluated	Curtis 1989
	Historic Grand Canal	N½ of Section 26, T2N, R2E	Not evaluated	Curtis 1989
	Peoria Central School	10304 N. 83rd Avenue	Listed (1985)	NRHP Database
	Beet Sugar Factory	5243 W. Glendale Avenue	Listed (1978)	NRHP Database
	Glendale Woman's Club Clubhouse	7032 N. 56th Avenue	Listed (1989)	NRHP Database
GA-24	Peoria High School Admin. Building	11152 N. 83rd Ave., Peoria	Unknown	Janus Associates, Inc. 1986
GA-25	Peoria High School Building	11200 N. 83rd Ave., Peoria	Eligible	Janus Associates, Inc. 1986

Previously Recorded Cultural Resources				
Site / Property No.	Name / Description	Address / Location	Eligibility Recommendations	Reference
GA-10	PWA State Headquarters Building	1824 W. McDowell	Eligible	Janus Associates, Inc. 1986
GA-11	A.E. Sherid Boarding House	2010 W. Palm Lane	Unknown	Janus Associates, Inc. 1986
	House- Ranch Style	2601 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1951)	2607 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1951)	2611 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1955)	2617 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1949)	2621 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1949)	2627 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1949)	2631 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	House- Ranch Style (1949)	2637 W. Verde Lane	Not Eligible	Grafil et. al. 2000
	Alhambra Court (1951)	2830 Grand Ave.	Not Eligible	Grafil et. al. 2000; Woodward 1993
	Byron Jackson Co. Building (1951)	2906 Grand Ave.	Not Eligible	Grafil et. al. 2000; Woodward 1993
	House- Spanish Colonial	3040 27th Ave	Not Eligible	Grafil et. al. 2000
GA-15; 31	Josiah Harbert Store Building (1892)	3138 Grand Ave.	Eligible	Janus Associates, Inc. 1986; Woodward 1993
GA-13	Miller and Johns Co. Warehouse (1954)	3301 Grand Ave.	Unknown	Janus Associates, Inc. 1986; Woodward 1993
GAC-09	House - Johnson Place Plat	4107 W. Camelback Road	Not Eligible	Grafil and Abele 2001
GA-12; 35	Harry Kay Farm House (1910-1916)	4204 N. 35th Avenue	Potentially Eligible	Janus Associates, Inc. 1986; Woodward 1993
	Workers Cabin- No form completed; Demolished; (1918-1930)	4360 N. Grand Avenue	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-10	House; Vee Gee Court (1925)	4460 N. Grand Ave	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-11	Roderick Farm House (1918-1930)	4468 Grand Avenue	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-04	House - Johnson Place Plat (1938)	4802 N. 41st Drive	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-05	House - Johnson Place Plat (1938)	4806 N. 41st Drive	Not Eligible	Grafil and Abele 2001; Woodward 1993
39	Hircock / McClure Farm House (1900-1910)	4813 N. 42nd Ave.	Not Eligible; Potentially Eligible	Grafil et. al. 2000; Woodward 1993
GAC-06	House - Johnson Place Plat	4814 N. 41st Drive	Not Eligible	Grafil and Abele 2001
GAC-01	House- Rundell Tract, McClure Farm (1928-1930)	4819 N. 42nd Ave	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-02	House- Rundell Tract, McClure Farm (1928-1930)	4823 N. 42nd Ave	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-03	House- Rundell Tract, McClure Farm (1928-1930)	4827 N. 42nd Ave	Not Eligible	Grafil and Abele 2001; Woodward 1993

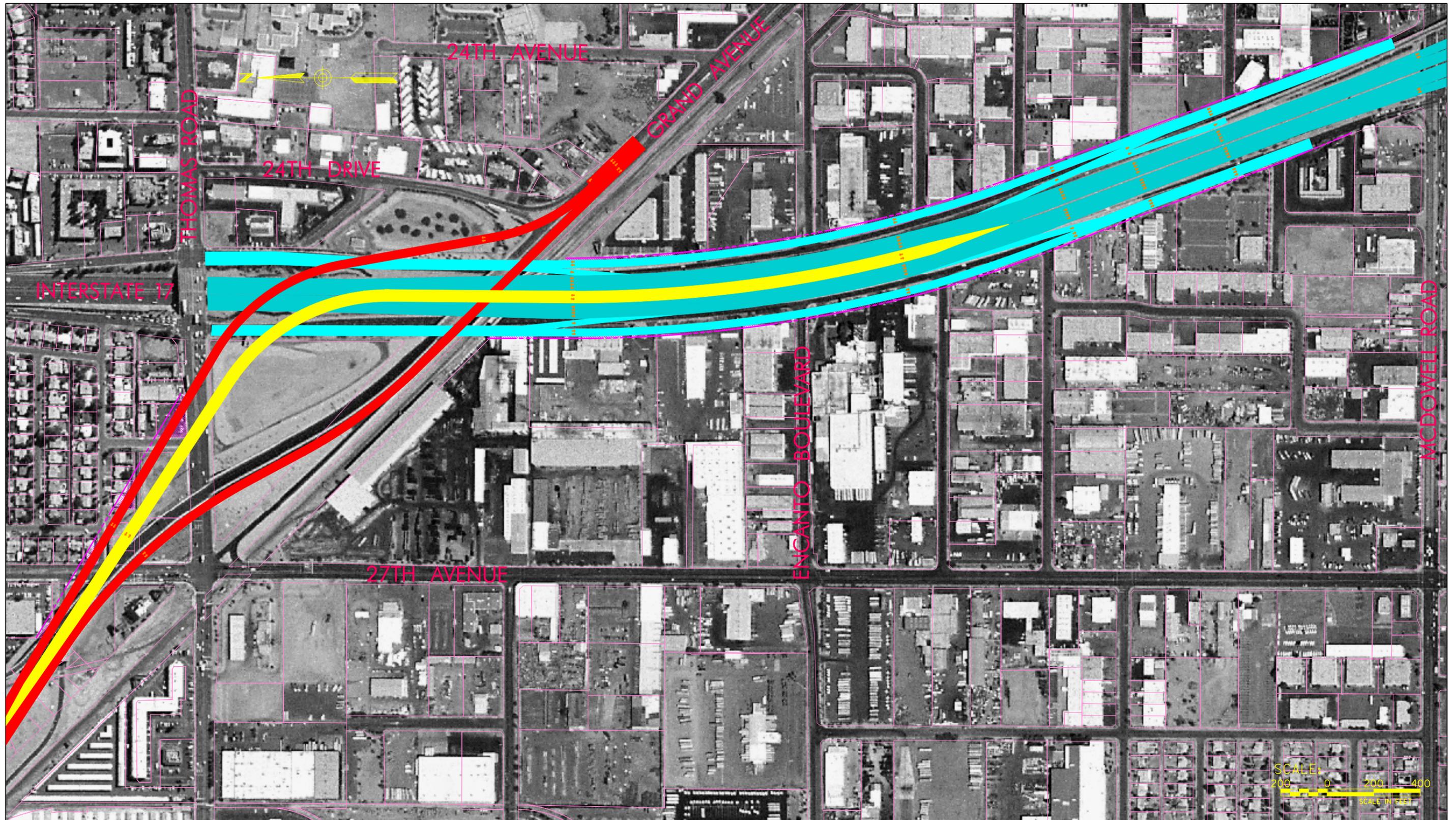
Previously Recorded Cultural Resources				
Site / Property No.	Name / Description	Address / Location	Eligibility Recommendations	Reference
43	House- No form completed; Demolished; (1928-1930)	4837 N. 42nd Ave	Not Eligible	Grafil and Abele 2001; Woodward 1993
GAC-07	House - Johnson Place Plat	4905 N. 41st Drive	Not Eligible	Grafil and Abele 2001
GAC-08	House - Johnson Place Plat	4909 N. 41st Drive	Not Eligible	Grafil and Abele 2001
	House- Vernacular wood (1961)	4970 Cavalier Drive	Not Eligible	Grafil et. al. 2000
	House- Vernacular wood (1945)	4974 Cavalier Drive	Not Eligible	Grafil et. al. 2000
	House- Vernacular wood (1955)	5006 Cavalier Drive	Not Eligible	Grafil et. al. 2000
	House- Vernacular wood (1954)	5008 Cavalier Drive	Not Eligible	Grafil et. al. 2000
51	Alex L. Silva House (1895-1900)	5035 W. Bethany Home Road	Eligible; Potentially Eligible	Grafil et. al. 2000; Woodward 1993
	Bugas Propane Company Building	5732-B N. 51st Ave	Not Eligible	Grafil et. al. 2000
1	Trails End Motel	5746 Grand Ave	Not Eligible	Doyle 2001
GL-189	Humphrey and Davidson Building	5819 W. Glendale Ave, Glendale	Eligible	Janus Associates, Inc. 1986
12	House (1945)	5851 Myrtle Ave	Listed on NRHP; Contributing to Catlin Court House Dist	Doyle 2001
25	House (1915 / 1968)- Orchard Addition	5907 Lamar Road	Not Eligible	Doyle 2001
26	House (1960)- Orchard Addition	5911 Lamar Road	Not Eligible	Doyle 2001
27	House (1925 / 1951) – Orchard Addition	5912-14 Lamar Road	Not Eligible	Doyle 2001
4	House (1935)	5913 W. Palmaire Ave	Not Eligible	Doyle 2001
GA-18	Rock Cottage Auto Court	5956 W. Palmaire, Glendale	Eligible	Janus Associates, Inc. 1986
3	Thunderbird Radiator	5986 and 5988 Grand Ave	Not Eligible	Doyle 2001
GL-178	House- Adobe Revival	6024 W. Myrtle, Glendale	Eligible	Janus Associates, Inc. 1986
GL-114; 108	William Weigold House (1910)	6101 W. Palmaire, Glendale	Determined Eligible	Janus Associates, Inc. 1986; Woodward 1993
GL-115; 107	Ray Weigold House (1910)	6115 W. Palmaire, Glendale	Determined Eligible	Janus Associates, Inc. 1986; Woodward 1993
	House – Ranch style	6211 N. 51st Ave	Not Eligible	Grafil et. al. 2000
	House (1950)	6217 N. 51st Ave	Not Eligible	Grafil et. al. 2000
	House (1949)	6223 N. 51st Ave	Not Eligible	Grafil et. al. 2000
	House- Vernacular Bungalow (1935)	6235 N. 51st Ave	Not Eligible	Grafil et. al. 2000
35	House (1945)- Zenia Tract	6518 N. 57th Ave	Not Eligible	Doyle 2001
36	House (1950)- Zenia Tract	6526 N. 57th Ave	Not Eligible	Doyle 2001
AZ T:8:146 (ASM)	House remnants- historic	6535 59th Ave	Not Eligible	Grafil 2001
38	House (1940)- Zenia Tract	6538 N. 57th Ave	Not Eligible	Doyle 2001
39; 55	House (1945)- Zenia Tract	6542 N. 57th Ave	Not Eligible	Doyle 2001; Woodward 1993

Previously Recorded Cultural Resources				
Site / Property No.	Name / Description	Address / Location	Eligibility Recommendations	Reference
21	Arizona Survey and Mapping (1955)	6722 N. 59th Ave	Not Eligible	Doyle 2001
22; 75	Harold W. Smith House (1936; 1926-1927) – Orchard Addition	6734 N. 59th Ave	Not Eligible; Potentially Eligible	Doyle 2001; Woodward 1993
23; 76	House (1944; 1930)- Orchard Addition	6738 N. 59th Ave	Not Eligible	Doyle 2001; Woodward 1993
29; 77	House (1940; 1928)- Orchard Addition	6814 N. 59th Ave	Not Eligible	Doyle 2001; Woodward 1993
32	House (1940)- Orchard Addition	6816 N. 59th Ave	Not Eligible	Doyle 2001
30; 78	Bessie Ross House (1930; 1916-1923)- Orchard Addition	6818 N. 59th Ave	Not Eligible	Doyle 2001; Woodward 1993
31; 79	Worker's Cabin (1920; 1932-1935)- Orchard Addition	6822 N. 59th Ave	Not Eligible	Doyle 2001; Woodward 1993
GL-159; 86	Sine Brothers Hardware Building (1912-1923)	6829 N. 58th Drive, Glendale	Eligible	Janus Associates, Inc. 1986; Woodward 1993
GL-158; 13; 113	First National Bank of Glendale (1918; 1913)	6838 N. 58th Drive; 6838 N. 59th Ave	Listed (1983)	Janus Associates, Inc. 1986; Doyle 2001; Woodward 1993
GL-125; 88	C.H. Tinker House (1913) – South First Street Historic District	6838 N. 59th Drive, Glendale	Determined Eligible	Janus Associates, Inc. 1986; Woodward 1993
8	Messinger House	7141 N. 59th Ave	Listed on NRHP; Contributing to Catlin Court House Dist	Doyle 2001
11	Commercial Bldg. (1917)	7157 N. 59th Ave	Listed on NRHP; Contributing to Catlin Court House Dist	Doyle 2001
GA-21; 114	James H. Wagoner Farm House (1912)	71st Ave. / Butler, Peoria	Eligible; Potentially Eligible	Janus Associates, Inc. 1986; Woodward 1993
GL-104	W.C. Welsh Rental House	7304 N. 61st Ave, Glendale	Eligible	Janus Associates, Inc. 1986
GA-20; 16; 115	H. C. Mann House (1910) and Farm Buildings	75th Ave. / Olive, Peoria	Eligible for State Register; Potentially Eligible	Janus Associates, Inc. 1986; Doyle 2001; Woodward 1993
GA-19; 14	Packing House; Triple R Sales	7831 N. 67th Ave., Glendale	Not Eligible	Janus Associates, Inc. 1986; Doyle 2001
GA-22	Peoria Ginning Co. Cotton Gin	79th Ave. / Grand Ave., Peoria	Eligible	Janus Associates, Inc. 1986
GA-23; 117	Valley Ginning Co. Cotton Gin (1926)	81st Ave. / Grand Ave., Peoria	Eligible	Janus Associates, Inc. 1986; Woodward 1993
GA-26	Peoria Hotel	8325 W. Washington, Peoria	Unknown	Janus Associates, Inc. 1986
GA-27	First Presbyterian Church	83rd Ave. / Madison, Peoria	Eligible	Janus Associates, Inc. 1986
GA-33	Central School	83rd Avenue / Madison, Peoria	Listed on NR	Janus Associates, Inc. 1986
GA-14	Alhambra Mercantile Co. Warehouse	Grand Ave.	Eligible	Janus Associates, Inc. 1986
GA-16; 38	Alhambra School Auditorium (1921)	Grand Ave.	Eligible; Potentially Eligible	Janus Associates, Inc. 1986; Woodward 1993
GA-9	Mining and Mineral Building	N. 19th Ave.	Eligible	Janus Associates, Inc. 1986
	House - Abandoned	N. of 6235 N. 51st Ave	Not Eligible	Grafil et. al. 2000

Previously Recorded Cultural Resources				
Site / Property No.	Name / Description	Address / Location	Eligibility Recommendations	Reference
AZ T:12:63 (ASM); AZ T:12:2 (ARS)	Three concrete slabs (1900-1930)	Northwest corner of Grand, Thomas, and 27th Aves.	Potentially Eligible	Curtis 1989; Grafil et. al. 2000
	Lory Meat Company	West of 51st Ave, south of Bethany Home Road	Not Eligible	Grafil et. al. 2000
AZ T:8:147 (ASM)	Possible historic habitation / commercial building	South of Grand Ave. and north of Orangewood Ave.	Not Eligible	Grafil 2001
	Grand Avenue		Not Eligible	Grafil et. al. 2000
GA-B1	Santa Fe R.R. Bridge at Grand Canal	R.R. ROW / Grand Canal	Unknown	Janus Associates, Inc. 1986
GA-B2; 15	Peoria Underpass (1936)	U. S. 60 at MP 152.20 / Grand Ave SE of 75th Ave	Not Eligible	Janus Associates, Inc. 1986; Doyle 2001
	Santa Fe Prescott and Phoenix RR; Atchison Topeka and Santa Fe RR; Burlington Northern Santa Fe RR	Parallels Grand Avenue (constructed in 1893)	Not Eligible	Curtis 1989; Grafil et. al. 2000
GA-A2	Historic Grand Avenue Streetcar System (1889-1948) a.k.a. Valley Street Railway Co.	Grand Ave. / Van Buren to McDowell	Eligible; subsurface remnants may be present	Janus Associates, Inc. 1986
	Zenia Tract (platted in 1947)	W. of 57th Ave between McLellan and Maryland	Potential Historic District	Doyle 2001
	Orchard Addition (platted in 1908); South First Street Historic District	W. of 59th Ave btwn Glendale and Ocotillo	Potential Historic District	Doyle 2001
	Federal Compress and Warehouse Complex	51st Ave / Bethany Home	Eligible	Grafil and Abele 2001
	Catlin Court Historic District	Palmaire and Myrtle from 57th Ave to 59th Ave	Listed on NRHP (1992)	Doyle 2001
*	84 Historic Buildings	Along Grand Ave	Varies	Woodward 1993
*	50 + Buildings on historic maps	Glendale, Alhambra, and Phoenix	Not evaluated	Curtis 1989

# **APPENDIX D**

## **Alternatives Analysis Exhibits**



**LEGEND**

- PARCELS
- PROPOSED RAMP CONNECTION
- PROPOSED GRAND AVENUE CONSTRUCTION
- PROPOSED I-17 MAINLINE CONSTRUCTION
- PROPOSED FRONTAGE ROAD CONSTRUCTION
- NEW RIGHT-OF-WAY

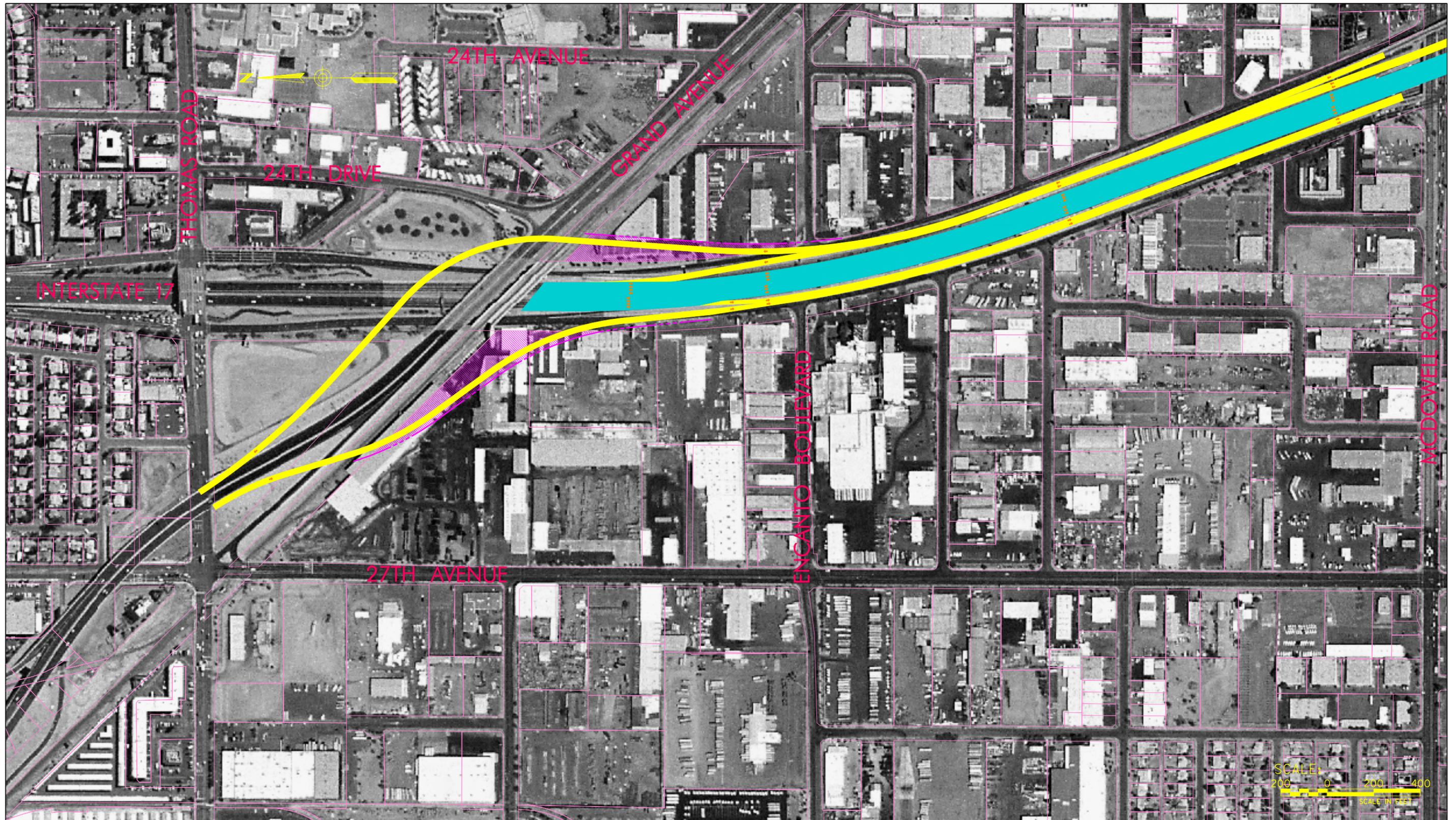


I-17/10 CONNECTION  
 MEDIAN RAMPS FROM I-17 TO GRAND AVENUE

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.1



**LEGEND**

- PARCELS
- PROPOSED RAMP CONNECTION
- PROPOSED GRAND AVENUE CONSTRUCTION
- PROPOSED I-17 MAINLINE CONSTRUCTION
- PROPOSED FRONTAGE ROAD CONSTRUCTION
- NEW RIGHT-OF-WAY

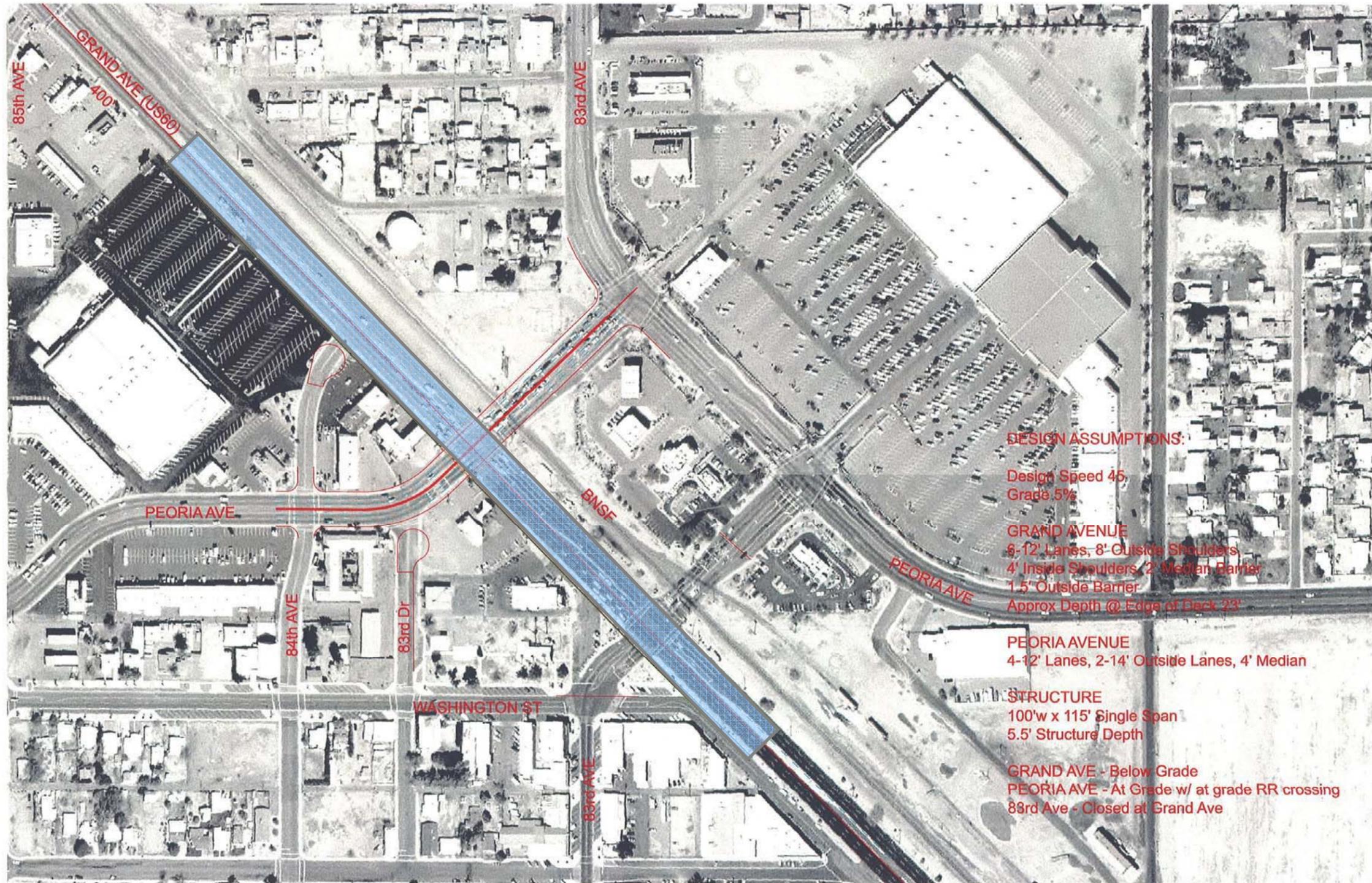
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.2



I-17/I-10 CONNECTION  
CD ROADS FROM I-10 RAMPS TO GRAND AVENUE



**DESIGN ASSUMPTIONS:**

Design Speed 45  
Grade 5%

**GRAND AVENUE**  
6-12' Lanes, 8' Outside Shoulders  
4' Inside Shoulders, 2' Median Barrier  
1.5' Outside Barrier  
Approx Depth @ Edge of Deck 23'

**PEORIA AVENUE**  
4-12' Lanes, 2-14' Outside Lanes, 4' Median

**STRUCTURE**  
100'w x 115' Single Span  
5.5' Structure Depth

GRAND AVE - Below Grade  
PEORIA AVE - At Grade w/ at grade RR crossing  
88rd Ave - Closed at Grand Ave



Grand Avenue Under

Peoria Ave.\83rd Ave.\Grand Ave

NOT TO SCALE

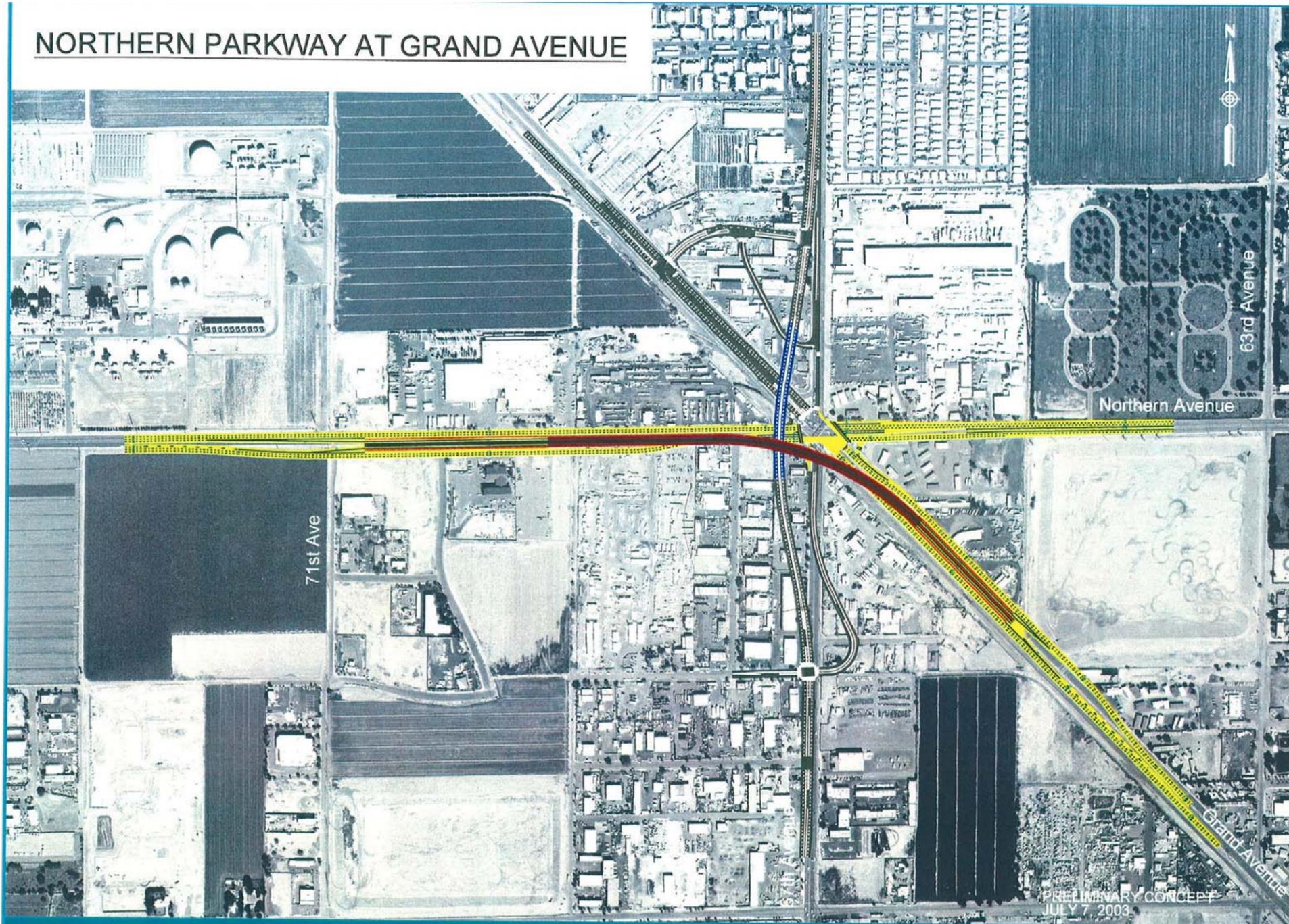
WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.14

# NORTHERN PARKWAY AT GRAND AVENUE



GLENDALE ONBOARD TRANSPORTATION PROGRAM



NOT TO SCALE

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.15



Bethany Home Road Under

Bethany Home Road \ Grand Ave

NOT TO SCALE

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
GRADE SEPARATIONS

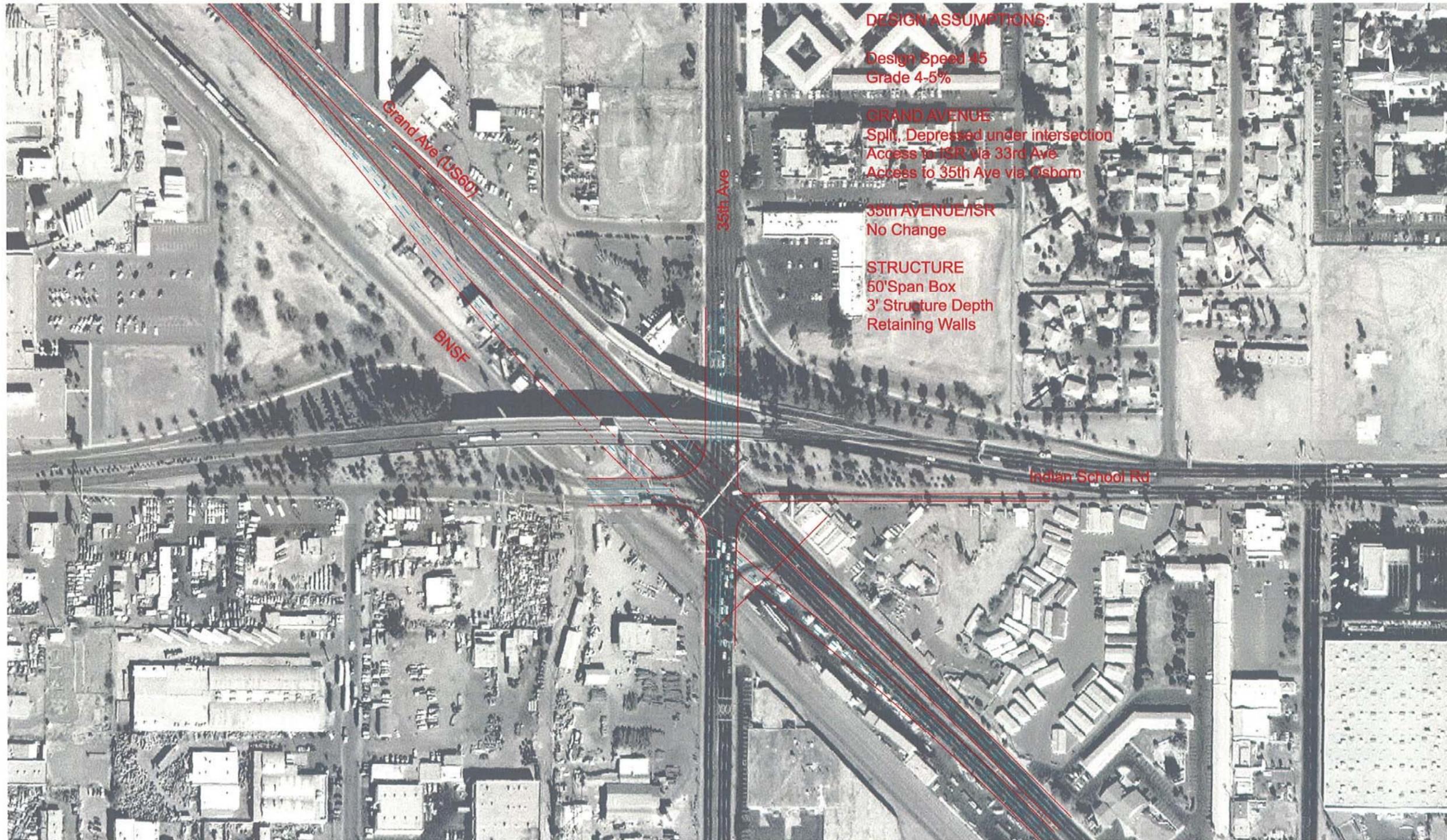
LEGEND

- EXISTING 51<sup>ST</sup> AVENUE OVERPASS
- BETHANY HOME ROAD UNDER

GRAND AVENUE MIS PHASE II



EXHIBIT 5.16



Grand Avenue Under

Indian School Road \ Grand Ave

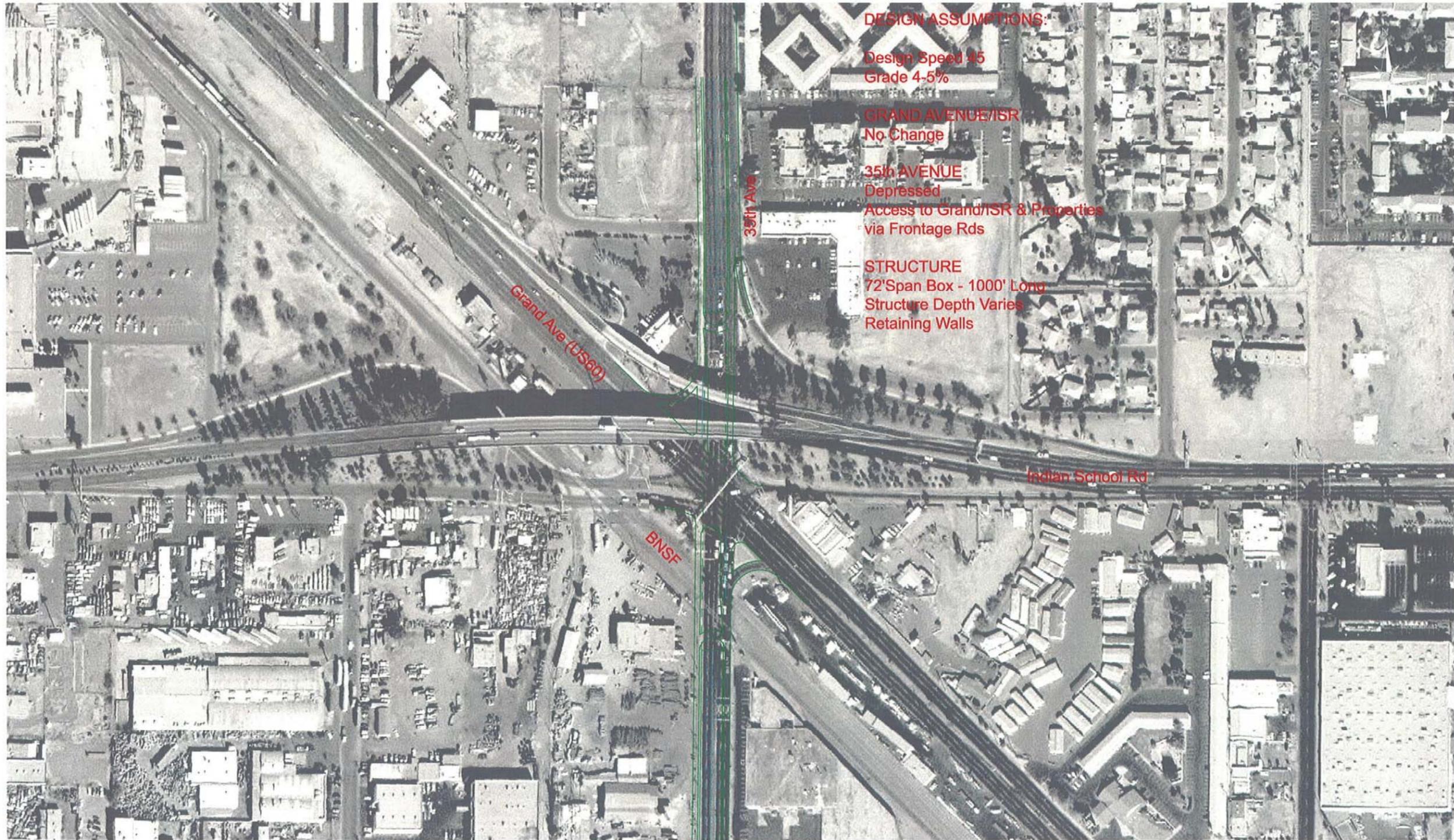
NOT TO SCALE

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.17



**DESIGN ASSUMPTIONS:**

Design Speed 45  
Grade 4-5%

GRAND AVENUE/ISR  
No Change

35th AVENUE  
Depressed  
Access to Grand/ISR & Properties  
via Frontage Rds

STRUCTURE  
72' Span Box - 1000' Long  
Structure Depth Varies  
Retaining Walls



35th Avenue Under

Indian School Road \ Grand Ave

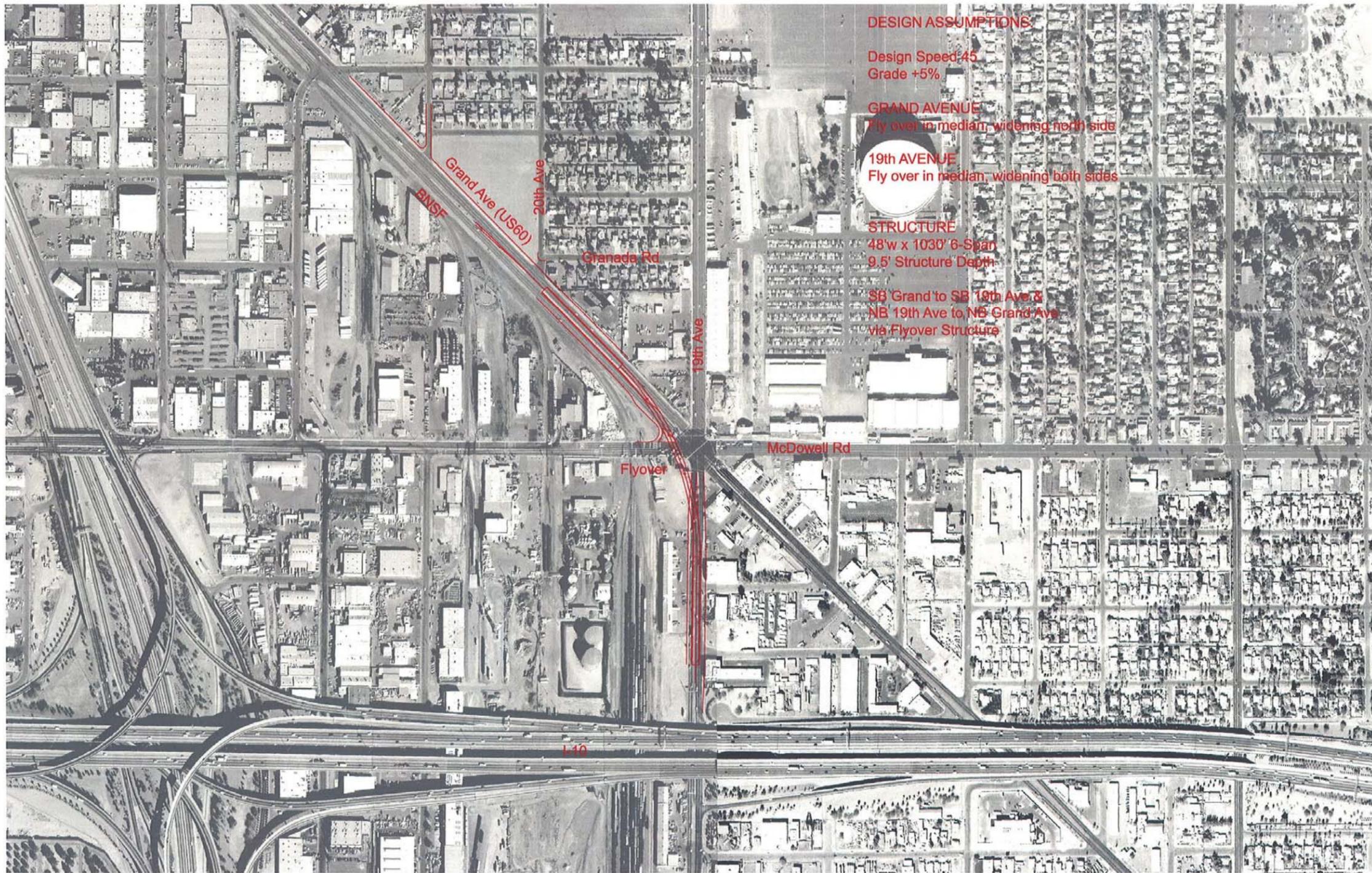
NOT TO SCALE

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.18



19th Ave/Grand Ave Flyover

McDowell Road\Grand Ave

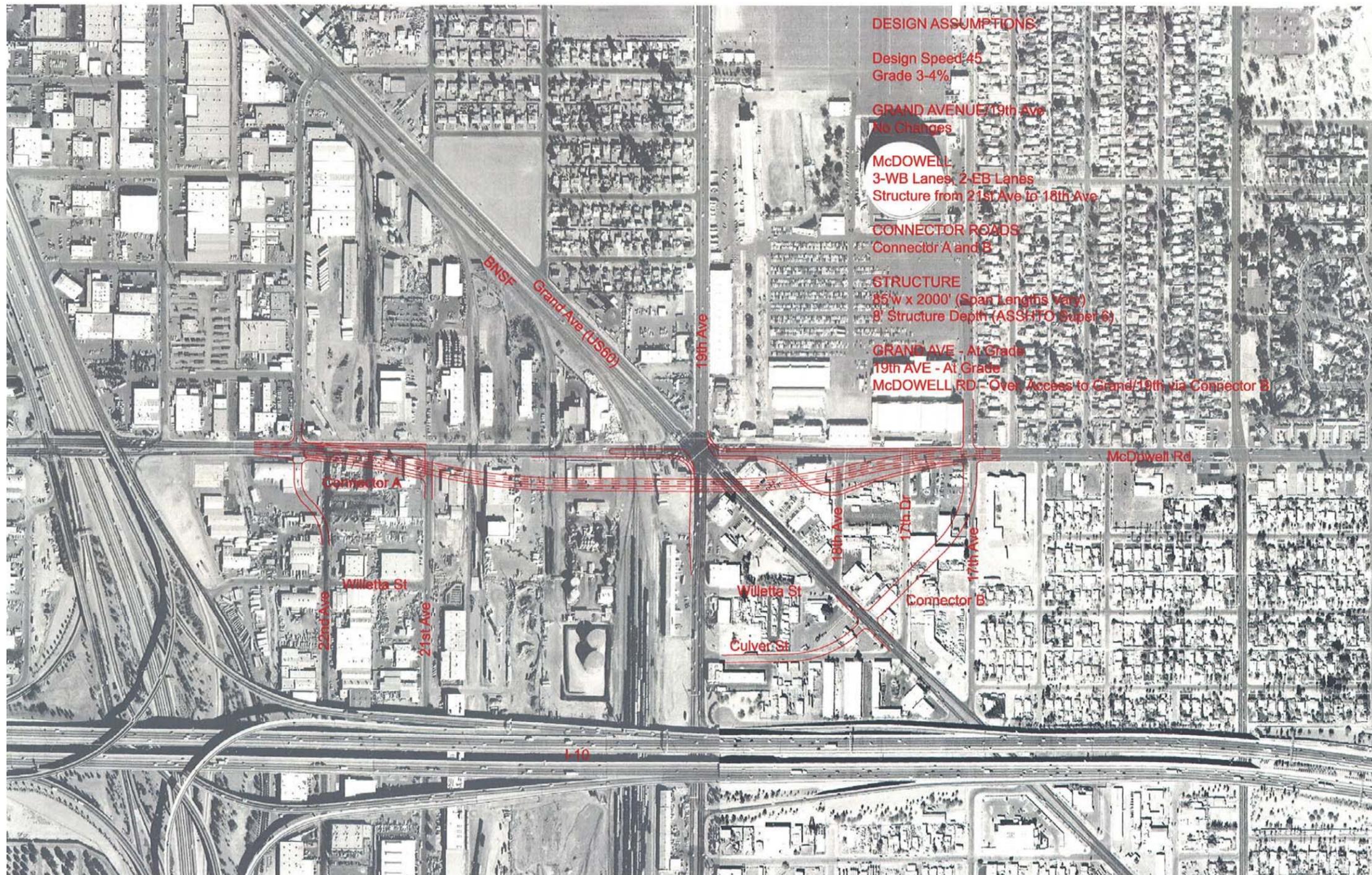
NOT TO SCALE

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
 GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.19



**DESIGN ASSUMPTIONS**

Design Speed 45  
Grade 3-4%

**GRAND AVENUE/19th Ave**  
No Changes

**McDOWELL**  
3-WB Lanes, 2-EB Lanes  
Structure from 21st Ave to 18th Ave

**CONNECTOR ROADS**  
Connector A and B

**STRUCTURE**  
85'w x 2000' (Span Lengths Vary)  
8' Structure Depth (ASHTO Super 6)

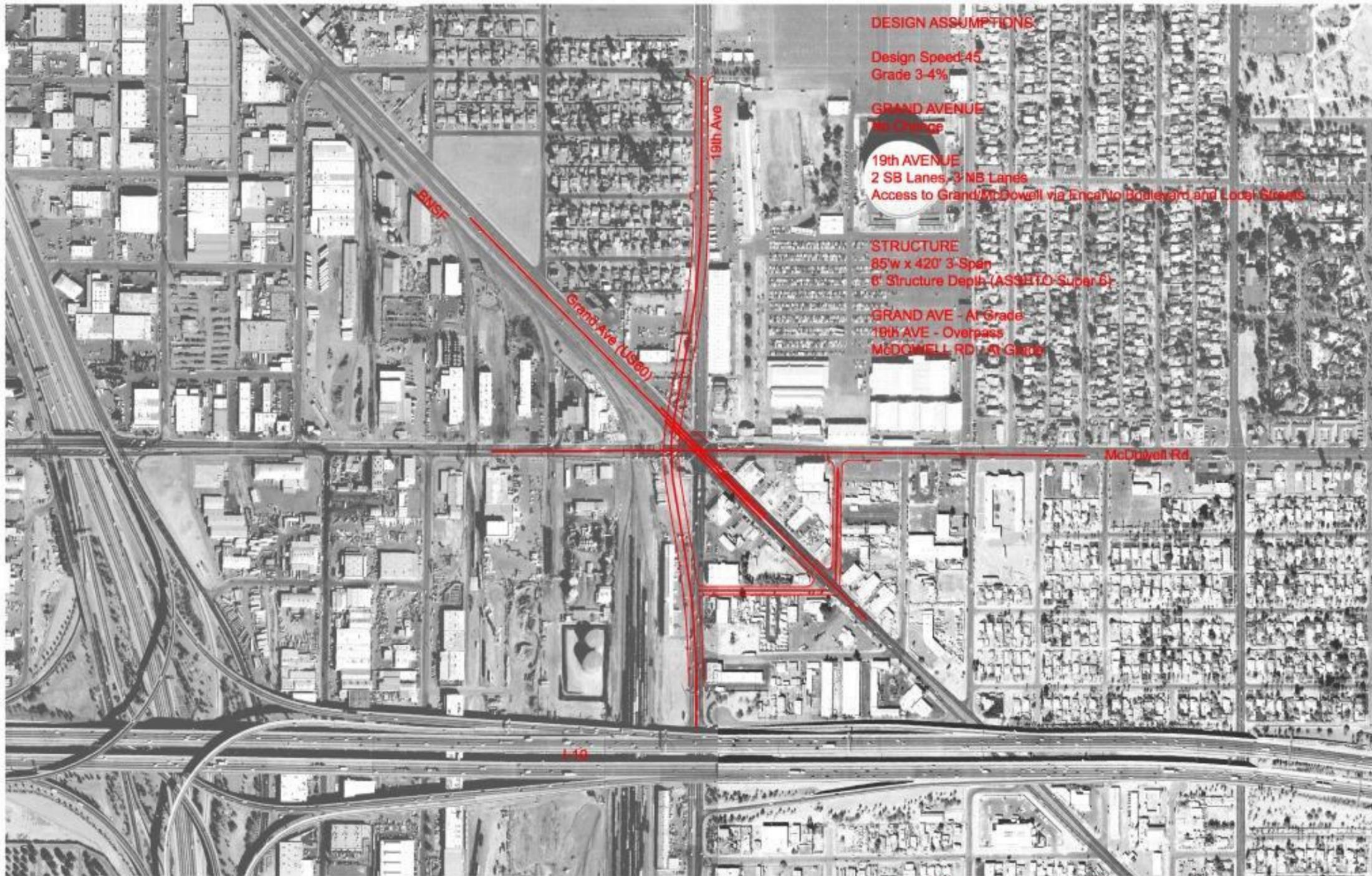
**GRAND AVE - At Grade**  
**19th AVE - At Grade**  
**McDOWELL RD - Over** Access to Grand/19th via Connector B

**McDowell Road Over**

**McDowell Road\Grand Ave**

NOT TO SCALE





19th Avenue Over

McDowell Road\Grand Ave

NOT TO SCALE

GRADE SEPARATIONS

GRAND AVENUE MIS PHASE II



EXHIBIT 5.21



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

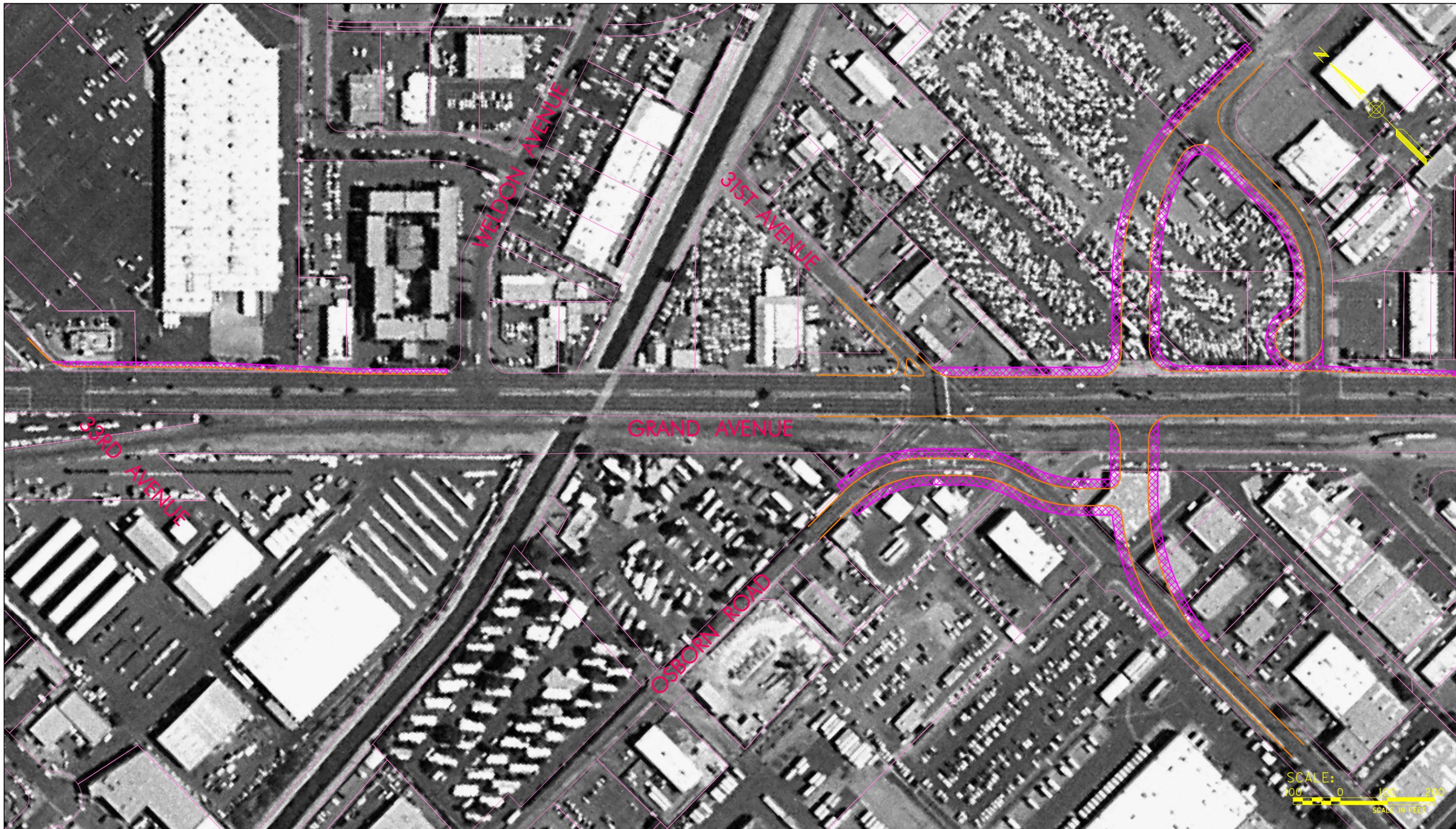
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.22



**INTERSECTION IMPROVEMENTS  
39TH AVENUE AND 37TH AVENUE**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.23



INTERSECTION IMPROVEMENTS  
31ST AVENUE / OSBORN ROAD



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.24



**INTERSECTION IMPROVEMENTS  
23RD AVENUE / ENCANTO BOULEVARD**



INTERSECTION IMPROVEMENTS  
19TH AVENUE DUAL LEFT-TURN LANES

LEGEND

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

GRAND AVENUE MIS PHASE II

EXHIBIT 5.25



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.27



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- DRIVEWAY POSSIBLY TO REMAIN
- DRIVEWAY POSSIBLY REMOVED
- DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

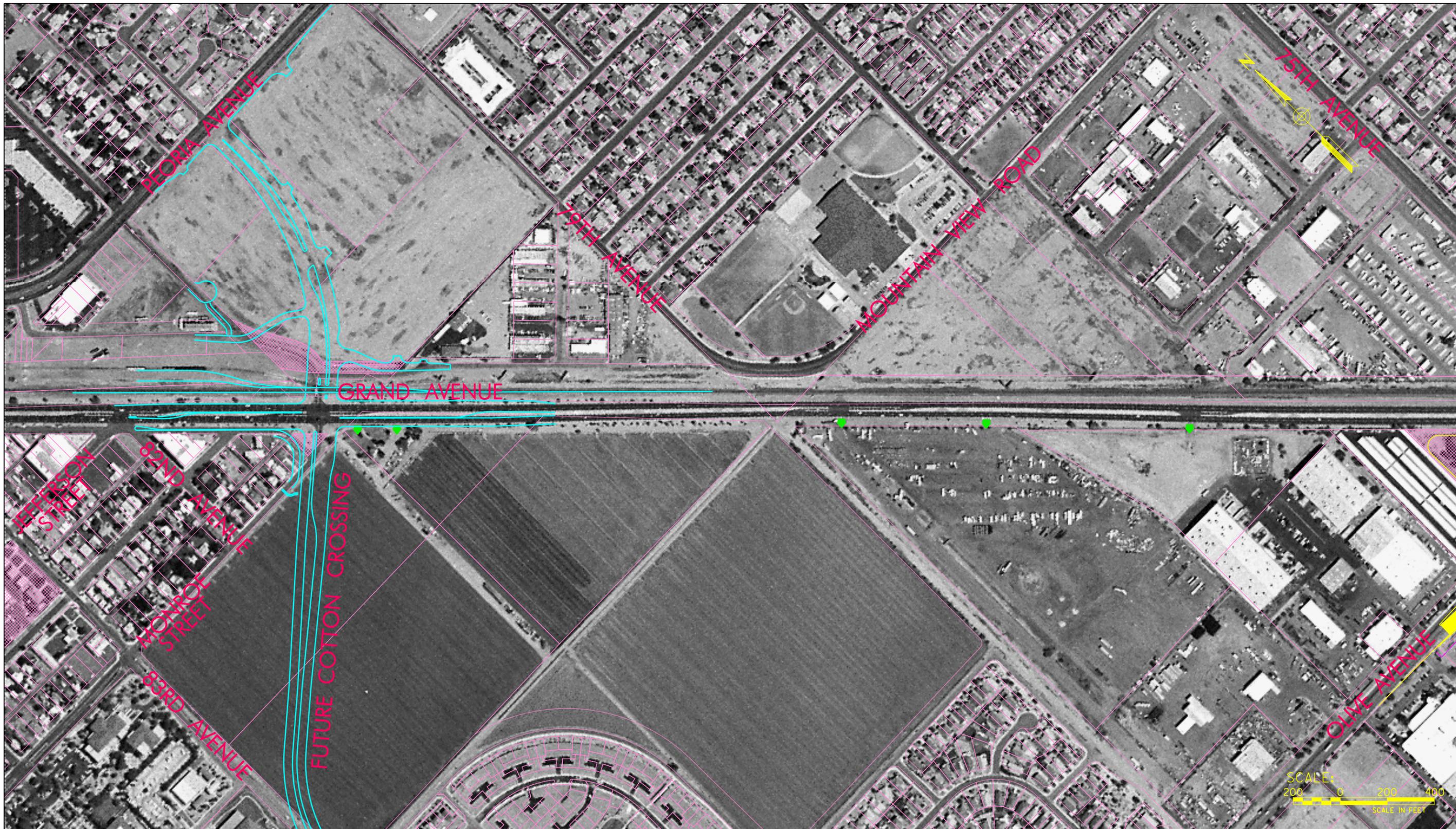
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.28



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.29



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- DRIVEWAY POSSIBLY TO REMAIN
- DRIVEWAY POSSIBLY REMOVED
- DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

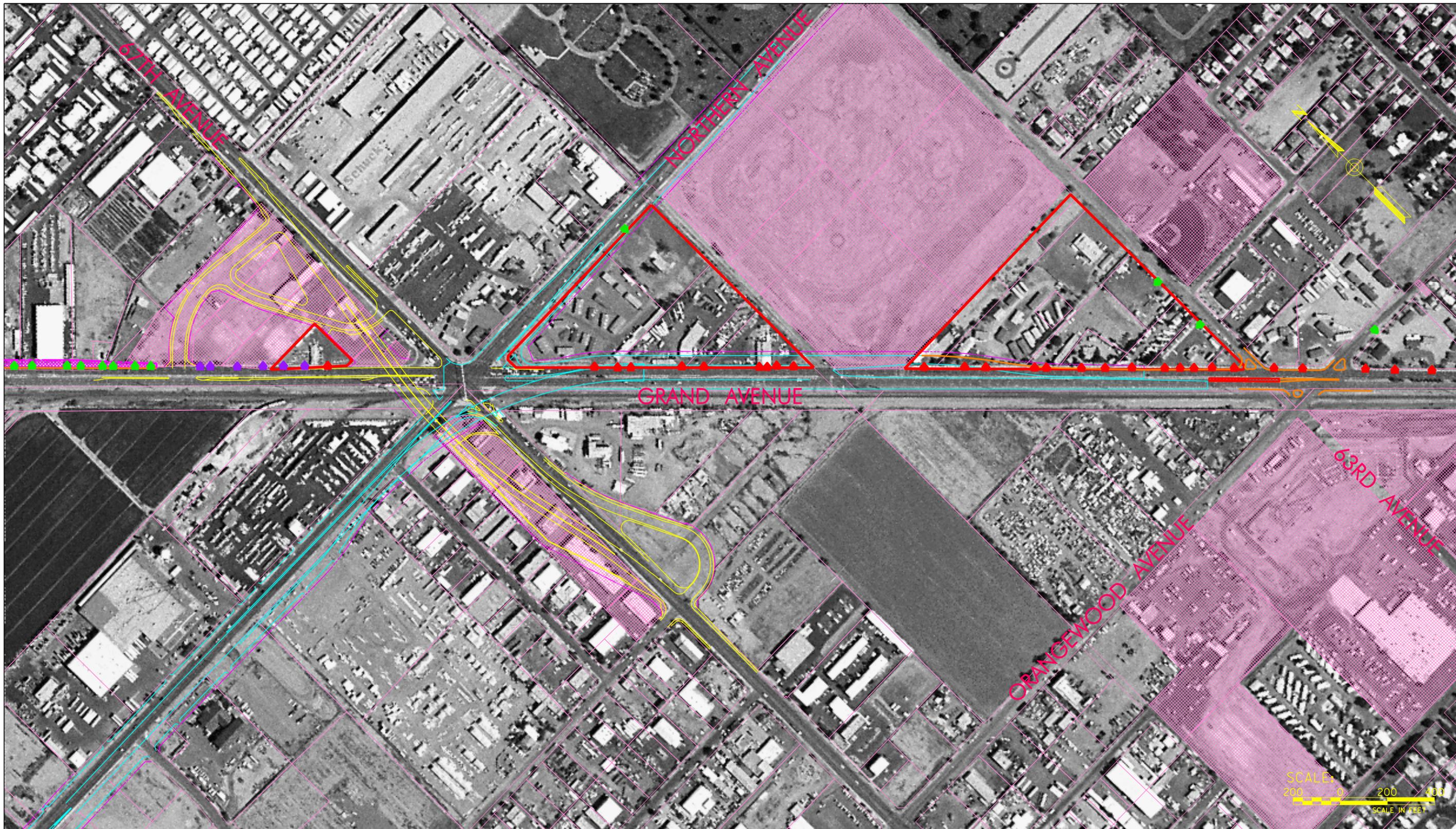
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.30



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- |   |                            |   |                                |
|---|----------------------------|---|--------------------------------|
|  | PARCELS                    |  | DRIVEWAY POSSIBLY TO REMAIN    |
|  | PUBLIC OWNERSHIP           |  | DRIVEWAY POSSIBLY REMOVED      |
|  | ADOT CONSTRUCTION          |  | DRIVEWAY PREVIOUSLY REMOVED    |
|  | OTHER PLANNED IMPROVEMENTS |  | MEDIAN BREAK POSSIBLY CLOSED   |
|   |                            |  | ACCESS MANAGEMENT IMPROVEMENTS |
|   |                            |  | NEW RIGHT-OF-WAY               |

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.31



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- |   |                            |   |                                |
|---|----------------------------|---|--------------------------------|
|  | PARCELS                    |  | DRIVEWAY POSSIBLY TO REMAIN    |
|  | PUBLIC OWNERSHIP           |  | DRIVEWAY POSSIBLY REMOVED      |
|  | ADOT CONSTRUCTION          |  | DRIVEWAY PREVIOUSLY REMOVED    |
|  | OTHER PLANNED IMPROVEMENTS |  | MEDIAN BREAK POSSIBLY CLOSED   |
|   |                            |  | ACCESS MANAGEMENT IMPROVEMENTS |
|   |                            |  | NEW RIGHT-OF-WAY               |

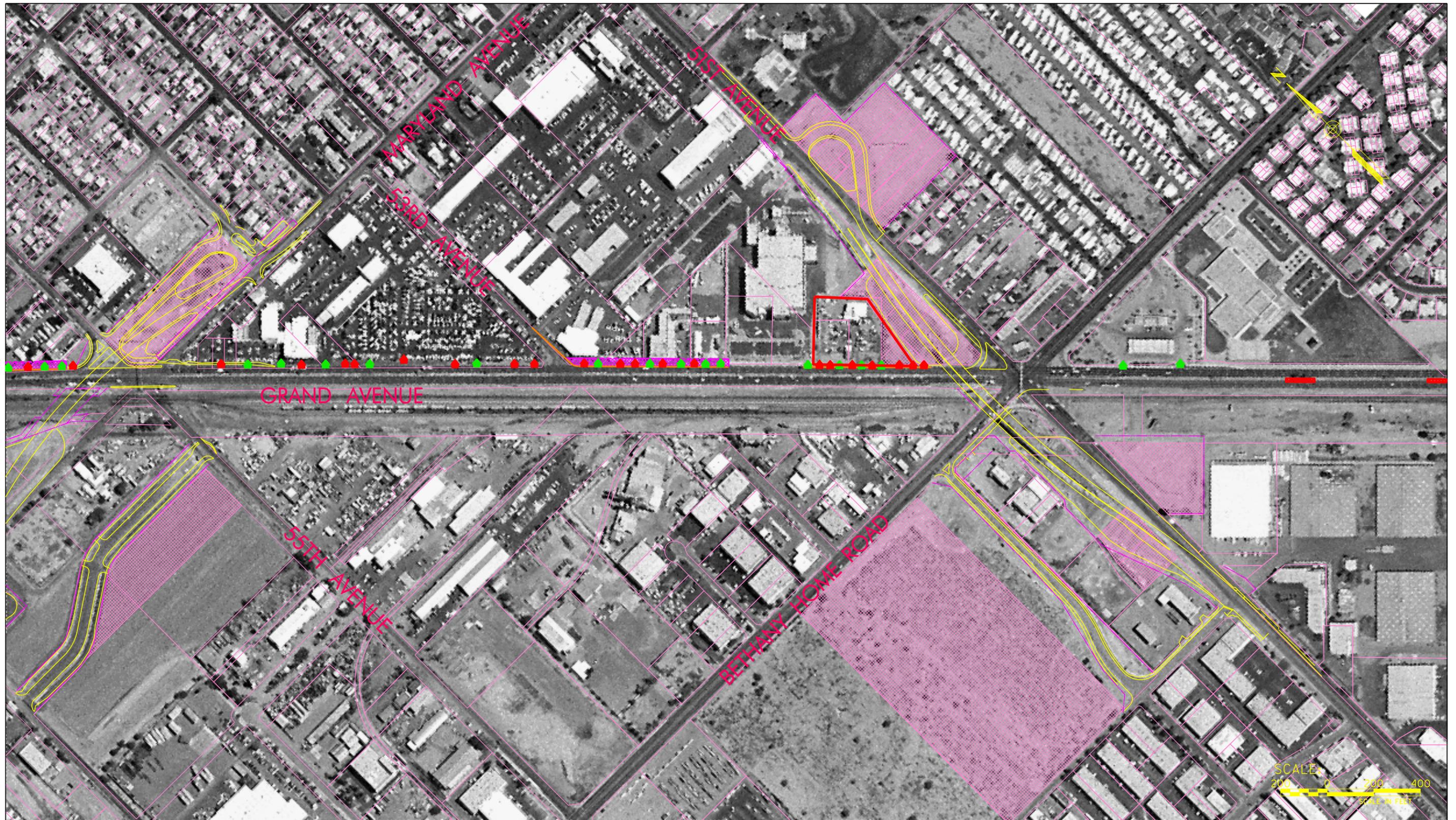
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.32



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- |  |                            |  |                                |
|--|----------------------------|--|--------------------------------|
|  | PARCELS                    |  | DRIVEWAY POSSIBLY TO REMAIN    |
|  | PUBLIC OWNERSHIP           |  | DRIVEWAY POSSIBLY REMOVED      |
|  | ADOT CONSTRUCTION          |  | DRIVEWAY PREVIOUSLY REMOVED    |
|  | OTHER PLANNED IMPROVEMENTS |  | MEDIAN BREAK POSSIBLY CLOSED   |
|  |                            |  | ACCESS MANAGEMENT IMPROVEMENTS |
|  |                            |  | NEW RIGHT-OF-WAY               |

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.33



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- DRIVEWAY POSSIBLY TO REMAIN
- DRIVEWAY POSSIBLY REMOVED
- DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.34



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.35



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- DRIVEWAY POSSIBLY TO REMAIN
- DRIVEWAY POSSIBLY REMOVED
- DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.36



**ACCESS MANAGEMENT PLAN**



**LEGEND**

- PARCELS
- PUBLIC OWNERSHIP
- ADOT CONSTRUCTION
- OTHER PLANNED IMPROVEMENTS
- ▲ DRIVEWAY POSSIBLY TO REMAIN
- ▲ DRIVEWAY POSSIBLY REMOVED
- ▲ DRIVEWAY PREVIOUSLY REMOVED
- MEDIAN BREAK POSSIBLY CLOSED
- ACCESS MANAGEMENT IMPROVEMENTS
- NEW RIGHT-OF-WAY

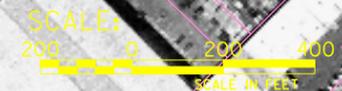
**GRAND AVENUE MIS PHASE II**



EXHIBIT 5.37

**ACCESS MANAGEMENT PLAN**





LEGEND	
	PARCELS
	PUBLIC OWNERSHIP
	ADOT CONSTRUCTION
	OTHER PLANNED IMPROVEMENTS
	DRIVEWAY POSSIBLY TO REMAIN
	DRIVEWAY POSSIBLY REMOVED
	DRIVEWAY PREVIOUSLY REMOVED
	MEDIAN BREAK POSSIBLY CLOSED
	ACCESS MANAGEMENT IMPROVEMENTS
	NEW RIGHT-OF-WAY

ACCESS MANAGEMENT PLAN

GRAND AVENUE MIS PHASE II



EXHIBIT 5.38





WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES

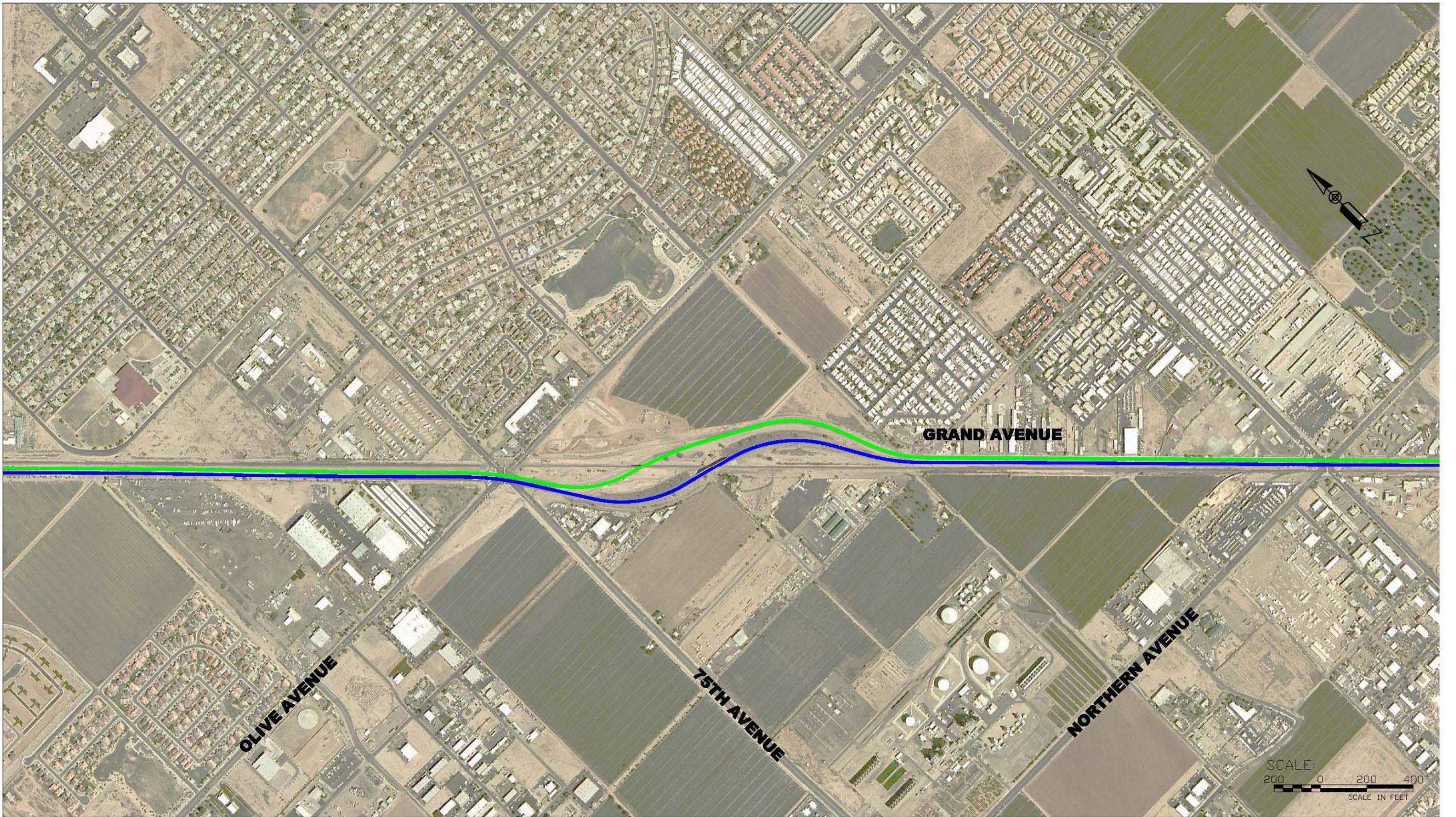


- LEGEND:**
- NB GRAND AVENUE BRT
  - SB GRAND AVENUE BRT
  - EXPRESS BUS
  - LOCAL BUS
  - PARK AND RIDE LOT



GRAND AVENUE MIS PHASE II

EXHIBIT 5.45



WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES

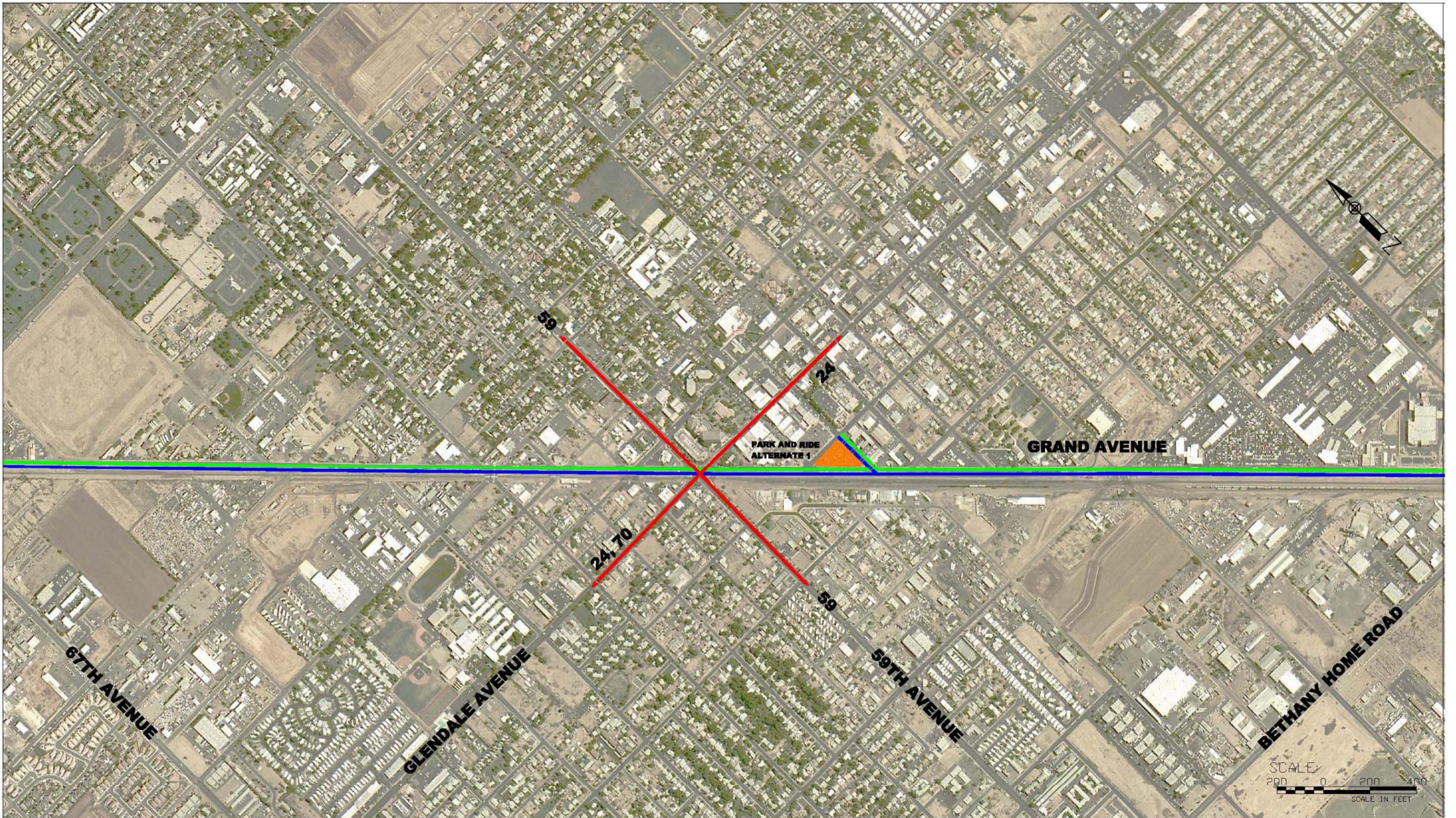


- LEGEND:**
-  NB GRAND AVENUE BRT
  -  SB GRAND AVENUE BRT
  -  EXPRESS BUS
  -  LOCAL BUS
  -  PARK AND RIDE LOT



GRAND AVENUE MIS PHASE II

EXHIBIT 5.46



WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES



- LEGEND:**
-  NB GRAND AVENUE BRT
  -  SB GRAND AVENUE BRT
  -  EXPRESS BUS
  -  LOCAL BUS
  -  PARK AND RIDE LOT



GRAND AVENUE MIS PHASE II

EXHIBIT 5.47



WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES

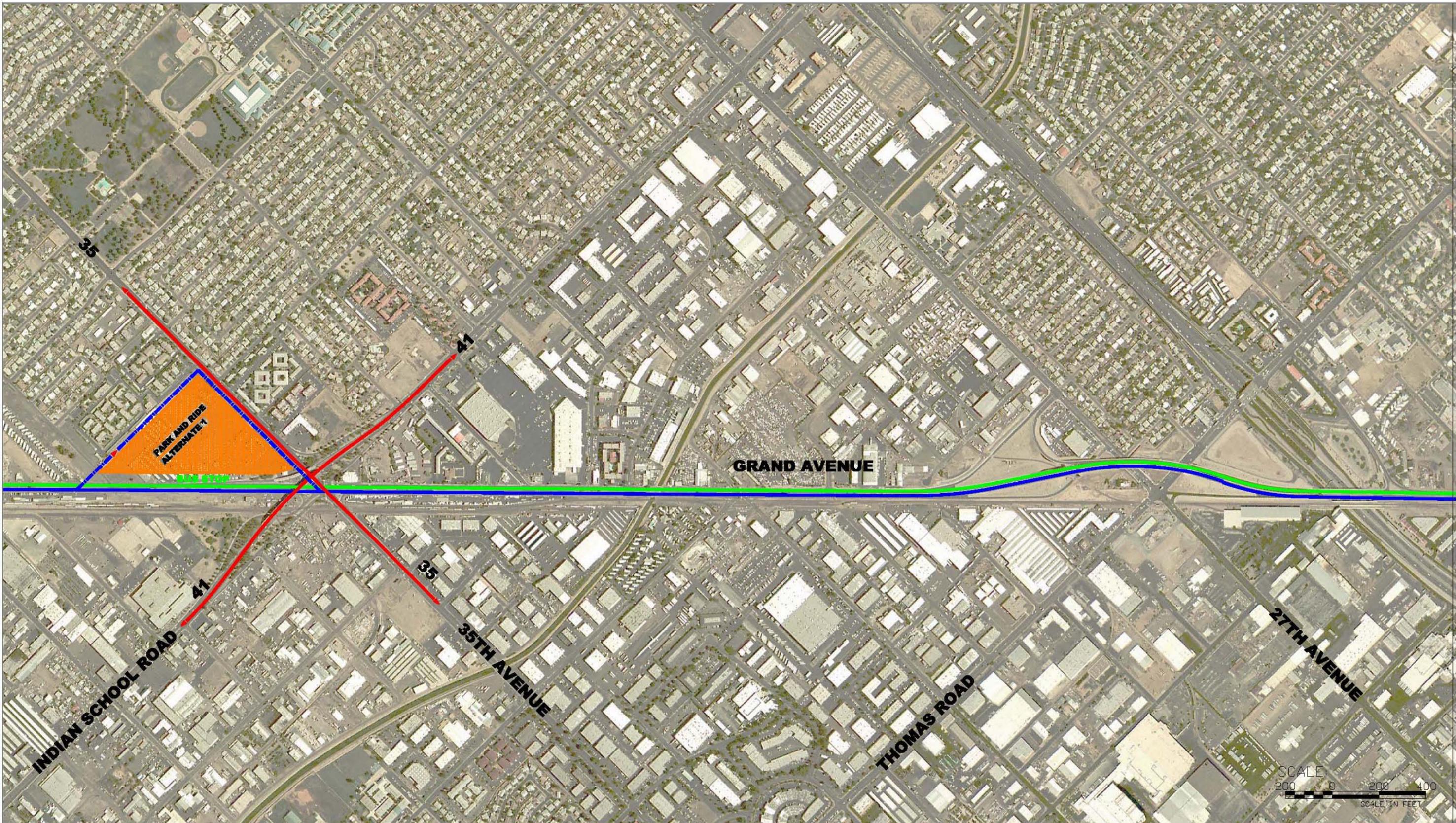


- LEGEND:**
-  NB GRAND AVENUE BRT
  -  SB GRAND AVENUE BRT
  -  EXPRESS BUS
  -  LOCAL BUS
  -  PARK AND RIDE LOT



GRAND AVENUE MIS PHASE II

EXHIBIT 5.48



WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES



- LEGEND:**
-  NB GRAND AVENUE BRT
  -  SB GRAND AVENUE BRT
  -  EXPRESS BUS
  -  LOCAL BUS
  -  PARK AND RIDE LOT



GRAND AVENUE MIS PHASE II

EXHIBIT 5.49



WORKING PAPER 5 -  
ALTERNATIVES ANALYSIS  
BRT ALTERNATIVES

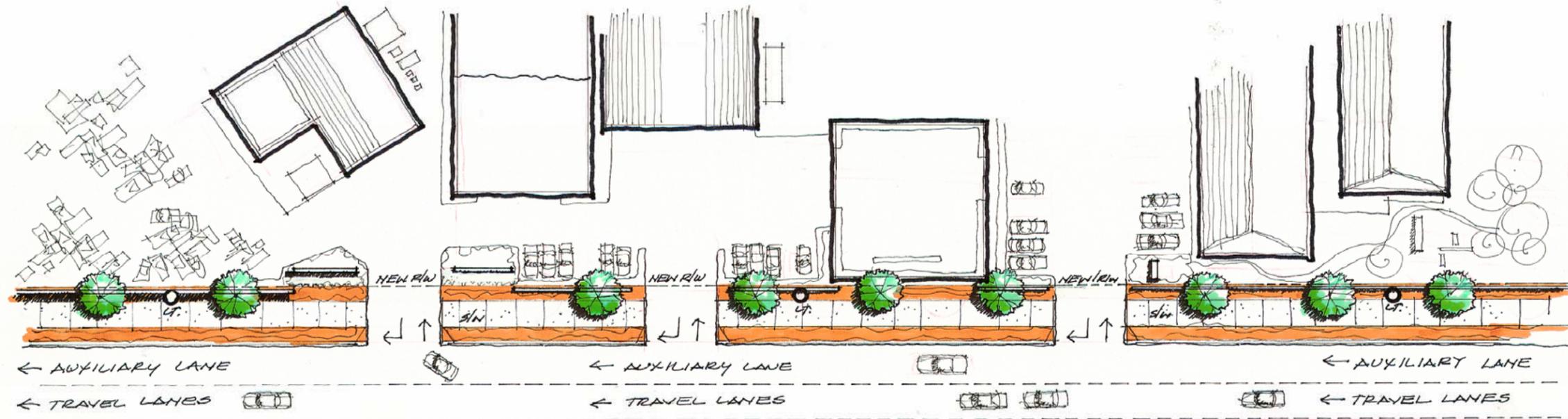


- LEGEND:**
- █ NB GRAND AVENUE BRT
  - █ SB GRAND AVENUE BRT
  - █ EXPRESS BUS
  - █ LOCAL BUS
  - PARK AND RIDE LOT



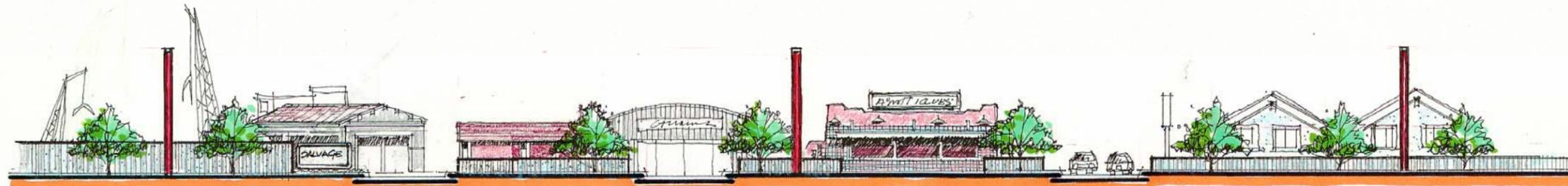
GRAND AVENUE MIS PHASE II

EXHIBIT 5.50



PLAN

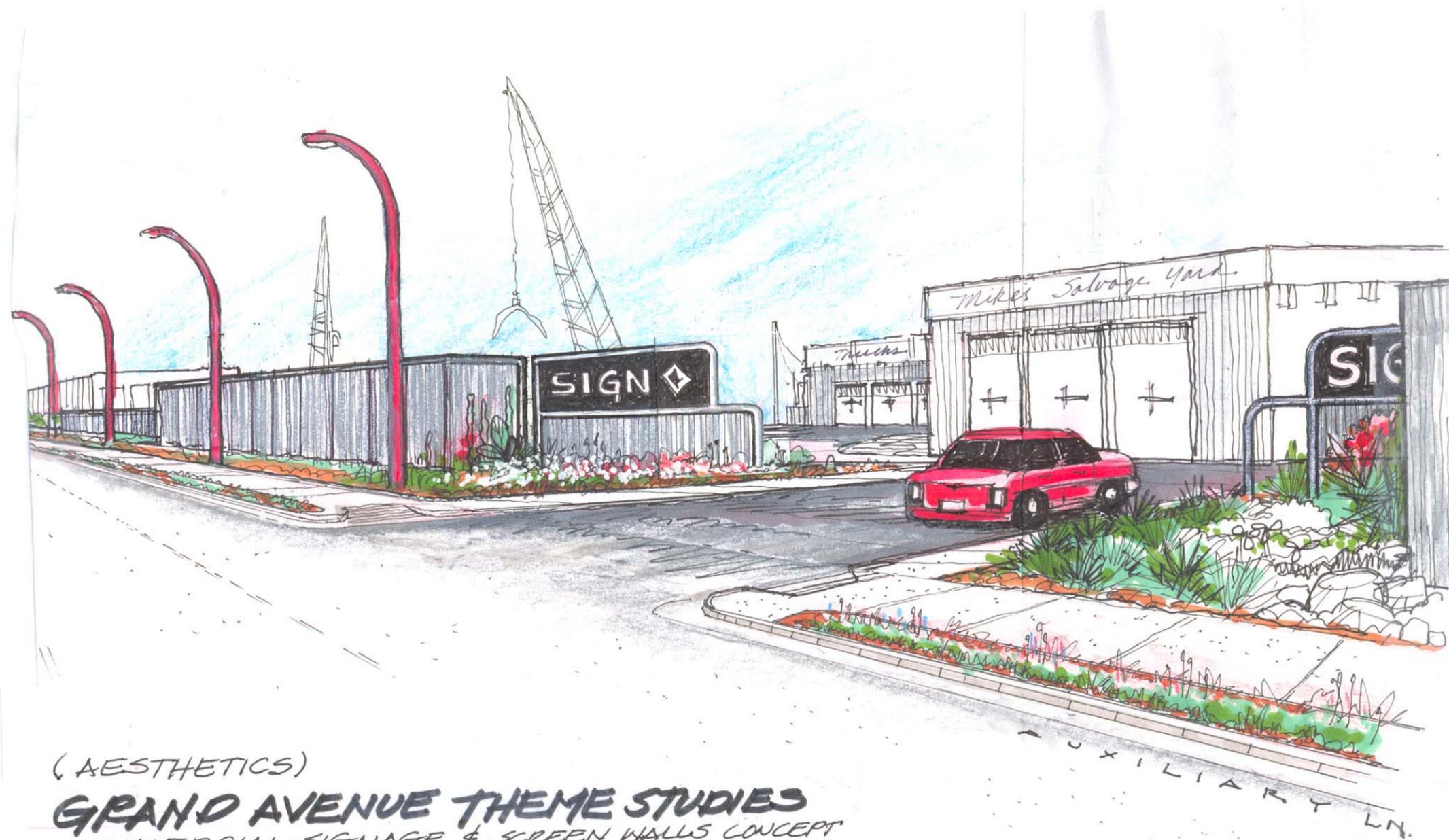
- SCREEN UNAESTHETIC LAND USE SUCH AS SALVAGE YARDS OR CONSTRUCTION MATERIAL STORAGE; REMOVE AND REPLACE ANY EXISTING BARBED WIRE OR CYCLONE FENCES AND REPLACE WITH THEME SCREEN WALLS AND PLANTING WHEN ALLOWED.
- INTEGRATE SCREENING ELEMENTS AT A REDUCED SCALE TO DIFFUSE PARKING AND PROVIDE THEME CONTINUITY; ADD COLOR AND TEXTURE WHEN POSSIBLE TO EXISTING WALLS AND BUILDING FACADES.
- CELEBRATE BUILDINGS THAT REFLECT THE INDUSTRIAL AND AGRICULTURAL HERITAGE OF THE AREA. BEAUTIFY BY RESTORATION AND OPEN UP THE VIEW FROM THE ROADWAY.
- REINFORCE POSITIVE AESTHETICS FOR USERS BY PLANTING TREES FOR SHADE AND VISUAL CONTINUITY; PROVIDE CONTROLLED COMMON ENTRY DRIVES TO BUSINESSES IF POSSIBLE, AND UNIFY WITH LOW THEME WALLS @ RW EDGE.



ELEVATION

(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
 CONCEPT APPLICATION AND EDGE TREATMENT  
 (WITH AUXILIARY LANE)





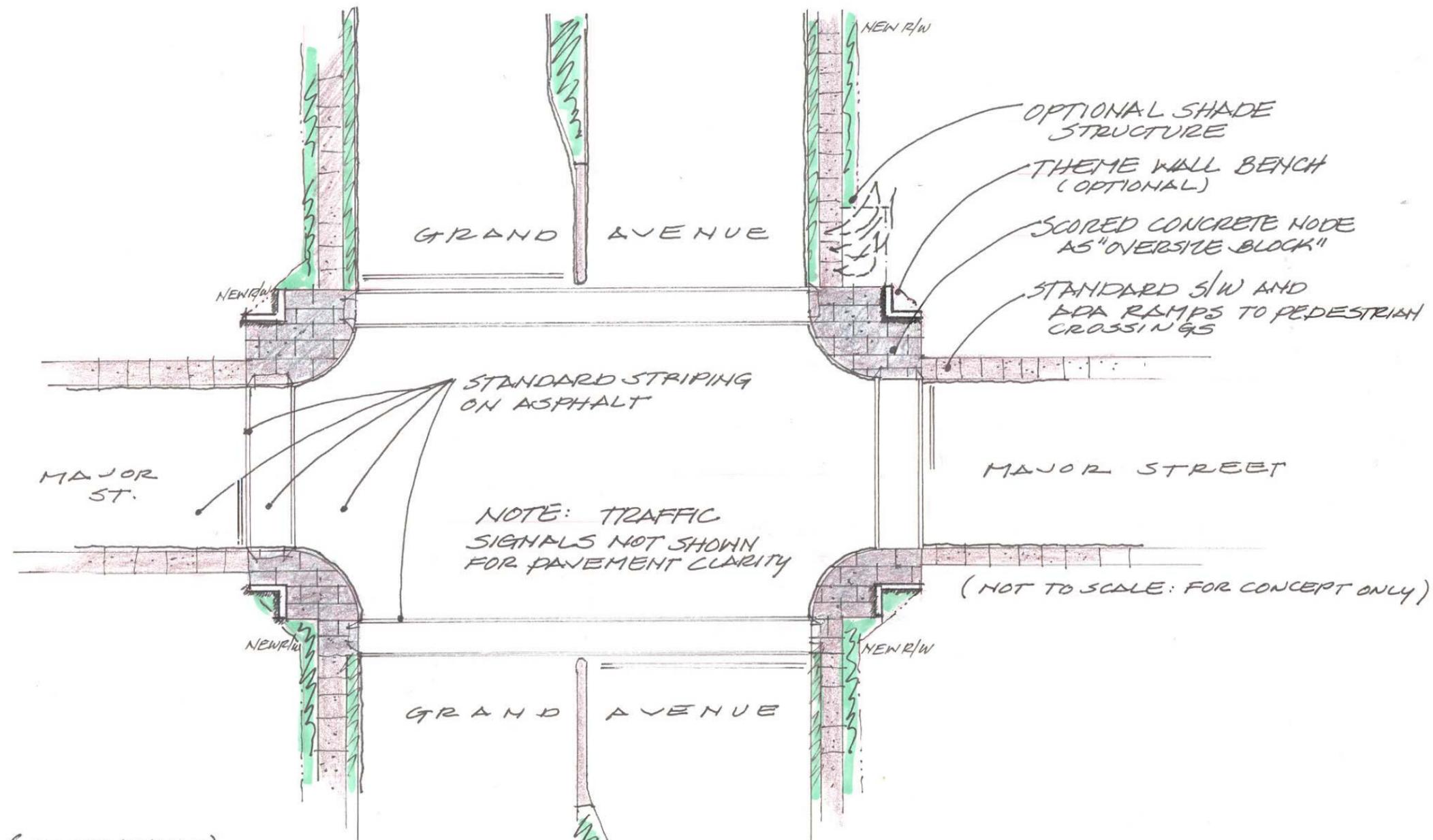
(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
COMMERCIAL SIGNAGE & SCREEN WALLS CONCEPT

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
COMMUNITY MITIGATION

GRAND AVENUE MIS PHASE II

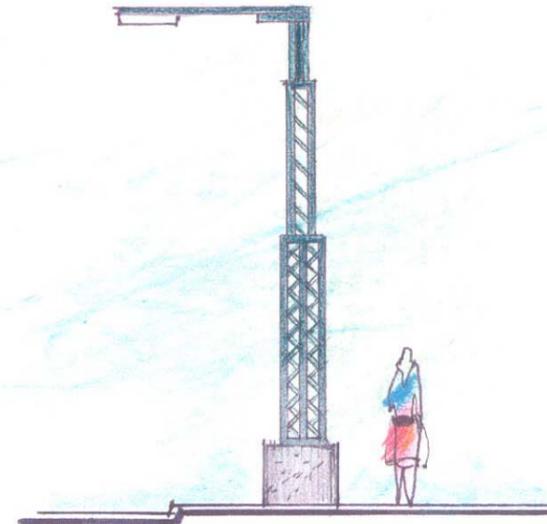
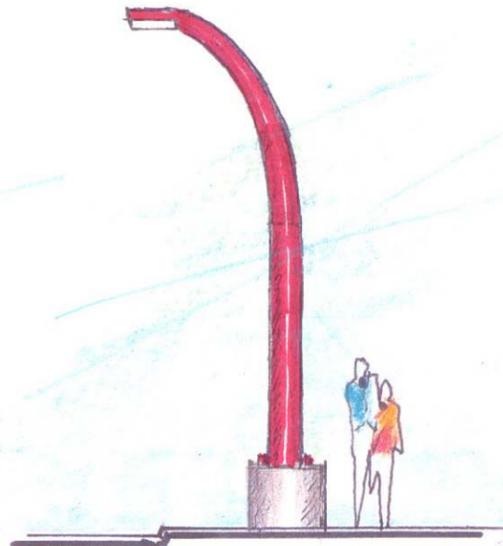
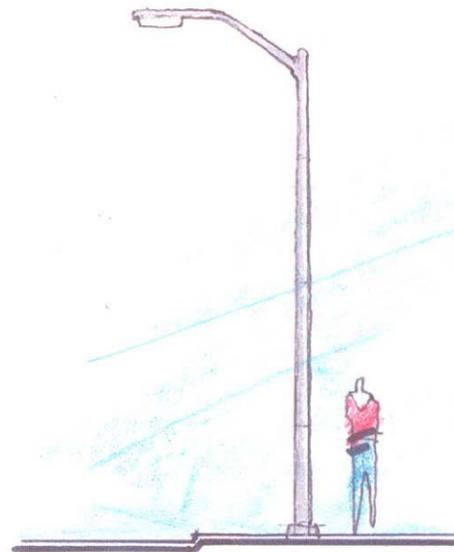
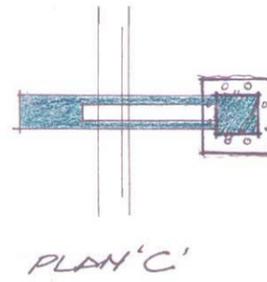
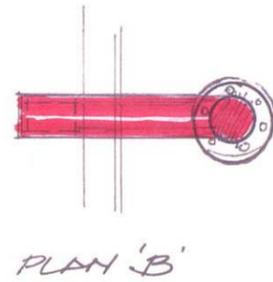
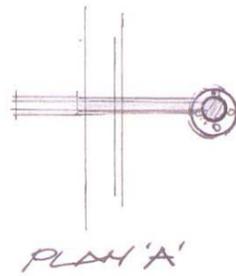


EXHIBIT 5.54



(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
 PEDESTRIAN NODES AND PAVING CONCEPT @  
 MAJOR INTERSECTIONS & GATEWAYS THAT ARE SIGNALIZED





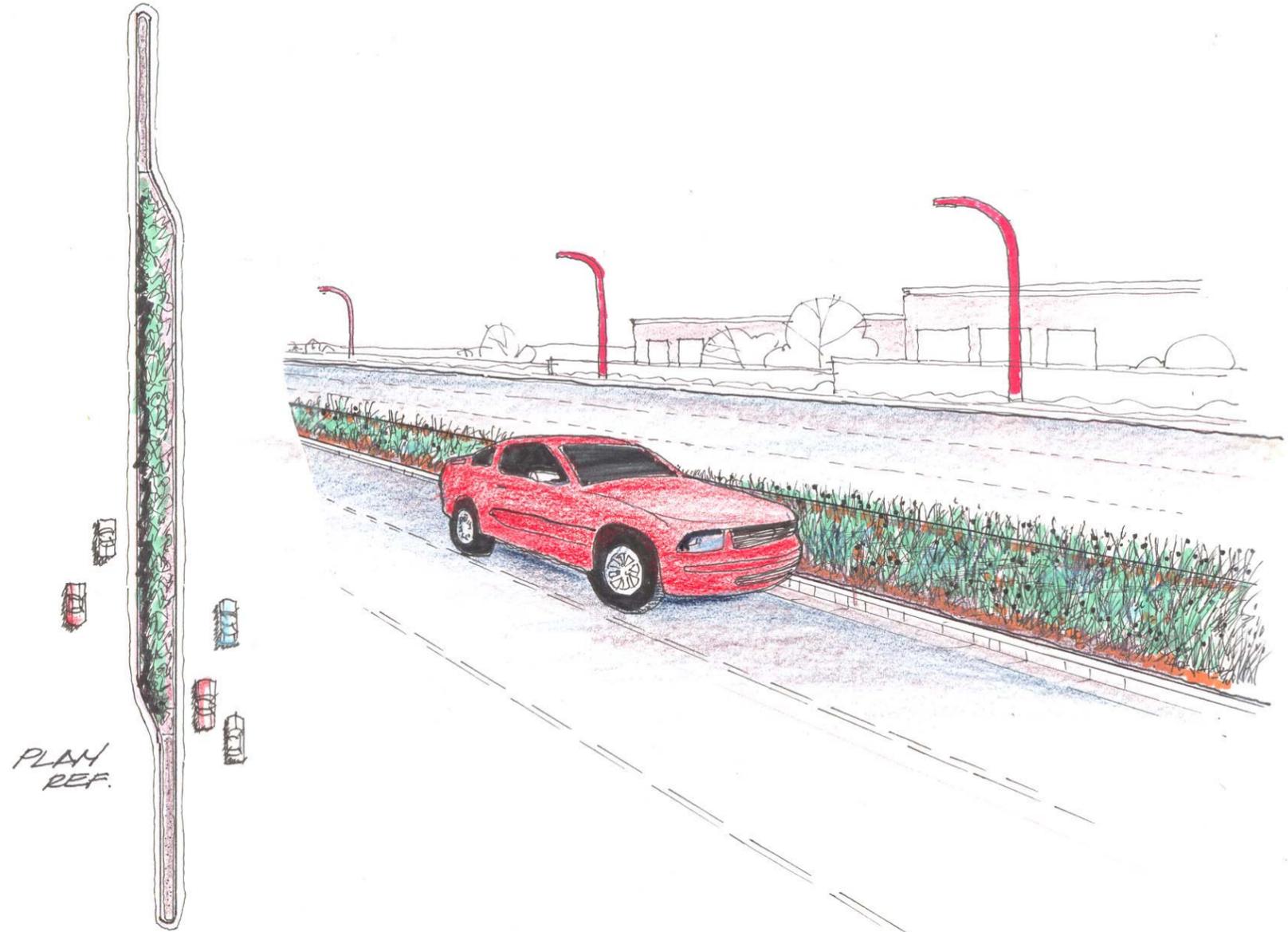
° TRADITIONAL 'A'  
LIGHT FIXTURE ELEVATION

° POLISHED METAL 'B'  
LIGHT FIXTURE ELEVATION

° EXPOSED TRUSS (METAL) 'C'  
LIGHT FIXTURE ELEVATION

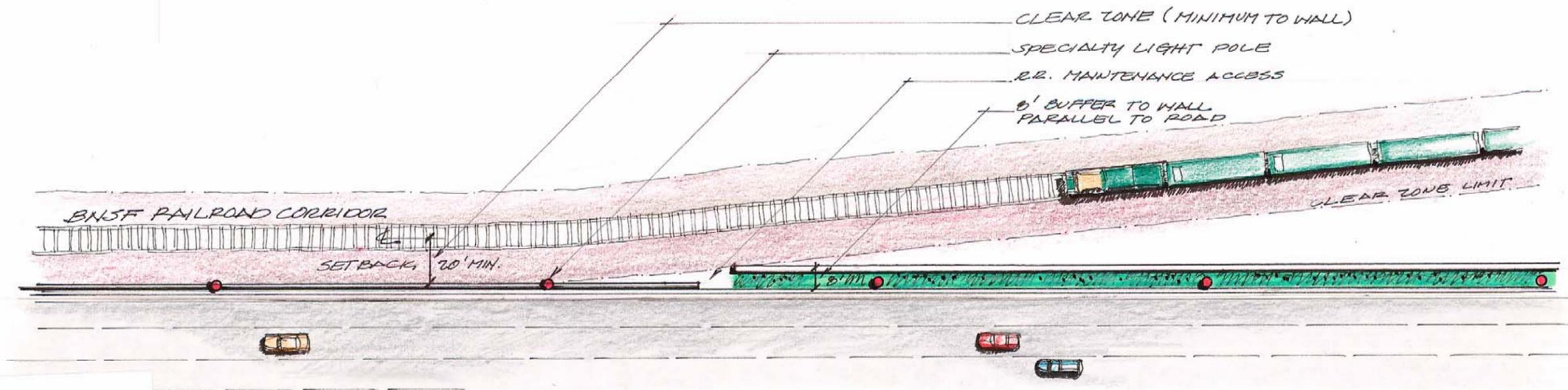
(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
LIGHTING CONCEPTS



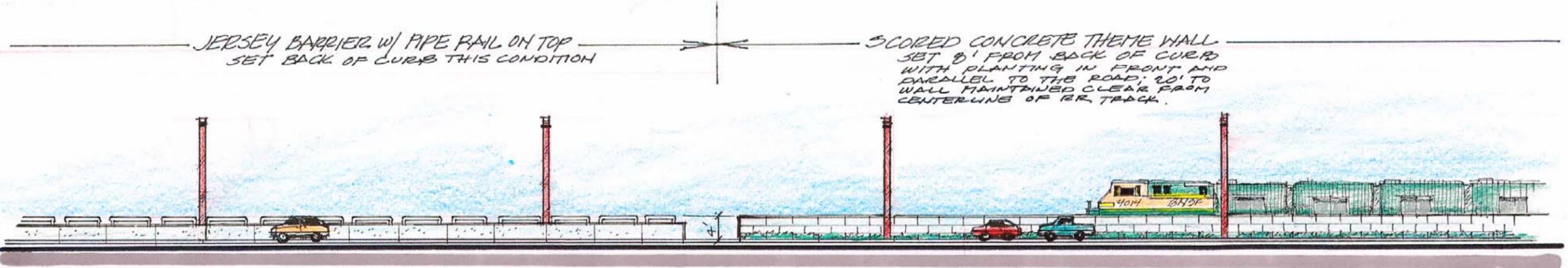


(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
MEDIAN PLANTING WITH GRASSES





**PLAN**

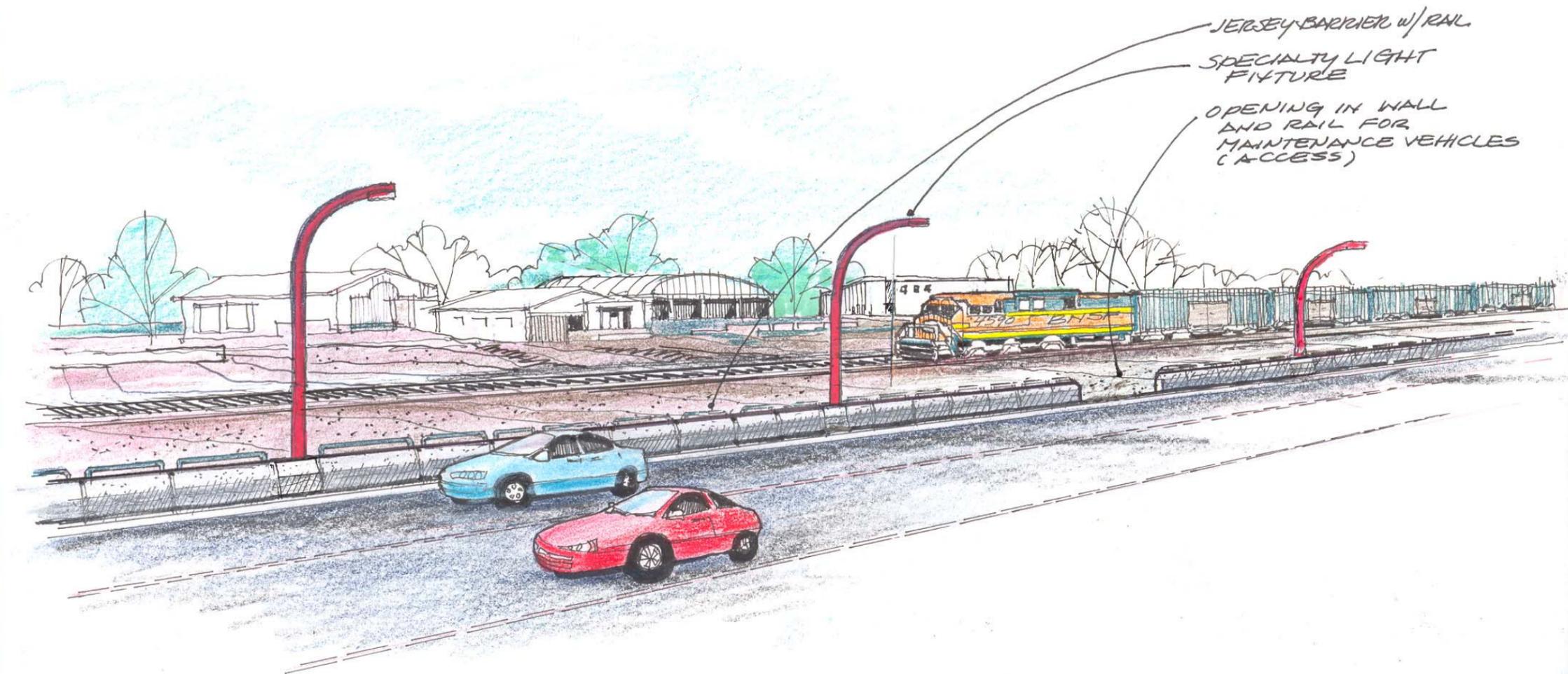


**ELEVATION**

WALLS EXAGGERATED VERTICALLY

(AESTHETICS)  
**GRAND CANYON THEME STUDIES**  
 THEME WALLS @ RAILROAD CORRIDOR





JERSEY BARRIER W/ RAIL  
 SPECIALTY LIGHT FIXTURE  
 OPENING IN WALL AND RAIL FOR MAINTENANCE VEHICLES (ACCESS)

(AESTHETICS)  
**GRAND AVENUE THEME STUDIES**  
 EDGE TREATMENT @ RAILROAD CORRIDOR (R/W)

WORKING PAPER 5 – ALTERNATIVES ANALYSIS  
 COMMUNITY MITIGATION

GRAND AVENUE MIS PHASE II



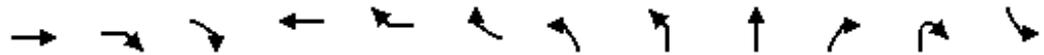
EXHIBIT 5.59

# **APPENDIX E**

## **Synchro Output - Existing LOS Analyses**

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Existing AM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2
Lane Configurations	↑↑↑	↔		↑↑↑	↔			↔	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0			
Lane Util. Factor	0.86	0.86		0.86	0.86			1.00	0.91			
Frt	0.99	0.85		0.98	0.85			1.00	0.99			
Flt Protected	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (prot)	4763	1362		4728	1362			1770	5031			
Flt Permitted	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (perm)	4763	1362		4728	1362			1770	5031			
Volume (vph)	481	91	137	235	83	26	87	61	370	26	3	34
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	523	99	149	255	90	28	95	66	402	28	3	37
Lane Group Flow (vph)	556	215	0	286	87	0	0	161	433	0	0	0
Turn Type	Perm			Perm			Prot	Prot				Prot
Protected Phases	4			8			5	5	2			1
Permitted Phases	4			8								
Actuated Green, G (s)	15.7	15.7		15.7	15.7			10.0	18.7			
Effective Green, g (s)	16.7	16.7		16.7	16.7			11.0	19.7			
Actuated g/C Ratio	0.15	0.15		0.15	0.15			0.10	0.17			
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	692	198		687	198			169	862			
v/s Ratio Prot	0.12			0.06				0.09	0.09			
v/s Ratio Perm		c0.16			0.06							
v/c Ratio	0.80	1.09		0.42	0.44			0.95	0.50			
Uniform Delay, d1	47.6	49.1		44.7	44.9			51.7	43.2			
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00			
Incremental Delay, d2	6.7	88.7		0.4	1.6			55.0	2.1			
Delay (s)	54.3	137.9		45.1	46.4			106.8	45.3			
Level of Service	D	F		D	D			F	D			
Approach Delay (s)	77.6			45.4					62.0			
Approach LOS	E			D					E			
<b>Intersection Summary</b>												
HCM Average Control Delay			65.5	HCM Level of Service				E				
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			115.0	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			95.2%	ICU Level of Service				E				
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Existing AM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue

												
Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SET	SER	SER2	NWL2	NWL	NWT
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0				4.0	4.0				4.0	4.0
Lane Util. Factor	1.00	0.95				0.97	0.91				0.97	0.91
Frt	1.00	0.99				1.00	0.96				1.00	0.98
Flt Protected	0.95	1.00				0.95	1.00				0.95	1.00
Satd. Flow (prot)	1770	3494				3433	4862				3433	4972
Flt Permitted	0.95	1.00				0.95	1.00				0.95	1.00
Satd. Flow (perm)	1770	3494				3433	4862				3433	4972
Volume (vph)	133	447	33	8	2	174	1262	513	8	4	12	168
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	145	486	36	9	2	189	1372	558	9	4	13	183
Lane Group Flow (vph)	182	531	0	0	0	191	1939	0	0	0	17	215
Turn Type	Prot				Prot	Prot				Prot	Prot	
Protected Phases	1	6			9	9	14			13	13	10
Permitted Phases												
Actuated Green, G (s)	11.0	19.7				9.7	43.0				1.6	34.9
Effective Green, g (s)	12.0	20.7				10.7	44.0				2.6	35.9
Actuated g/C Ratio	0.10	0.18				0.09	0.38				0.02	0.31
Clearance Time (s)	5.0	5.0				5.0	5.0				5.0	5.0
Vehicle Extension (s)	3.0	3.0				3.0	3.0				3.0	3.0
Lane Grp Cap (vph)	185	629				319	1860				78	1552
v/s Ratio Prot	c0.10	c0.15				c0.06	c0.40				0.00	0.04
v/s Ratio Perm												
v/c Ratio	0.98	0.84				0.60	1.04				0.22	0.14
Uniform Delay, d1	51.4	45.6				50.1	35.5				55.2	28.4
Progression Factor	1.00	1.00				1.00	1.00				1.00	1.00
Incremental Delay, d2	61.0	13.1				3.0	32.9				1.4	0.0
Delay (s)	112.4	58.7				53.1	68.4				56.6	28.5
Level of Service	F	E				D	E				E	C
Approach Delay (s)		72.4					67.0					30.5
Approach LOS		E					E					C
Intersection Summary												



Movement	NWR	NWR2
<b>Lane Configurations</b>		
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Volume (vph)	25	5
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	27	5
Lane Group Flow (vph)	0	0
<b>Turn Type</b>		
Protected Phases		
Permitted Phases		
Actuated Green, G (s)		
Effective Green, g (s)		
Actuated g/C Ratio		
Clearance Time (s)		
Vehicle Extension (s)		
<b>Lane Grp Cap (vph)</b>		
v/s Ratio Prot		
v/s Ratio Perm		
v/c Ratio		
Uniform Delay, d1		
Progression Factor		
Incremental Delay, d2		
Delay (s)		
Level of Service		
Approach Delay (s)		
Approach LOS		
<b>Intersection Summary</b>		

HCM Signalized Intersection Capacity Analysis  
3: Grand Avenue & 83rd Avenue

Existing AM Peak Hour  
Peoria Road/83rd Avenue/Grand Avenue

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↵	↕↕↕		↵	↕↕↕		↵	↕↕		↵	↕↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5070		1770	5040		1770	3500		1770	3356	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5070		1770	5040		1770	3500		1770	3356	
Volume (vph)	97	799	17	9	505	32	9	128	10	46	107	56
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	868	18	10	549	35	10	139	11	50	116	61
Lane Group Flow (vph)	105	886	0	10	584	0	10	150	0	50	177	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Actuated Green, G (s)	6.9	36.4		0.8	30.3		0.8	8.2		3.6	11.0	
Effective Green, g (s)	6.9	36.4		0.8	30.3		0.8	8.2		3.6	11.0	
Actuated g/C Ratio	0.11	0.56		0.01	0.47		0.01	0.13		0.06	0.17	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	188	2839		22	2349		22	442		98	568	
v/s Ratio Prot	c0.06	c0.17		0.01	0.12		0.01	0.04		c0.03	c0.05	
v/s Ratio Perm												
v/c Ratio	0.56	0.31		0.45	0.25		0.45	0.34		0.51	0.31	
Uniform Delay, d1	27.6	7.6		31.9	10.5		31.9	25.9		29.8	23.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.6	0.3		14.2	0.3		14.2	0.5		4.4	0.3	
Delay (s)	31.2	7.9		46.1	10.7		46.1	26.4		34.3	24.0	
Level of Service	C	A		D	B		D	C		C	C	
Approach Delay (s)		10.4			11.3			27.6			26.3	
Approach LOS		B			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			13.9			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.35									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			35.7%			ICU Level of Service				A		
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis  
3: Grand Avenue & Peoria Raod

Existing PM Peak Hour  
Peoria Road/83rd Avenue/Grand Avenue

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↵	↕↗		↵	↕↗		↵	↕↗		↵	↕↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5047		1770	5022		1770	3518		1770	3338	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5047		1770	5022		1770	3518		1770	3338	
Volume (vph)	208	709	38	12	832	75	36	282	12	30	276	168
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	771	41	13	904	82	39	307	13	33	300	183
Lane Group Flow (vph)	226	812	0	13	986	0	39	320	0	33	483	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Actuated Green, G (s)	11.3	35.2		0.8	24.7		1.6	11.4		1.6	11.4	
Effective Green, g (s)	11.3	35.2		0.8	24.7		1.6	11.4		1.6	11.4	
Actuated g/C Ratio	0.17	0.54		0.01	0.38		0.02	0.18		0.02	0.18	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	308	2733		22	1908		44	617		44	585	
v/s Ratio Prot	c0.13	0.16		0.01	c0.20		c0.02	0.09		0.02	c0.14	
v/s Ratio Perm												
v/c Ratio	0.73	0.30		0.59	0.52		0.89	0.52		0.75	0.83	
Uniform Delay, d1	25.4	8.1		31.9	15.5		31.6	24.3		31.5	25.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.7	0.3		36.0	1.0		92.1	0.7		51.4	9.3	
Delay (s)	34.2	8.4		67.9	16.6		123.7	25.1		82.9	35.1	
Level of Service	C	A		E	B		F	C		F	D	
Approach Delay (s)		14.0			17.2			35.8			38.2	
Approach LOS		B			B			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			22.1			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			56.0%			ICU Level of Service				A		
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis  
 3: Grand Avenue & Peoria Raod

Existing AM Peak Hour  
 Peoria Road/83rd Avenue/Grand Avenue

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↔	↑↑↓		↔	↑↑↓		↔	↑↑↓		↔	↑↑↓	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.99		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5078		1770	5059		1770	3407		1770	3357	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5078		1770	5059		1770	3407		1770	3357	
Volume (vph)	148	908	8	44	559	20	2	347	115	78	290	152
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	161	987	9	48	608	22	2	377	125	85	315	165
Lane Group Flow (vph)	161	996	0	48	630	0	2	502	0	85	480	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Actuated Green, G (s)	7.9	25.1		3.6	20.8		0.8	15.5		4.8	19.5	
Effective Green, g (s)	7.9	25.1		3.6	20.8		0.8	15.5		4.8	19.5	
Actuated g/C Ratio	0.12	0.39		0.06	0.32		0.01	0.24		0.07	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	215	1961		98	1619		22	812		131	1007	
v/s Ratio Prot	c0.09	c0.20		0.03	0.12		0.00	c0.15		c0.05	c0.14	
v/s Ratio Perm												
v/c Ratio	0.75	0.51		0.49	0.39		0.09	0.62		0.65	0.48	
Uniform Delay, d1	27.6	15.2		29.8	17.2		31.7	22.1		29.3	18.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.3	0.9		3.8	0.7		1.8	1.4		10.6	0.4	
Delay (s)	40.9	16.2		33.6	17.9		33.5	23.5		39.8	18.9	
Level of Service	D	B		C	B		C	C		D	B	
Approach Delay (s)		19.6			19.0			23.6			22.1	
Approach LOS		B			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			20.6			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			55.0%			ICU Level of Service				A		
c	Critical Lane Group											

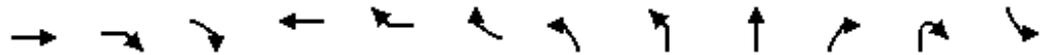
HCM Signalized Intersection Capacity Analysis  
3: Grand Avenue & Peoria Raod

Existing PM Peak Hour  
Peoria Road/83rd Avenue/Grand Avenue

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.99		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5076		1770	5035		1770	3478		1770	3389	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5076		1770	5035		1770	3478		1770	3389	
Volume (vph)	247	780	10	93	814	57	8	681	89	56	508	200
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	268	848	11	101	885	62	9	740	97	61	552	217
Lane Group Flow (vph)	268	859	0	101	947	0	9	837	0	61	769	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Actuated Green, G (s)	11.0	21.2		6.9	17.1		0.8	18.5		2.4	20.1	
Effective Green, g (s)	11.0	21.2		6.9	17.1		0.8	18.5		2.4	20.1	
Actuated g/C Ratio	0.17	0.33		0.11	0.26		0.01	0.28		0.04	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	300	1656		188	1325		22	990		65	1048	
v/s Ratio Prot	c0.15	0.17		0.06	c0.19		0.01	c0.24		c0.03	0.23	
v/s Ratio Perm												
v/c Ratio	0.89	0.52		0.54	0.71		0.41	0.85		0.94	0.73	
Uniform Delay, d1	26.4	17.8		27.5	21.7		31.9	21.9		31.2	20.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.6	1.2		2.9	3.3		11.9	6.7		89.0	2.7	
Delay (s)	53.1	18.9		30.5	25.1		43.8	28.6		120.2	22.8	
Level of Service	D	B		C	C		D	C		F	C	
Approach Delay (s)		27.0			25.6			28.8			29.9	
Approach LOS		C			C			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			27.7			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			73.6%			ICU Level of Service				C		
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Existing PM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2
Lane Configurations	↑↑↑	↔		↑↑↑	↔			↔	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0			
Lane Util. Factor	0.86	0.86		0.86	0.86			1.00	0.91			
Frt	0.98	0.85		1.00	0.85			1.00	1.00			
Flt Protected	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (prot)	4718	1362		4797	1362			1770	5074			
Flt Permitted	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (perm)	4718	1362		4797	1362			1770	5074			
Volume (vph)	329	63	121	1219	299	73	51	264	825	11	1	40
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	68	132	1325	325	79	55	287	897	12	1	43
Lane Group Flow (vph)	408	150	0	1341	388	0	0	342	910	0	0	0
Turn Type	Perm			Perm			Prot		Prot		Prot	
Protected Phases	4			8			5	5	2			1
Permitted Phases		4			8							
Actuated Green, G (s)	32.0	32.0		32.0	32.0			21.0	29.3			
Effective Green, g (s)	33.0	33.0		33.0	33.0			22.0	30.3			
Actuated g/C Ratio	0.24	0.24		0.24	0.24			0.16	0.22			
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	1153	333		1173	333			288	1139			
v/s Ratio Prot	0.09			0.28				c0.19	c0.18			
v/s Ratio Perm		0.11			c0.28							
v/c Ratio	0.35	0.45		1.14	1.17			1.19	0.80			
Uniform Delay, d1	42.2	43.3		51.0	51.0			56.5	49.5			
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00			
Incremental Delay, d2	0.2	1.0		75.0	102.1			113.7	5.9			
Delay (s)	42.4	44.3		126.0	153.1			170.2	55.4			
Level of Service	D	D		F	F			F	E			
Approach Delay (s)	42.9			132.1					86.7			
Approach LOS	D			F					F			
<b>Intersection Summary</b>												
HCM Average Control Delay	100.9			HCM Level of Service				F				
HCM Volume to Capacity ratio	1.07											
Actuated Cycle Length (s)	135.0			Sum of lost time (s)				16.0				
Intersection Capacity Utilization	109.9%			ICU Level of Service				F				
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Existing PM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue

												
Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SET	SER	SER2	NWL2	NWL	NWT
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0				4.0	4.0				4.0	4.0
Lane Util. Factor	1.00	0.95				0.97	0.91				0.97	0.91
Frt	1.00	0.98				1.00	0.94				1.00	0.99
Flt Protected	0.95	1.00				0.95	1.00				0.95	1.00
Satd. Flow (prot)	1770	3456				3433	4796				3433	5032
Flt Permitted	0.95	1.00				0.95	1.00				0.95	1.00
Satd. Flow (perm)	1770	3456				3433	4796				3433	5032
Volume (vph)	53	330	52	9	3	74	278	157	12	9	126	1329
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	359	57	10	3	80	302	171	13	10	137	1445
Lane Group Flow (vph)	101	426	0	0	0	83	486	0	0	0	147	1553
Turn Type	Prot				Prot	Prot				Prot	Prot	
Protected Phases	1	6			9	9	14			13	13	10
Permitted Phases												
Actuated Green, G (s)	9.7	18.0				4.0	30.2				8.8	35.0
Effective Green, g (s)	10.7	19.0				5.0	31.2				9.8	36.0
Actuated g/C Ratio	0.08	0.14				0.04	0.23				0.07	0.27
Clearance Time (s)	5.0	5.0				5.0	5.0				5.0	5.0
Vehicle Extension (s)	3.0	3.0				3.0	3.0				3.0	3.0
Lane Grp Cap (vph)	140	486				127	1108				249	1342
v/s Ratio Prot	0.06	0.12				0.02	0.10				c0.04	c0.31
v/s Ratio Perm												
v/c Ratio	0.72	0.88				0.65	0.44				0.59	1.16
Uniform Delay, d1	60.7	56.9				64.1	44.4				60.7	49.5
Progression Factor	1.00	1.00				1.00	1.00				1.00	1.00
Incremental Delay, d2	16.7	19.5				11.5	0.3				3.7	79.5
Delay (s)	77.4	76.3				75.6	44.7				64.4	129.0
Level of Service	E	E				E	D				E	F
Approach Delay (s)		76.5					49.2					123.4
Approach LOS		E					D					F
Intersection Summary												



Movement	NWR	NWR2
<b>Intersection Summary</b>		
<b>Approach Configurations</b>		
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Volume (vph)	97	3
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	105	3
Lane Group Flow (vph)	0	0
Turn Type		
Protected Phases		
Permitted Phases		
Actuated Green, G (s)		
Effective Green, g (s)		
Actuated g/C Ratio		
Clearance Time (s)		
Vehicle Extension (s)		
Lane Grp Cap (vph)		
v/s Ratio Prot		
v/s Ratio Perm		
v/c Ratio		
Uniform Delay, d1		
Progression Factor		
Incremental Delay, d2		
Delay (s)		
Level of Service		
Approach Delay (s)		
Approach LOS		
<b>Intersection Summary</b>		

HCM Signalized Intersection Capacity Analysis  
 3: Indian School Road & 35th Avenue

Existing PM Peak Hour  
 Indian School Road/35th Avenue/Grand Avenue

												
Movement	EBL	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88		1.00	0.91		1.00	0.91	0.91	0.97	0.91
Frt	1.00	1.00	0.85		1.00	0.98		1.00	1.00	0.85	1.00	0.97
Flt Protected	0.95	1.00	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	2787		1770	4980		1770	3390	1441	3433	4908
Flt Permitted	0.95	1.00	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	2787		1770	4980		1770	3390	1441	3433	4908
Volume (vph)	200	2248	189	0	396	1785	287	267	772	287	189	764
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2443	205	0	430	1940	312	290	839	312	205	830
Lane Group Flow (vph)	217	2443	205	0	430	2252	0	290	839	312	205	1082
Turn Type	Perm		Perm		Prot			Prot		Perm	Prot	
Protected Phases		4			5	2		1	6		9	14
Permitted Phases	4		4						6			
Actuated Green, G (s)	30.0	30.0	30.0		7.0	24.0		6.0	23.0	23.0	4.0	25.0
Effective Green, g (s)	31.0	31.0	31.0		8.0	25.0		7.0	24.0	24.0	5.0	26.0
Actuated g/C Ratio	0.27	0.27	0.27		0.07	0.22		0.06	0.21	0.21	0.04	0.23
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	477	502	751		123	1083		108	707	301	149	1110
v/s Ratio Prot		c1.31			c0.24	c0.45		0.16	0.25		c0.06	0.22
v/s Ratio Perm	0.12		0.07							0.22		
v/c Ratio	0.45	4.87	0.27		3.50	2.08		2.69	1.19	1.04	1.38	0.97
Uniform Delay, d1	35.0	42.0	33.1		53.5	45.0		54.0	45.5	45.5	55.0	44.2
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	1744.4	0.2		1143.3	488.9		784.0	97.9	61.7	205.5	21.0
Delay (s)	35.7	1786.4	33.3		1196.8	533.9		838.0	143.4	107.2	260.5	65.1
Level of Service	D	F	C		F	F		F	F	F	F	E
Approach Delay (s)		1528.4		0.0		640.2			275.4			96.3
Approach LOS		F		A		F			F			F
<b>Intersection Summary</b>												
HCM Average Control Delay			843.4		HCM Level of Service					F		
HCM Volume to Capacity ratio			3.11									
Actuated Cycle Length (s)			115.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			282.6%		ICU Level of Service					H		
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: Indian School Road & 35th Avenue

Existing PM Peak Hour  
 Indian School Road/35th Avenue/Grand Avenue



Movement	SER	NWL	NWT	NWR
Left Lane Configurations		←←	↑↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	
Lane Util. Factor		0.97	0.91	
Frt		1.00	0.98	
Flt Protected		0.95	1.00	
Satd. Flow (prot)		3433	4959	
Flt Permitted		0.95	1.00	
Satd. Flow (perm)		3433	4959	
Volume (vph)	232	170	2753	544
Peak-hour factor, PHF	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	185	2992	591
Lane Group Flow (vph)	0	185	3583	0
Turn Type		Prot		
Protected Phases		13	10	
Permitted Phases				
Actuated Green, G (s)		5.0	26.0	
Effective Green, g (s)		6.0	27.0	
Actuated g/C Ratio		0.05	0.23	
Clearance Time (s)		5.0	5.0	
Vehicle Extension (s)		3.0	3.0	
Lane Grp Cap (vph)		179	1164	
v/s Ratio Prot		0.05	c0.72	
v/s Ratio Perm				
v/c Ratio		1.03	3.08	
Uniform Delay, d1		54.5	44.0	
Progression Factor		1.00	1.00	
Incremental Delay, d2		76.3	937.5	
Delay (s)		130.8	981.5	
Level of Service		F	F	
Approach Delay (s)			939.7	
Approach LOS			F	
<b>Intersection Summary</b>				

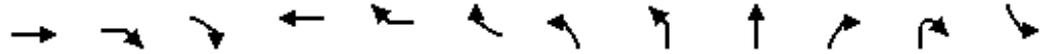
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# **APPENDIX F**

## **Synchro Output - Proposed LOS Analyses**

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Alternative 1 AM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2
Lane Configurations	↑↑↑	↔		↑↑↑	↔			↔	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0			
Lane Util. Factor	0.86	0.86		0.86	0.86			1.00	0.91			
Frt	0.99	0.85		0.98	0.85			1.00	0.99			
Flt Protected	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (prot)	4757	1362		4728	1362			1770	5031			
Flt Permitted	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (perm)	4757	1362		4728	1362			1770	5031			
Volume (vph)	481	91	137	235	83	26	87	0	370	26	3	34
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	523	99	149	255	90	28	95	0	402	28	3	37
Lane Group Flow (vph)	561	210	0	286	87	0	0	95	433	0	0	0
Turn Type	Perm			Perm			Prot		Prot		Prot	
Protected Phases	4			8			5	5	2			1
Permitted Phases	4			8								
Actuated Green, G (s)	17.3	17.3		17.3	17.3			8.6	22.0			
Effective Green, g (s)	18.3	18.3		18.3	18.3			9.6	23.0			
Actuated g/C Ratio	0.16	0.16		0.16	0.16			0.08	0.20			
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	757	217		752	217			148	1006			
v/s Ratio Prot	0.12			0.06				0.05	0.09			
v/s Ratio Perm		c0.15			0.06							
v/c Ratio	0.74	0.97		0.38	0.40			0.64	0.43			
Uniform Delay, d1	46.1	48.1		43.3	43.4			51.0	40.3			
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00			
Incremental Delay, d2	3.9	51.3		0.3	1.2			9.2	1.3			
Delay (s)	50.0	99.4		43.6	44.6			60.2	41.6			
Level of Service	D	F		D	D			E	D			
Approach Delay (s)	63.5			43.8					45.0			
Approach LOS	E			D					D			
<b>Intersection Summary</b>												
HCM Average Control Delay	48.0			HCM Level of Service				D				
HCM Volume to Capacity ratio	0.79											
Actuated Cycle Length (s)	115.0			Sum of lost time (s)				16.0				
Intersection Capacity Utilization	79.1%			ICU Level of Service				C				
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Alternative 1 AM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue

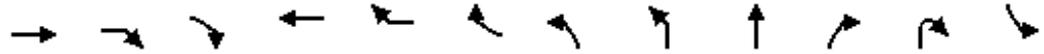
													
Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SET	SER2	NWL2	NWL	NWT	NWR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0				4.0	4.0			4.0	4.0		
Lane Util. Factor	1.00	0.95				0.97	0.91			0.97	0.91		
Frt	1.00	0.99				1.00	1.00			1.00	0.98		
Flt Protected	0.95	1.00				0.95	1.00			0.95	1.00		
Satd. Flow (prot)	1770	3494				3433	5080			3433	4972		
Flt Permitted	0.95	1.00				0.95	1.00			0.95	1.00		
Satd. Flow (perm)	1770	3494				3433	5080			3433	4972		
Volume (vph)	133	447	33	8	2	174	1262	8	4	12	168	25	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	145	486	36	9	2	189	1372	9	4	13	183	27	
Lane Group Flow (vph)	182	531	0	0	0	191	1381	0	0	17	215	0	
Turn Type	Prot				Prot	Prot			Prot	Prot			
Protected Phases	1	6			9	9	14		13	13	10		
Permitted Phases													
Actuated Green, G (s)	14.7	28.1				9.7	34.4			1.6	26.3		
Effective Green, g (s)	15.7	29.1				10.7	35.4			2.6	27.3		
Actuated g/C Ratio	0.14	0.25				0.09	0.31			0.02	0.24		
Clearance Time (s)	5.0	5.0				5.0	5.0			5.0	5.0		
Vehicle Extension (s)	3.0	3.0				3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	242	884				319	1564			78	1180		
v/s Ratio Prot	c0.10	c0.15				c0.06	c0.27			0.00	0.04		
v/s Ratio Perm													
v/c Ratio	0.75	0.60				0.60	0.88			0.22	0.18		
Uniform Delay, d1	47.8	37.8				50.1	37.8			55.2	35.0		
Progression Factor	1.00	1.00				1.00	1.00			1.00	1.00		
Incremental Delay, d2	12.4	3.0				3.0	6.3			1.4	0.1		
Delay (s)	60.2	40.8				53.1	44.1			56.6	35.0		
Level of Service	E	D				D	D			E	D		
Approach Delay (s)		45.8					45.2				36.6		
Approach LOS		D					D				D		
Intersection Summary													



<b>Movement</b>	<b>NWR2</b>
Lane Configurations	
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Volume (vph)	5
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	5
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
<b>Intersection Summary</b>	

HCM Signalized Intersection Capacity Analysis  
3: McDowell Road & 19th Avenue

Alternative 1 PM Peak Hour  
McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2
Lane Configurations	↑↑↑	↔		↑↑↑	↔			↔	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0			
Lane Util. Factor	0.86	0.86		0.86	0.86			1.00	0.91			
Frt	0.98	0.85		1.00	0.85			1.00	1.00			
Flt Protected	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (prot)	4713	1362		4797	1362			1770	5074			
Flt Permitted	1.00	1.00		1.00	1.00			0.95	1.00			
Satd. Flow (perm)	4713	1362		4797	1362			1770	5074			
Volume (vph)	329	63	121	1219	299	73	51	0	825	11	1	40
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	68	132	1325	325	79	55	0	897	12	1	43
Lane Group Flow (vph)	411	147	0	1342	387	0	0	55	910	0	0	0
Turn Type	Perm			Perm			Prot		Prot		Prot	
Protected Phases	4			8			5	5	2			1
Permitted Phases	4			8								
Actuated Green, G (s)	35.0	35.0		35.0	35.0			4.0	25.0			
Effective Green, g (s)	36.0	36.0		36.0	36.0			5.0	26.0			
Actuated g/C Ratio	0.27	0.27		0.27	0.27			0.04	0.19			
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)	1257	363		1279	363			66	977			
v/s Ratio Prot	0.09			0.28				0.03	c0.18			
v/s Ratio Perm		0.11		c0.28								
v/c Ratio	0.33	0.40		1.05	1.07			0.83	0.93			
Uniform Delay, d1	39.8	40.7		49.5	49.5			64.6	53.6			
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00			
Incremental Delay, d2	0.2	0.7		39.1	65.9			56.6	16.4			
Delay (s)	39.9	41.4		88.6	115.4			121.2	70.0			
Level of Service	D	D		F	F			F	E			
Approach Delay (s)	40.3			94.6					72.9			
Approach LOS	D			F					E			
<b>Intersection Summary</b>												
HCM Average Control Delay	76.3			HCM Level of Service				E				
HCM Volume to Capacity ratio	1.03											
Actuated Cycle Length (s)	135.0			Sum of lost time (s)				24.0				
Intersection Capacity Utilization	102.1%			ICU Level of Service				F				
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Alternative 1 PM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue

													
Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SET	SER2	NWL2	NWL	NWT	NWR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0				4.0	4.0				4.0	4.0	
Lane Util. Factor	1.00	0.95				0.97	0.91				0.97	0.91	
Frt	1.00	0.98				1.00	0.99				1.00	0.99	
Flt Protected	0.95	1.00				0.95	1.00				0.95	1.00	
Satd. Flow (prot)	1770	3456				3433	5054				3433	5032	
Flt Permitted	0.95	1.00				0.95	1.00				0.95	1.00	
Satd. Flow (perm)	1770	3456				3433	5054				3433	5032	
Volume (vph)	53	330	52	9	3	74	278	12	9	126	1329	97	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	58	359	57	10	3	80	302	13	10	137	1445	105	
Lane Group Flow (vph)	101	426	0	0	0	83	315	0	0	147	1553	0	
Turn Type	Prot					Prot	Prot			Prot	Prot		
Protected Phases	1	6				9	9	14			13	13	10
Permitted Phases													
Actuated Green, G (s)	7.0	28.0				4.0	34.2			8.8	39.0		
Effective Green, g (s)	8.0	29.0				5.0	35.2			9.8	40.0		
Actuated g/C Ratio	0.06	0.21				0.04	0.26			0.07	0.30		
Clearance Time (s)	5.0	5.0				5.0	5.0			5.0	5.0		
Vehicle Extension (s)	3.0	3.0				3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	105	742				127	1318			249	1491		
v/s Ratio Prot	c0.06	c0.12				0.02	0.06			c0.04	c0.31		
v/s Ratio Perm													
v/c Ratio	0.96	0.57				0.65	0.24			0.59	1.04		
Uniform Delay, d1	63.3	47.5				64.1	39.3			60.7	47.5		
Progression Factor	1.00	1.00				1.00	1.00			1.00	1.00		
Incremental Delay, d2	75.2	3.2				11.5	0.1			3.7	34.9		
Delay (s)	138.6	50.7				75.6	39.4			64.4	82.4		
Level of Service	F	D				E	D			E	F		
Approach Delay (s)	67.5					47.0				80.9			
Approach LOS	E					D				F			
Intersection Summary													



<b>Movement</b>	<b>NWR2</b>
Lane Configurations	
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Volume (vph)	3
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	3
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
<b>Intersection Summary</b>	

HCM Signalized Intersection Capacity Analysis  
 3: Indian School Road & 35th Avenue

Alternative 1 PM Peak Hour  
 Indian School Road/35th Avenue/Grand Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0					4.0	4.0		4.0	4.0		
Lane Util. Factor	1.00	1.00					1.00	0.91		1.00	0.95		
Frt	1.00	0.88					1.00	0.99		1.00	0.98		
Flt Protected	0.95	1.00					0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1770	1642					1770	5028		1770	3471		
Flt Permitted	0.95	1.00					0.95	1.00		0.95	1.00		
Satd. Flow (perm)	1770	1642					1770	5028		1770	3471		
Volume (vph)	100	50	189	0	0	0	198	1785	144	144	906	133	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	109	54	205	0	0	0	215	1940	157	157	985	145	
Lane Group Flow (vph)	109	259	0	0	0	0	215	2097	0	157	1130	0	
Turn Type	Perm						Prot			Prot			
Protected Phases							5	2			1	6	
Permitted Phases	4												
Actuated Green, G (s)	9.4	9.4					9.7	34.6			6.0	30.9	
Effective Green, g (s)	10.4	10.4					10.7	35.6			7.0	31.9	
Actuated g/C Ratio	0.16	0.16					0.16	0.55			0.11	0.49	
Clearance Time (s)	5.0	5.0					5.0	5.0			5.0	5.0	
Vehicle Extension (s)	3.0	3.0					3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)	283	263					291	2754			191	1703	
v/s Ratio Prot	c0.16						c0.12	c0.42			0.09	0.33	
v/s Ratio Perm	0.06												
v/c Ratio	0.39	0.98					0.74	0.76			0.82	0.66	
Uniform Delay, d1	24.4	27.2					25.8	11.4			28.4	12.5	
Progression Factor	1.00	1.00					1.00	1.00			1.00	1.00	
Incremental Delay, d2	0.9	50.9					9.4	2.0			23.9	2.1	
Delay (s)	25.3	78.1					35.2	13.5			52.3	14.6	
Level of Service	C						D		B		D		B
Approach Delay (s)	62.5		0.0				15.5				19.2		
Approach LOS	E		A				B				B		
<b>Intersection Summary</b>													
HCM Average Control Delay			21.0		HCM Level of Service				C				
HCM Volume to Capacity ratio			0.82										
Actuated Cycle Length (s)			65.0		Sum of lost time (s)				12.0				
Intersection Capacity Utilization			75.2%		ICU Level of Service				C				
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
3: McDowell Road & 19th Avenue

Alternative 2 AM Peak Hour  
McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR2	WBT	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations		↗		↗		↘	↑↑↑				↘	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0				4.0	4.0
Lane Util. Factor		1.00		1.00		1.00	0.91				1.00	0.95
Frt		0.86		0.86		1.00	0.99				1.00	0.99
Flt Protected		1.00		1.00		0.95	1.00				0.95	1.00
Satd. Flow (prot)		1611		1611		1770	5031				1770	3494
Flt Permitted		1.00		1.00		0.95	1.00				0.95	1.00
Satd. Flow (perm)		1611		1611		1770	5031				1770	3494
Volume (vph)	0	228	0	108	87	61	370	26	3	34	133	447
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	248	0	117	95	66	402	28	3	37	145	486
Lane Group Flow (vph)	0	248	0	117	0	161	433	0	0	0	182	531
Turn Type		Free		Free	Prot	Prot				Prot	Prot	
Protected Phases					5	5	2			1	1	6
Permitted Phases		Free		Free								
Actuated Green, G (s)		94.0		94.0		10.6	20.8				11.6	21.8
Effective Green, g (s)		94.0		94.0		11.6	21.8				12.6	22.8
Actuated g/C Ratio		1.00		1.00		0.12	0.23				0.13	0.24
Clearance Time (s)						5.0	5.0				5.0	5.0
Vehicle Extension (s)						3.0	3.0				3.0	3.0
Lane Grp Cap (vph)		1611		1611		218	1167				237	847
v/s Ratio Prot						0.09	0.09				c0.10	c0.15
v/s Ratio Perm		c0.15		0.07								
v/c Ratio		0.15		0.07		0.74	0.37				0.77	0.63
Uniform Delay, d1		0.0		0.0		39.7	30.3				39.3	31.8
Progression Factor		1.00		1.00		1.00	1.00				1.00	1.00
Incremental Delay, d2		0.2		0.1		12.3	0.9				13.8	3.5
Delay (s)		0.2		0.1		52.0	31.2				53.1	35.3
Level of Service		A		A		D	C				D	D
Approach Delay (s)	0.2		0.1				36.9					39.9
Approach LOS	A		A				D					D
<b>Intersection Summary</b>												
HCM Average Control Delay			30.9			HCM Level of Service					C	
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			94.0			Sum of lost time (s)					12.0	
Intersection Capacity Utilization			79.6%			ICU Level of Service					C	
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Alternative 2 AM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue



Movement	SBR	SBR2	SEL2	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR	NWR2
Lane Configurations				⇌	⇌⇌				⇌	⇌⇌		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0				4.0	4.0		
Lane Util. Factor				0.97	0.91				0.97	0.91		
Frt				1.00	0.96				1.00	0.98		
Flt Protected				0.95	1.00				0.95	1.00		
Satd. Flow (prot)				3433	4862				3433	4972		
Flt Permitted				0.95	1.00				0.95	1.00		
Satd. Flow (perm)				3433	4862				3433	4972		
Volume (vph)	33	8	2	174	1262	513	8	4	12	168	25	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	9	2	189	1372	558	9	4	13	183	27	5
Lane Group Flow (vph)	0	0	0	191	1939	0	0	0	17	215	0	0
Turn Type				Prot	Prot				Prot	Prot		
Protected Phases				9	9	14			13	13	10	
Permitted Phases												
Actuated Green, G (s)				7.9	40.0				1.6	33.7		
Effective Green, g (s)				8.9	41.0				2.6	34.7		
Actuated g/C Ratio				0.09	0.44				0.03	0.37		
Clearance Time (s)				5.0	5.0				5.0	5.0		
Vehicle Extension (s)				3.0	3.0				3.0	3.0		
Lane Grp Cap (vph)				325	2121				95	1835		
v/s Ratio Prot				c0.06	c0.40				0.00	0.04		
v/s Ratio Perm												
v/c Ratio				0.59	0.91				0.18	0.12		
Uniform Delay, d1				40.8	24.9				44.7	19.6		
Progression Factor				1.00	1.00				1.00	1.00		
Incremental Delay, d2				2.7	6.6				0.9	0.0		
Delay (s)				43.5	31.5				45.6	19.6		
Level of Service				D	C				D	B		
Approach Delay (s)					32.5					21.5		
Approach LOS					C					C		
Intersection Summary												

HCM Signalized Intersection Capacity Analysis  
3: McDowell Road & 19th Avenue

Alternative 2 PM Peak Hour  
McDowell Road/19th Avenue/Grand Avenue



Movement	EBT	EBR2	WBT	WBR2	NBL2	NBL	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations		↗		↗		↘	↑↑↑				↘	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0				4.0	4.0
Lane Util. Factor		1.00		1.00		1.00	0.91				1.00	0.95
Frt		0.86		0.86		1.00	1.00				1.00	0.98
Flt Protected		1.00		1.00		0.95	1.00				0.95	1.00
Satd. Flow (prot)		1611		1611		1770	5074				1770	3456
Flt Permitted		1.00		1.00		0.95	1.00				0.95	1.00
Satd. Flow (perm)		1611		1611		1770	5074				1770	3456
Volume (vph)	0	184	0	372	51	264	825	11	1	40	53	330
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	200	0	404	55	287	897	12	1	43	58	359
Lane Group Flow (vph)	0	200	0	404	0	342	910	0	0	0	101	426
Turn Type		Free		Free	Prot	Prot				Prot	Prot	
Protected Phases					5	5	2			1	1	6
Permitted Phases		Free		Free								
Actuated Green, G (s)		90.0		90.0		19.2	30.1				7.7	18.6
Effective Green, g (s)		90.0		90.0		20.2	31.1				8.7	19.6
Actuated g/C Ratio		1.00		1.00		0.22	0.35				0.10	0.22
Clearance Time (s)						5.0	5.0				5.0	5.0
Vehicle Extension (s)						3.0	3.0				3.0	3.0
Lane Grp Cap (vph)		1611		1611		397	1753				171	753
v/s Ratio Prot						c0.19	c0.18				0.06	0.12
v/s Ratio Perm		0.12		0.25								
v/c Ratio		0.12		0.25		0.86	0.52				0.59	0.57
Uniform Delay, d1		0.0		0.0		33.6	23.5				38.9	31.4
Progression Factor		1.00		1.00		1.00	1.00				1.00	1.00
Incremental Delay, d2		0.2		0.4		17.2	1.1				5.4	3.1
Delay (s)		0.2		0.4		50.7	24.6				44.3	34.5
Level of Service		A		A		D	C				D	C
Approach Delay (s)	0.2		0.4				31.7					36.4
Approach LOS	A		A				C					D
<b>Intersection Summary</b>												
HCM Average Control Delay			30.1		HCM Level of Service						C	
HCM Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			78.0%		ICU Level of Service					C		
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 3: McDowell Road & 19th Avenue

Alternative 2 PM Peak Hour  
 McDowell Road/19th Avenue/Grand Avenue



Movement	SBR	SBR2	SEL2	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR	NWR2
Lane Configurations				⇌	⇌⇌				⇌	⇌⇌		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0				4.0	4.0		
Lane Util. Factor				0.97	0.91				0.97	0.91		
Frt				1.00	0.94				1.00	0.99		
Flt Protected				0.95	1.00				0.95	1.00		
Satd. Flow (prot)				3433	4796				3433	5032		
Flt Permitted				0.95	1.00				0.95	1.00		
Satd. Flow (perm)				3433	4796				3433	5032		
Volume (vph)	52	9	3	74	278	157	12	9	126	1329	97	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	10	3	80	302	171	13	10	137	1445	105	3
Lane Group Flow (vph)	0	0	0	83	486	0	0	0	147	1553	0	0
Turn Type				Prot	Prot				Prot	Prot		
Protected Phases				9	9	14			13	13	10	
Permitted Phases												
Actuated Green, G (s)				3.2	25.3				6.9	29.0		
Effective Green, g (s)				4.2	26.3				7.9	30.0		
Actuated g/C Ratio				0.05	0.29				0.09	0.33		
Clearance Time (s)				5.0	5.0				5.0	5.0		
Vehicle Extension (s)				3.0	3.0				3.0	3.0		
Lane Grp Cap (vph)				160	1401				301	1677		
v/s Ratio Prot				0.02	0.10				c0.04	c0.31		
v/s Ratio Perm												
v/c Ratio				0.52	0.35				0.49	0.93		
Uniform Delay, d1				41.9	25.1				39.1	28.9		
Progression Factor				1.00	1.00				1.00	1.00		
Incremental Delay, d2				2.8	0.2				1.2	9.2		
Delay (s)				44.7	25.2				40.4	38.1		
Level of Service				D	C				D	D		
Approach Delay (s)					28.1					38.3		
Approach LOS					C					D		
Intersection Summary												

HCM Signalized Intersection Capacity Analysis  
3: Indian School Road & Grand Avenue

Alternative 2 PM Peak Hour  
Indian School Road/35th Avenue/Grand Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕	↗				↖	↖↗		↖	↖↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00				0.97	0.91		0.97	0.91	
Frt		1.00	0.85				1.00	0.98		1.00	0.99	
Flt Protected		0.97	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1802	1583				3433	4997		3433	5017	
Flt Permitted		0.97	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1802	1583				3433	4997		3433	5017	
Volume (vph)	100	50	189	0	0	0	189	881	116	170	2753	272
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	54	205	0	0	0	205	958	126	185	2992	296
Lane Group Flow (vph)	0	163	205	0	0	0	205	1084	0	185	3288	0
Turn Type	Perm		Perm				Prot			Prot		
Protected Phases		4					9	14		13	10	
Permitted Phases	4		4									
Actuated Green, G (s)		17.0	17.0				5.0	59.3		8.7	63.0	
Effective Green, g (s)		18.0	18.0				6.0	60.3		9.7	64.0	
Actuated g/C Ratio		0.18	0.18				0.06	0.60		0.10	0.64	
Clearance Time (s)		5.0	5.0				5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		324	285				206	3013		333	3211	
v/s Ratio Prot							c0.06	0.22		0.05	c0.66	
v/s Ratio Perm		0.09	c0.13									
v/c Ratio		0.50	0.72				1.00	0.36		0.56	1.02	
Uniform Delay, d1		37.0	38.6				47.0	10.1		43.1	18.0	
Progression Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.2	8.4				61.0	0.1		2.0	22.3	
Delay (s)		38.2	47.0				108.0	10.1		45.1	40.3	
Level of Service		D	D				F	B		D	D	
Approach Delay (s)		43.1			0.0			25.7			40.6	
Approach LOS		D			A			C			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			37.0				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			89.1%				ICU Level of Service			D		
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: McDowell Road & Grand Avenue

Alternative 3 AM Peak Hour  
McDowell Road/19th Avenue/Grand Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑	↑		↑↑↑	↑	↑↑	↑↑↑		↑↑	↑↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.86	0.86		0.86	0.86	0.97	0.91		0.97	0.91	
Frt		0.97	0.85		0.99	0.85	1.00	1.00		1.00	1.00	
Flt Protected		1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		4681	1362		4742	1362	3433	5065		3433	5068	
Flt Permitted		1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		4681	1362		4742	1362	3433	5065		3433	5068	
Volume (vph)	0	481	329	0	235	109	174	1518	41	12	193	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	523	358	0	255	118	189	1650	45	13	210	5
Lane Group Flow (vph)	0	633	248	0	280	93	189	1695	0	13	215	0
Turn Type		Perm			Perm		Prot		Prot			
Protected Phases		4			8		9	14		13	10	
Permitted Phases		4			8							
Actuated Green, G (s)		36.1	36.1		36.1	36.1	10.2	37.6		1.3	28.7	
Effective Green, g (s)		37.1	37.1		37.1	37.1	11.2	38.6		2.3	29.7	
Actuated g/C Ratio		0.41	0.41		0.41	0.41	0.12	0.43		0.03	0.33	
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		1930	561		1955	561	427	2172		88	1672	
v/s Ratio Prot		0.14			0.06		c0.06	c0.33		0.00	0.04	
v/s Ratio Perm			c0.18			0.07						
v/c Ratio		0.33	0.44		0.14	0.17	0.44	0.78		0.15	0.13	
Uniform Delay, d1		18.0	19.0		16.5	16.7	36.5	22.1		42.9	21.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1	0.6		0.0	0.1	0.7	1.9		0.8	0.0	
Delay (s)		18.1	19.6		16.6	16.8	37.2	23.9		43.7	21.1	
Level of Service		B	B		B	B	D	C		D	C	
Approach Delay (s)		18.5			16.6			25.3			22.4	
Approach LOS		B			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay		22.4			HCM Level of Service					C		
HCM Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		90.0			Sum of lost time (s)					12.0		
Intersection Capacity Utilization		59.0%			ICU Level of Service					A		
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: McDowell Road & Grand Avenue

Alternative 3 PM Peak Hour  
McDowell Road/19th Avenue/Grand Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑	↑		↑↑↑	↑	↑↑	↑↑↑		↑↑	↑↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.86	0.86		0.86	0.86	0.97	0.91		0.97	0.91	
Frt		0.98	0.85		1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		4695	1362		4806	1362	3433	4967		3433	5084	
Flt Permitted		1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		4695	1362		4806	1362	3433	4967		3433	5084	
Volume (vph)	0	329	184	0	1219	372	74	352	64	126	1426	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	358	200	0	1325	404	80	383	70	137	1550	3
Lane Group Flow (vph)	0	423	135	0	1325	404	80	453	0	137	1553	0
Turn Type		Perm			Perm		Prot		Prot			
Protected Phases		4			8		9	14		13	10	
Permitted Phases		4			8							
Actuated Green, G (s)		39.3	39.3		39.3	39.3	3.2	29.7		6.0	32.5	
Effective Green, g (s)		40.3	40.3		40.3	40.3	4.2	30.7		7.0	33.5	
Actuated g/C Ratio		0.45	0.45		0.45	0.45	0.05	0.34		0.08	0.37	
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2102	610		2152	610	160	1694		267	1892	
v/s Ratio Prot		0.09			0.28		0.02	0.09		c0.04	c0.31	
v/s Ratio Perm			0.10			c0.30						
v/c Ratio		0.20	0.22		0.62	0.66	0.50	0.27		0.51	0.82	
Uniform Delay, d1		15.1	15.2		18.9	19.5	41.9	21.5		39.9	25.5	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.0	0.2		0.5	2.7	2.4	0.1		1.7	3.0	
Delay (s)		15.1	15.4		19.5	22.2	44.3	21.6		41.5	28.5	
Level of Service		B	B		B	C	D	C		D	C	
Approach Delay (s)		15.2			20.1			25.0			29.6	
Approach LOS		B			C			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay		23.6			HCM Level of Service				C			
HCM Volume to Capacity ratio		0.73										
Actuated Cycle Length (s)		90.0			Sum of lost time (s)				12.0			
Intersection Capacity Utilization		72.0%			ICU Level of Service				C			
c Critical Lane Group												

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# APPENDIX G

## Unfunded Projects

### Estimated Costs for Unfunded Projects (2005 Dollars)

Segment	Item of Work	Estimated 2005 Cost
91 <sup>st</sup> Ave to / 83 <sup>rd</sup> Ave	Grand Avenue Underpass at Peoria Avenue	\$24,493,000
	Park-n-Ride Station & Transit Center (Transit Funding)	\$9,000,000
	Pedestrian Crossing TBD (Potential Pedestrian Funding)	\$2,000,000
83 <sup>rd</sup> Ave to 75 <sup>th</sup> Ave	None	\$0
75 <sup>th</sup> Ave to 67 <sup>th</sup> Ave	Auxiliary Lane (including landscaping, sidewalk, wall, driveway closures and utility undergrounding) – 71 <sup>st</sup> Ave. to Royal Palm Drive	\$6,871,000
67 <sup>th</sup> Ave to 59 <sup>th</sup> Ave	Pedestrian Crossing at 61 <sup>st</sup> Avenue (Potential Pedestrian Funding)	\$2,000,000
	Myrtle Avenue Improvements (Related to SE bound Grand Avenue Dual Left-Turn Lanes)	\$1,445,000
59 <sup>th</sup> Ave to 51 <sup>st</sup> Ave	Park-n-Ride Station & Transit Center (Transit Funding)	\$8,000,000
51 <sup>st</sup> Ave to 43 <sup>rd</sup> Ave	None	\$0
43 <sup>rd</sup> Ave to 35 <sup>th</sup> Ave	Auxiliary Lane (including landscaping, detached sidewalk, and wall)	\$7,034,000
	39 <sup>th</sup> Avenue Intersection Improvements	\$1,474,000
	37 <sup>th</sup> Avenue Intersection Improvements	\$625,000
	Park-n-Ride Station (Transit Funding)	\$4,000,000
35 <sup>th</sup> Ave to 27 <sup>th</sup> Ave	Auxiliary Lane (including landscaping, detached sidewalk, and wall)	\$9,265,000
27 <sup>th</sup> Ave to 19 <sup>th</sup> Ave	Auxiliary Lane (including landscaping, detached sidewalk, and wall)	\$3,463,000
	23 <sup>rd</sup> Avenue/Encanto Boulevard Intersection Improvements	\$3,888,000
91 <sup>st</sup> Ave to 19 <sup>th</sup> Ave	Fiber Optic, Cameras and VMS (ITS Funding)	\$1,640,000
	<b>Total Unfunded Projects</b>	<b>\$85,198,000</b>

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# **APPENDIX H**

## **Conceptual Cost Estimates**

**Grade Separations**

**Intersection Improvements**

**Access Management and Community Mitigation**

Note: The following estimates are considered planning level estimates and could be subject to substantial change based upon changing market conditions. Costs shown are program costs and include right-of-way, design engineering, contingencies, and construction administration.

**Bethany Home Road Underpass @ Grand / 51st Avenue  
Project Cost Estimate (2005 \$)**

<b>Item</b>	<b>Quantity</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>2003 Cost</b>	<b>Adjusted Cost 20% Increase</b>
Clearing and Grubbing	11	AC	\$2,500.00	\$27,500	\$33,000
Remove Asphalt Concrete Pavement	14,622	SY	\$4.00	\$58,488	\$70,186
Remove Curb and Gutter	3,200	LF	\$5.00	\$16,000	\$19,200
Remove Sidewalk	5,000	SF	\$3.00	\$15,000	\$18,000
Removal of Traffic Signals	1	EA	\$10,000.00	\$10,000	\$12,000
Excavation	80,000	CY	\$5.00	\$400,000	\$480,000
Aggregate Base	4,100	CY	\$30.00	\$123,000	\$147,600
Asphalt Concrete	5,920	TON	\$40.00	\$236,800	\$284,160
Concrete Sidewalk	24,000	SF	\$3.50	\$84,000	\$100,800
Concrete Curb and Gutter	4,500	LF	\$10.00	\$45,000	\$54,000
Concrete Curb	4,000	LF	\$8.00	\$32,000	\$38,400
Concrete Half Barrier	3,100	LF	\$50.00	\$155,000	\$186,000
Concrete Barrier (@ Pier)	200	LF	\$100.00	\$20,000	\$24,000
Attenuator	2	EA	\$5,000.00	\$10,000	\$12,000
Drainage Pipe	2,000	LF	\$120.00	\$240,000	\$288,000
Catch Basins	12	EA	\$3,000.00	\$36,000	\$43,200
Manholes	9	EA	\$3,500.00	\$31,500	\$37,800
Offsite Storm Drain System	1	L SUM	\$2,000,000.00	\$2,000,000	\$2,400,000
Detention Basins (Include Landscaping)	1	L SUM	\$1,800,000.00	\$1,800,000	\$2,160,000
Pump Station	1	EA	\$1,000,000.00	\$1,000,000	\$1,200,000
Grand Ave Bridge Structure	12,456	SF	\$65.00	\$809,640	\$971,568
BNSF Structure (75' Span x 2 Tracks)	150	RR LF	\$7,500.00	\$1,125,000	\$1,350,000
MSE Walls*(Includes Embankment)	29,820	SF	\$25.00	\$745,500	\$894,600
Pavement Marking & Signing	1	MI	\$75,000.00	\$75,000	\$90,000
Utility Relocations/Removals	1	L SUM	\$1,600,000.00	\$1,600,000	\$1,920,000
Lighting	1	L SUM	\$200,000.00	\$200,000	\$240,000
FMS	1	L SUM	\$50,000.00	\$50,000	\$60,000
Landscaping (Mainline)	1	L SUM	\$50,000.00	\$50,000	\$60,000
<i>Traffic Signals</i>	<i>3</i>	<i>EA</i>	<i>\$100,000.00</i>	<i>\$300,000</i>	<i>\$440,000</i>
<b>Subtotal</b>				\$11,295,428	\$13,644,514
Environmental Mitigation		LS	\$1,000,000.00	\$1,000,000	\$1,200,000
SWPPP		LS	\$80,000.00	\$80,000	\$96,000
Water Supply & Dust Palliative		LS	\$120,000.00	\$120,000	\$144,000
Traffic Control		LS	\$400,000.00	\$400,000	\$480,000
Mobilization		LS	\$560,000.00	\$560,000	\$672,000
Construction Surveying		LS	\$120,000.00	\$120,000	\$144,000
<b>Roadway &amp; Structures Subtotal</b>				\$13,575,428	\$16,380,514
Unidentified Items (30%)				\$4,072,628	\$4,914,154
Construction Cost Subtotal				\$17,648,056	\$21,294,668
Constr Eng. & Administration (14%)				\$2,470,728	\$2,981,253
Total Construction Cost				\$20,118,784	\$24,275,921
Design Engineering (10%)				\$2,011,878	\$2,427,592
<i>Total Right-of-Way Cost</i>				<i>\$4,000,000</i>	<i>\$6,000,000</i>
<b>TOTAL PROJECT COST</b>				<b>\$26,130,663</b>	<b>\$32,694,000</b>

**Grand Avenue Under Indian School Road & 35th Avenue  
Project Cost Estimate (2005 \$)**

Description	Unit	Quantity	Unit Cost	Total
Clearing and Grubbing	LS	1	10,000.00	\$10,000
Remove Existing Pavement	SY	24,000	1.50	\$36,000
Remove Existing Curb & Gutter	LF	75,000	2.50	\$187,500
Remove Existing Median Curb	LF	4,700	1.50	\$7,050
New Bridge Structure	SF	15,300	85.00	\$1,300,500
Excavation	CY	100,000	6.00	\$600,000
Mainline & Ramp (AC)	SY	28,500	15.00	\$427,500
Mainline & Ramp (AB)	SY	28,500	10.00	\$285,000
Concrete Curb & Gutter	LF	14,800	12.00	\$177,600
Concrete Median Curb	LF	1,500	8.00	\$12,000
Sidewalk	SF	22,000	5.00	\$110,000
Sidewalk Ramps	EA	4	1,000.00	\$4,000
Retaining Wall	SF	128,000	75.00	\$9,600,000
Concrete Half Barrier	LF	10,200	60.00	\$612,000
Concrete Half Barrier Transition	EA	12	3,000.00	\$36,000
Pavement Marking & Signing	LS	1	10,000.00	\$10,000
Roadway Lighting	LS	1	25,000.00	\$25,000
Traffic Signals	LS	1	100,000.00	\$100,000
Landscaping	LS	1	10,000.00	\$10,000
Pump Station	LS	1	3,000,000.00	\$3,000,000
Drainage Pipe	LF	2,000	200.00	\$400,000
<b>Subtotal</b>				<b>\$16,950,150</b>
Traffic Control			7.0%	\$1,186,511
Mobilization			5.0%	\$847,508
Misc. Items (Survey, QC)			5.0%	\$847,508
<b>Total</b>				<b>\$19,831,676</b>
Unidentified Items			30.0%	\$5,949,503
<b>Total</b>				<b>\$25,781,178</b>
Utility Relocation/Removals			10.0%	\$2,578,118
Construction Engineering and Administration			14.0%	\$3,609,365
<b>Total Construction Cost</b>				<b>\$31,968,661</b>
ROW	Acre	14.73	200,000.00	\$2,945,308
Design Engineering			8%	\$2,557,493
<b>Total Project Cost</b>				<b>\$37,472,000</b>

**19th Avenue Over Grand Avenue & McDowell Road  
Project Cost Estimate (2005 \$)**

Description	Unit	Quantity	Unit Cost	Total
Clearing and Grubbing	LS	1	10,000.00	\$10,000
Remove Existing Pavement	SY	23,000	1.50	\$34,500
Remove Existing Curb & Gutter	LF	14,200	2.50	\$35,500
Remove Existing Median Curb	LF	5,100	1.50	\$7,650
New Bridge Structure	SF	35,700	75.00	\$2,677,500
Embankment (Borrow)	CY	45,800	9.00	\$412,200
Mainline & Ramp (AC)	SY	57,000	15.00	\$855,000
Mainline & Ramp (AB)	SY	57,000	10.00	\$570,000
Concrete Curb & Gutter	LF	9,200	12.00	\$110,400
Concrete Median Curb	LF	2,800	8.00	\$22,400
Sidewalk	SF	46,000	5.00	\$230,000
Sidewalk Ramps	EA	24	1,000.00	\$24,000
Retaining Wall	SF	29,100	75.00	\$2,182,500
Concrete Half Barrier	LF	5,700	60.00	\$342,000
Concrete Half Barrier Transition	EA	6	3,000.00	\$18,000
Pavement Marking & Signing	LS	1	10,000.00	\$10,000
Roadway Lighting	LS	1	25,000.00	\$25,000
Traffic Signals	LS	1	100,000.00	\$100,000
Landscaping	LS	1	10,000.00	\$10,000
Catch Basins	LS	1	50,000.00	\$50,000
Drainage Pipe	LF	2,000	200.00	\$400,000
<b>Subtotal</b>				<b>\$8,126,650</b>
Traffic Control			7.0%	\$568,866
Mobilization			5.0%	\$406,333
Misc. Items (Survey, QC)			5.0%	\$406,333
<b>Total</b>				<b>\$9,508,181</b>
Unidentified Items			30.0%	\$2,852,454
<b>Total</b>				<b>\$12,360,635</b>
Utility Relocation/Removals			10.0%	\$1,236,063
Construction Engineering and Administration			14.0%	\$1,730,489
<b>Total Construction Cost</b>				<b>\$15,327,187</b>
ROW	Acre	12.09	200,000.00	\$2,418,434
Design Engineering			8%	\$1,226,175
<b>Total Project Cost</b>				<b>\$18,972,000</b>

**Intersection Improvements  
31<sup>st</sup> Avenue / Osborn Road**

ITEM	UNIT	UNIT COST	QUANTITY	COST
NEW PAVEMENT	SQ. YD.	\$40	24000	\$960,000
RAISED MEDIAN	EACH	\$50,000	1	\$50,000
INCIDENTALS	L. SUM	\$350,000	1	\$350,000
TRAFFIC CONTROL	L. SUM	\$35,000	1	\$35,000
<b>SUBTOTAL</b>				<b>\$1,395,000</b>
LEVEL 0 CONTINGENCY (20% OF SUBTOTAL CONSTRUCTION)				\$279,000
CONSTRUCTION ENGINEERING AND ADMINISTRATION (14%)				\$234,400.0
<b>TOTAL CONSTRUCTION COST</b>				<b>\$1,908,400</b>
DESIGN ENGINEERING (10% OF TOTAL CONSTRUCTION)				\$190,840
RIGHT OF WAY	SQ. FT	\$10	215,000	\$2,150,000
TOTAL TAKES	EACH	\$700,000	4	\$2,800,000
BILLBOARD REMOVAL	EACH	\$200,000	1	\$200,000
<b>TOTAL COST</b>				<b>\$7,250,000</b>

**19<sup>th</sup> Avenue Dual Left-Turn Lanes**

19<sup>th</sup> Avenue Dual Left-Turn estimate (\$1,472,000) was prepared in 2005 by Aztec Engineering, Inc. and is provided in Appendix J of this report.

**SE bound Grand Avenue Dual Left-Turn Lanes at Myrtle Avenue**

SE bound Dual Left-Turn Lanes estimate (\$1,219,000) was prepared in 2005 by URS and is provided in Appendix I of this report.

**Peoria Avenue / 83<sup>rd</sup> Avenue Intersection Improvements**

Peoria Avenue / 83<sup>rd</sup> Avenue intersection improvements funding recommendation was an estimated amount (\$5,000,000). Detailed plans and estimated costs should be developed as part of ADOT's design concept report, in association with City of Peoria staff.

**Access Management & Community Mitigation Estimated Costs**

**91st Ave to 83rd Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	1,225	\$42	\$51,450
Sidewalk	L.F.	1,225	\$18	\$22,050
Screen Wall	L.F.	1,225	\$90	\$110,250
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	4,739	\$36	\$170,604
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$13,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.	13,540	\$20	\$270,800
SUBTOTAL A				\$625,154
Level 0 Contingency (20%)	L.S.	%	20%	\$125,031
SUBTOTAL B				\$750,185
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$105,026
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$855,211</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$85,521</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$940,732</b>

**Access Management & Community Mitigation Estimated Costs**

**83rd Ave to 75th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	4,345	\$42	\$182,490
Sidewalk	L.F.	4,345	\$18	\$78,210
Screen Wall	L.F.	4,345	\$90	\$391,050
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	5,174	\$36	\$186,278
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$13,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.	14,784	\$20	\$295,680
SUBTOTAL A				\$1,133,708
Level 0 Contingency (20%)	L.S.	%	20%	\$226,742
SUBTOTAL B				\$1,360,450
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$190,463
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,550,913</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$155,091
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,706,004</b>

**Access Management & Community Mitigation Estimated Costs**

**75th Ave to 67th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$300,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.	6,180	\$20	\$123,600
SUBTOTAL A				\$123,600
Level 0 Contingency (20%)	L.S.	%	20%	\$24,720
SUBTOTAL B				\$148,320
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$20,765
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$169,085</b>
Land Acquisition	SQ.FT.	52,801	\$10	\$528,010
Land Acquisition (Total Takes)	EACH	1	\$700,000	\$700,000
Reconfigure Access	EACH	1	\$100,000	\$100,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$1,328,010</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$16,909</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,514,004</b>

**Access Management & Community Mitigation Estimated Costs**

**67th Ave to 59th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	400	\$40	\$16,000
Curb & Gutter	L.F.	400	\$8	\$3,200
Misc (Removals/Earthwork/Drainage)	L.F.	400	\$14	\$5,600
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	5,500	\$42	\$231,000
Sidewalk	L.F.	5,500	\$18	\$99,000
Screen Wall	L.F.	5,500	\$90	\$495,000
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,850	\$36	\$138,600
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	2	\$50,000	\$100,000
Rt-in Rt Out Reconfiguration	Each	2	\$50,000	\$100,000
Driveway Closure	Each	8	\$15,000	\$120,000
Existing Utility Undergrounding	L.S.	1	\$1,789,800	\$1,789,800
Intersection Aesthetics	Each	2	\$20,000	\$40,000
New Street Lighting	L.F.	11,000	\$20	\$220,000
SUBTOTAL A				\$3,383,000
Level 0 Contingency (20%)	L.S.	%	20%	\$676,600
SUBTOTAL B				\$4,059,600
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$568,344
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$4,594,018</b>
Land Acquisition	SQ.FT.	113,050	\$10	\$1,130,500
Land Acquisition (Total Takes)	EACH	12	\$700,000	\$8,400,000
Reconfigure Access	EACH	10	\$100,000	\$1,000,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$10,530,500</b>
Design Engineering (10%)	L.S.	%	10%	\$459,402
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$15,584,000</b>

**Access Management & Community Mitigation Estimated Costs**

**59th Ave to 51st Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	1,450	\$40	\$58,000
Curb & Gutter	L.F.	1,450	\$8	\$11,600
Misc (Removals/Earthwork/Drainage)	L.F.	1,450	\$14	\$20,300
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	4,650	\$42	\$195,300
Sidewalk	L.F.	4,650	\$18	\$83,700
Screen Wall	L.F.	4,650	\$90	\$418,500
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,255	\$36	\$117,180
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	2	\$50,000	\$100,000
Rt-in Rt Out Reconfiguration	Each	1	\$50,000	\$50,000
Driveway Closure	Each	17	\$15,000	\$255,000
Existing Utility Undergrounding	L.S.	1	\$36,400	\$36,400
Intersection Aesthetics	Each	0	\$20,000	\$0
New Street Lighting	L.F.	9,300	\$20	\$186,000
SUBTOTAL A				\$1,531,980
Level 0 Contingency (20%)	L.S.	%	20%	\$306,396
SUBTOTAL B				\$1,838,376
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$257,373
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$2,095,749</b>
Land Acquisition	SQ.FT.	83,300	\$10	\$833,000
Land Acquisition (Total Takes)	EACH	5	\$700,000	\$3,500,000
Reconfigure Access	EACH	6	\$100,000	\$600,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$4,933,000</b>
Design Engineering (10%)	L.S.	%	10%	\$209,575
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$7,238,324</b>

**Access Management & Community Mitigation Estimated Costs**

**51st Ave to 43rd Ave**

**Phase 1**

ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	500	\$40	\$20,000
Curb & Gutter	L.F.	500	\$8	\$4,000
Misc (Removals/Earthwork/Drainage)	L.F.	500	\$14	\$7,000
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	4,500	\$42	\$189,000
Sidewalk	L.F.	4,500	\$18	\$81,000
Screen Wall	L.F.	4,500	\$90	\$405,000
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,150	\$36	\$113,400
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	4	\$50,000	\$200,000
Rt-in Rt Out Reconfiguration	Each	1	\$50,000	\$50,000
Driveway Closure	Each	3	\$15,000	\$45,000
Existing Utility Undergrounding	L.S.	1	\$31,500	\$31,500
Intersection Aesthetics	Each	0	\$20,000	\$0
New Street Lighting	L.F.	9,000	\$20	\$180,000
SUBTOTAL A				\$1,325,900
Level 0 Contingency (20%)	L.S.	%	20%	\$265,180
SUBTOTAL B				\$1,591,080
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$222,751
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,813,831</b>
Land Acquisition	SQ.FT.	97,000	\$10	\$970,000
Land Acquisition (Total Takes)	EACH	4	\$700,000	\$2,800,000
Reconfigure Access	EACH	4	\$100,000	\$400,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$4,170,000</b>
Design Engineering (10%)	L.S.	%	10%	\$181,383
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$6,165,214</b>

**Access Management & Community Mitigation Estimated Costs**

**43rd Ave to 35th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.	4,300	\$18	\$77,400
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,010	\$36	\$108,360
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	4	\$50,000	\$200,000
Rt-in Rt Out Reconfiguration	Each	1	\$50,000	\$50,000
Driveway Closure	Each	23	\$15,000	\$345,000
Existing Utility Undergrounding	L.S.		\$180,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.	8,600	\$20	\$172,000
SUBTOTAL A				\$952,760
Level 0 Contingency (20%)	L.S.	%	20%	\$190,552
SUBTOTAL B				\$1,143,312
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$160,064
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,303,376</b>
Land Acquisition	SQ.FT.	41,000	\$10	\$410,000
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$410,000</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$130,338</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,843,714</b>

**Access Management & Community Mitigation Estimated Costs**

**35th Ave to 27th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	300	\$40	\$12,000
Curb & Gutter	L.F.	300	\$8	\$2,400
Misc (Removals/Earthwork/Drainage)	L.F.	300	\$14	\$4,200
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	300	\$42	\$12,600
Sidewalk	L.F.	2,600	\$18	\$46,800
Screen Wall	L.F.	300	\$90	\$27,000
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,472	\$36	\$124,992
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	1	\$50,000	\$50,000
Rt-in Rt Out Reconfiguration	Each	0	\$50,000	\$0
Driveway Closure	Each	15	\$15,000	\$225,000
Existing Utility Undergrounding	L.S.		\$493,300	\$0
Intersection Aesthetics	Each	2	\$20,000	\$40,000
New Street Lighting	L.F.	9,920	\$20	\$198,400
SUBTOTAL A				\$743,392
Level 0 Contingency (20%)	L.S.	%	20%	\$148,678
SUBTOTAL B				\$892,070
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$124,890
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,016,960</b>
Land Acquisition	SQ.FT.	10,300	\$10	\$103,000
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$103,000</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$101,696</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,221,656</b>

**Access Management & Community Mitigation Estimated Costs**

**27th Ave to 19th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.	660	\$18	\$11,880
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	3,430	\$36	\$123,480
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	6	\$50,000	\$300,000
Rt-in Rt Out Reconfiguration	Each	4	\$50,000	\$200,000
Driveway Closure	Each	21	\$15,000	\$315,000
Existing Utility Undergrounding	L.S.		\$493,300	\$0
Intersection Aesthetics	Each	1	\$20,000	\$20,000
New Street Lighting	L.F.	9,800	\$20	\$196,000
SUBTOTAL A				\$1,166,360
Level 0 Contingency (20%)	L.S.	%	20%	\$233,272
SUBTOTAL B				\$1,399,632
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$195,948
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,595,580</b>
Land Acquisition	SQ.FT.	17,300	\$10	\$173,000
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH	1	\$100,000	\$100,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$273,000</b>
Design Engineering (10%)	L.S.	%	10%	\$159,558
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$2,028,138</b>

**Access Management & Community Mitigation Total Estimated Costs**

**91st Ave to 19th Ave**

**Phase 1**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	3,050	\$40	\$122,000
Curb & Gutter	L.F.	3,050	\$8	\$24,400
Misc (Removals/Earthwork/Drainage)	L.F.	3,050	\$14	\$42,700
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	20,520	\$42	\$861,840
Sidewalk	L.F.	27,780	\$18	\$500,040
Screen Wall	L.F.	20,520	\$90	\$1,846,800
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	30,080	\$36	\$1,082,894
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.	0	\$20	\$0
Screen Wall	L.F.	0	\$45	\$0
Concrete Barrier	L.F.	0	\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	19	\$50,000	\$950,000
Rt-in Rt Out Reconfiguration	Each	9	\$50,000	\$450,000
Driveway Closure	Each	87	\$15,000	\$1,305,000
Existing Utility Undergrounding	L.S.	1	\$1,857,700	\$1,857,700
Intersection Aesthetics	Each	5	\$20,000	\$100,000
New Street Lighting	L.F.	92,124	\$20	\$1,842,480
SUBTOTAL A				\$10,985,854
Level 0 Contingency (20%)	L.S.	%	20%	\$2,197,171
SUBTOTAL B				\$13,183,025
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$1,845,624
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$15,028,649</b>
Land Acquisition	SQ.FT.	422,901	\$10	\$4,229,010
Land Acquisition (Total Takes)	EACH	23	\$700,000	\$16,100,000
Reconfigure Access	EACH	26	\$100,000	\$2,600,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$22,929,010</b>
Design Engineering (10%)	L.S.	%	10%	\$1,502,865
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$39,460,524</b>

**Access Management & Community Mitigation Estimated Costs**

**91st Ave to 83rd Ave**

**Phase 2**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	4,560	\$40	\$182,400
Curb & Gutter	L.F.	4,560	\$8	\$36,480
Misc (Removals/Earthwork/Drainage)	L.F.	4,560	\$14	\$63,840
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	5,075	\$42	\$213,150
Sidewalk	L.F.	5,075	\$18	\$91,350
Screen Wall	L.F.	5,075	\$90	\$456,750
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	1	\$50,000	\$50,000
Rt-in Rt Out Reconfiguration	Each	0	\$50,000	\$0
Driveway Closure	Each	1	\$15,000	\$15,000
Existing Utility Undergrounding	L.S.	1	\$13,300	\$13,300
Intersection Aesthetics	Each	1	\$20,000	\$20,000
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$1,142,270
Level 0 Contingency (20%)	L.S.	%	20%	\$228,454
SUBTOTAL B				\$1,370,724
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$191,901
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,562,625</b>
Land Acquisition	SQ.FT.	206,450	\$10	\$2,064,500
Land Acquisition (Total Takes)	EACH	7	\$700,000	\$4,900,000
Reconfigure Access	EACH	1	\$100,000	\$100,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$7,064,500</b>
Design Engineering (10%)	L.S.	%	10%	\$156,263
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$8,773,388</b>

**Access Management & Community Mitigation Estimated Costs**

**43rd Ave to 35th Ave**

**Phase 2**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.	1	\$1,632,800	\$1,632,800
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$1,632,800
Level 0 Contingency (20%)	L.S.	%	20%	\$326,560
SUBTOTAL B				\$1,959,360
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$274,310
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$2,233,670</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$223,367</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$2,457,037</b>

**Access Management & Community Mitigation Estimated Costs**

**35th Ave to 27th Ave**

**Phase 2**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.	1	\$1,151,400	\$1,151,400
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$1,151,400
Level 0 Contingency (20%)	L.S.	%	20%	\$230,280
SUBTOTAL B				\$1,381,680
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$193,435
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$1,575,115</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$157,512
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,732,627</b>

**Access Management & Community Mitigation Estimated Costs**

**27th Ave to 19th Ave**

**Phase 2**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.	1	\$703,400	\$703,400
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$703,400
Level 0 Contingency (20%)	L.S.	%	20%	\$140,680
SUBTOTAL B				\$844,080
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$118,171
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$962,251</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$96,225
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$1,058,476</b>

**Access Management & Community Mitigation Total Estimated Costs**

**91st Ave to 19th Ave**

**Phase 2**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	4,560	\$40	\$182,400
Curb & Gutter	L.F.	4,560	\$8	\$36,480
Misc (Removals/Earthwork/Drainage)	L.F.	4,560	\$14	\$63,840
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	5,075	\$42	\$213,150
Sidewalk	L.F.	5,075	\$18	\$91,350
Screen Wall	L.F.	5,075	\$90	\$456,750
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.		\$65	\$0
<b>Miscellaneous Improvements</b>				
Median Closure	Each	1	\$50,000	\$50,000
Rt-in Rt Out Reconfiguration	Each	0	\$50,000	\$0
Driveway Closure	Each	1	\$15,000	\$15,000
Existing Utility Undergrounding	L.S.	1	\$3,500,900	\$3,500,900
Intersection Aesthetics	Each	1	20,000	\$20,000
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$4,629,870
Level 0 Contingency (20%)	L.S.	%	20%	\$925,974
SUBTOTAL B				\$5,555,844
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$777,818
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$6,333,662</b>
Land Acquisition	SQ.FT.	206,450	\$10	\$2,064,500
Land Acquisition (Total Takes)	EACH	7	\$700,000	\$4,900,000
Reconfigure Access	EACH	1	\$100,000	\$100,000
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$7,064,500</b>
Design Engineering (10%)	L.S.	%	10%	\$633,366
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$14,022,528</b>

**Access Management & Community Mitigation Estimated Costs**

**91st Ave to 83rd Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	6,770	\$65	\$440,050
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$13,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$440,050
Level 0 Contingency (20%)	L.S.	%	20%	\$88,010
SUBTOTAL B				\$528,060
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$73,928
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$601,988</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$60,199
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$662,187</b>

**Access Management & Community Mitigation Estimated Costs**

**83rd Ave to 75th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	3,696	\$65	\$240,240
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$13,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$240,240
Level 0 Contingency (20%)	L.S.	%	20%	\$48,048
SUBTOTAL B				\$288,288
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$40,360
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$328,648</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$32,865
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$361,513</b>

**Access Management & Community Mitigation Estimated Costs**

**75th Ave to 67th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.	2,190	\$20	\$43,800
Screen Wall	L.F.	2,190	\$45	\$98,550
Concrete Barrier	L.F.	900	\$65	\$58,500
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$300,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$200,850
Level 0 Contingency (20%)	L.S.	%	20%	\$40,170
SUBTOTAL B				\$241,020
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$33,743
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$274,763</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$27,476</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$302,239</b>

**Access Management & Community Mitigation Estimated Costs**

**67th Ave to 59th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	5,500	\$65	\$357,500
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$300,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$357,500
Level 0 Contingency (20%)	L.S.	%	20%	\$71,500
SUBTOTAL B				\$429,000
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$60,060
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$489,060</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$48,906</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$537,966</b>

**Access Management & Community Mitigation Estimated Costs**

**59th Ave to 51st Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	4,650	\$65	\$302,250
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$300,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$302,250
Level 0 Contingency (20%)	L.S.	%	20%	\$60,450
SUBTOTAL B				\$362,700
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$50,778
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$413,478</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$41,348</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$454,826</b>

**Access Management & Community Mitigation Estimated Costs**

**51st Ave to 43rd Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.	3,500	\$20	\$70,000
Screen Wall	L.F.	3,500	\$45	\$157,500
Concrete Barrier	L.F.	1,000	\$65	\$65,000
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$300,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$292,500
Level 0 Contingency (20%)	L.S.	%	20%	\$58,500
SUBTOTAL B				\$351,000
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$49,140
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$400,140</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$40,014
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$440,154</b>

**Access Management & Community Mitigation Estimated Costs**

**43rd Ave to 35th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	4,300	\$65	\$279,500
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$180,000	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$279,500
Level 0 Contingency (20%)	L.S.	%	20%	\$55,900
SUBTOTAL B				\$335,400
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$46,956
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$382,356</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$38,236</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$420,592</b>

**Access Management & Community Mitigation Estimated Costs**

**35th Ave to 27th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	4,960	\$65	\$322,400
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$493,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$322,400
Level 0 Contingency (20%)	L.S.	%	20%	\$64,480
SUBTOTAL B				\$386,880
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$54,163
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$441,043</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$44,104</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$485,147</b>

**Access Management & Community Mitigation Estimated Costs**

**27th Ave to 19th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.		\$40	\$0
Curb & Gutter	L.F.		\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.		\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.		\$42	\$0
Sidewalk	L.F.		\$18	\$0
Screen Wall	L.F.		\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.		\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.		\$20	\$0
Screen Wall	L.F.		\$45	\$0
Concrete Barrier	L.F.	4,900	\$65	\$318,500
<b>Miscellaneous Improvements</b>				
Median Closure	Each		\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each		\$50,000	\$0
Driveway Closure	Each		\$15,000	\$0
Existing Utility Undergrounding	L.S.		\$493,300	\$0
Intersection Aesthetics	Each		\$20,000	\$0
New Street Lighting	L.F.		\$20	\$0
SUBTOTAL A				\$318,500
Level 0 Contingency (20%)	L.S.	%	20%	\$63,700
SUBTOTAL B				\$382,200
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$53,508
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$435,708</b>
Land Acquisition	SQ.FT.		\$10	\$0
Land Acquisition (Total Takes)	EACH		\$700,000	\$0
Reconfigure Access	EACH		\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	\$43,571
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$479,279</b>

**Access Management & Community Mitigation Total Estimated Costs**

**91st Ave to 19th Ave**

**Phase 4**

<b>ITEM</b>	<b>UNIT</b>	<b>QUANTITY</b>	<b>UNIT COST</b>	<b>TOTAL</b>
<b>Aux Lane/Rt Turn Lane</b>				
Pavement Section	L.F.	0	\$40	\$0
Curb & Gutter	L.F.	0	\$8	\$0
Misc (Removals/Earthwork/Drainage)	L.F.	0	\$14	\$0
<b>Community Mitigations (Non-RR side)</b>				
Landscaping/Irrigation	L.F.	0	\$42	\$0
Sidewalk	L.F.	0	\$18	\$0
Screen Wall	L.F.	0	\$90	\$0
<b>Median Landscaping</b>				
Landscaping/Irrigation (assumed 70%)	L.F.	0	\$36	\$0
<b>RR Landscaping/Barrier</b>				
Landscaping/Irrigation	L.F.	5,690	\$20	\$113,800
Screen Wall	L.F.	5,690	\$45	\$256,050
Concrete Barrier	L.F.	36,676	\$65	\$2,383,940
<b>Miscellaneous Improvements</b>				
Median Closure	Each	0	\$50,000	\$0
Rt-in Rt Out Reconfiguration	Each	0	\$50,000	\$0
Driveway Closure	Each	0	\$15,000	\$0
Existing Utility Undergrounding	L.S.	0	\$493,300	\$0
Intersection Aesthetics	Each	0	\$20,000	\$0
New Street Lighting	L.F.	0	\$20	\$0
SUBTOTAL A				\$2,753,790
Level 0 Contingency (20%)	L.S.	%	20%	\$550,758
SUBTOTAL B				\$3,304,548
Construction Engineering (CO's) (14%)	L.S.	%	14%	\$462,637
<b>TOTAL ESTIMATED CONSTRUCTION COST</b>				<b>\$3,767,185</b>
Land Acquisition	SQ.FT.	0	\$10	\$0
Land Acquisition (Total Takes)	EACH	0	\$700,000	\$0
Reconfigure Access	EACH	0	\$100,000	\$0
<b>TOTAL ESTIMATED RIGHT-OF-WAY COST</b>				<b>\$0</b>
Design Engineering (10%)	L.S.	%	10%	<b>\$376,719</b>
Miscellaneous Improvements				<b>\$1,209,000</b>
<b>TOTAL ESTIMATED PROGRAM COST</b>				<b>\$5,353,000</b>

Note: \$1.2 million was added to this line item for miscellaneous improvements.

# APPENDIX I

## Myrtle Avenue Connection to Grand



4561 E. McDowell Road  
Phoenix, AZ 85008  
602.454.0402  
602.454.0403 (fax)

Memo

**To:** Chris Woolery  
**Subject:** CMAQ Project Evaluation  
**Project:** CMAQ Project Evaluation Traffic Analysis  
19<sup>th</sup> Avenue/McDowell Road/Grand Avenue  
**From:** Marina Stender

**Date:** March 30, 2005  
**Project Number:** City of Phoenix Project Number: ST85140017  
AZTEC Project Number: AZ04152/04 Tasks 3

AZTEC has completed the traffic analysis of the 19<sup>th</sup> Avenue/McDowell Road/Grand Avenue intersection for the Project Evaluation of MAG CMAQ funding application as part of the Federal Aid Program Manager Contract.

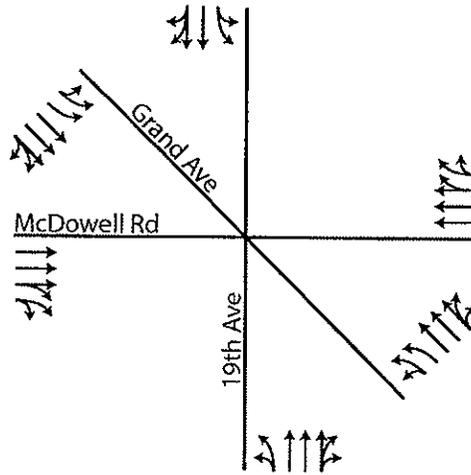
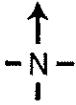
In order to evaluate the existing conditions of this intersection, the following tasks were undertaken:

1. Aerial files for this intersection were obtained from the City of Phoenix.
2. Field review of the site was conducted to evaluate the existing physical and operational characteristics of the intersection. Existing geometrics are shown in Appendix A.
3. Traffic signal data, including signal timing and phasing, was obtained from the City of Phoenix.
4. Existing traffic count data was collected by TRA on December 16, 2004. Additional existing traffic count data was provided the City of Phoenix, collected on March 25, 2004. A review of the two data sets showed that the second set (03/25/04) was more reliable and, hence, was used for the traffic analysis, see Appendix B.
5. A traffic forecasting spreadsheet was provided by the City of Phoenix, however, no future traffic data was analyzed, per direction from the City of Phoenix.
6. A meeting with the City of Phoenix was held on January 18, 2005 to identify their project objectives and AZTEC's approach to this analysis. The following improvement alternatives were recommended to be used in the traffic analysis as follows (proposed geometrics shown in Appendix A):
  - Dual Lefts for Northbound and Southbound Traffic
  - Add/Drop Lane for Southbound Traffic
  - Combined (NB/SB Dual Lefts and SB Add/Drop Lane)
  - Signal Timing improvements, including optimization of cycle length and splits.
7. Level of Service (LOS) Analysis was conducted for the existing traffic data using Syncro. The intersection was analyzed for the existing geometrics as well as the recommended alternatives listed above.
8. CADD files showing existing and proposed intersection geometrics were provided by the City of Phoenix.
9. A spreadsheet summary of the LOS analysis was completed and is attached in Appendix C.
10. Second visit to the project site was conducted to document the existing utilities and other site information in order to develop a preliminary construction cost estimate.
11. Right-of-Way records were obtained from the City of Phoenix.
12. Per the direction from the City of Phoenix a preliminary construction cost estimate was prepared for the proposed alternative with dual lefts for northbound and southbound traffic, see Appendix D.

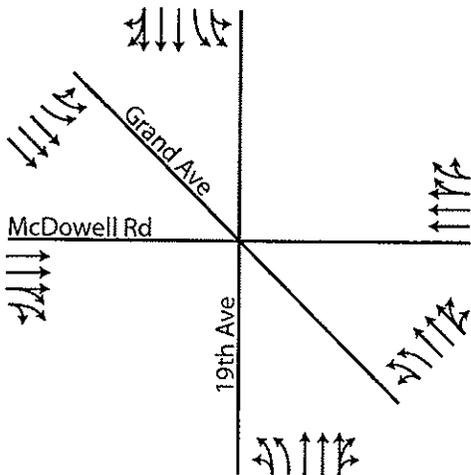
# Appendix A

## Existing Lane Configurations

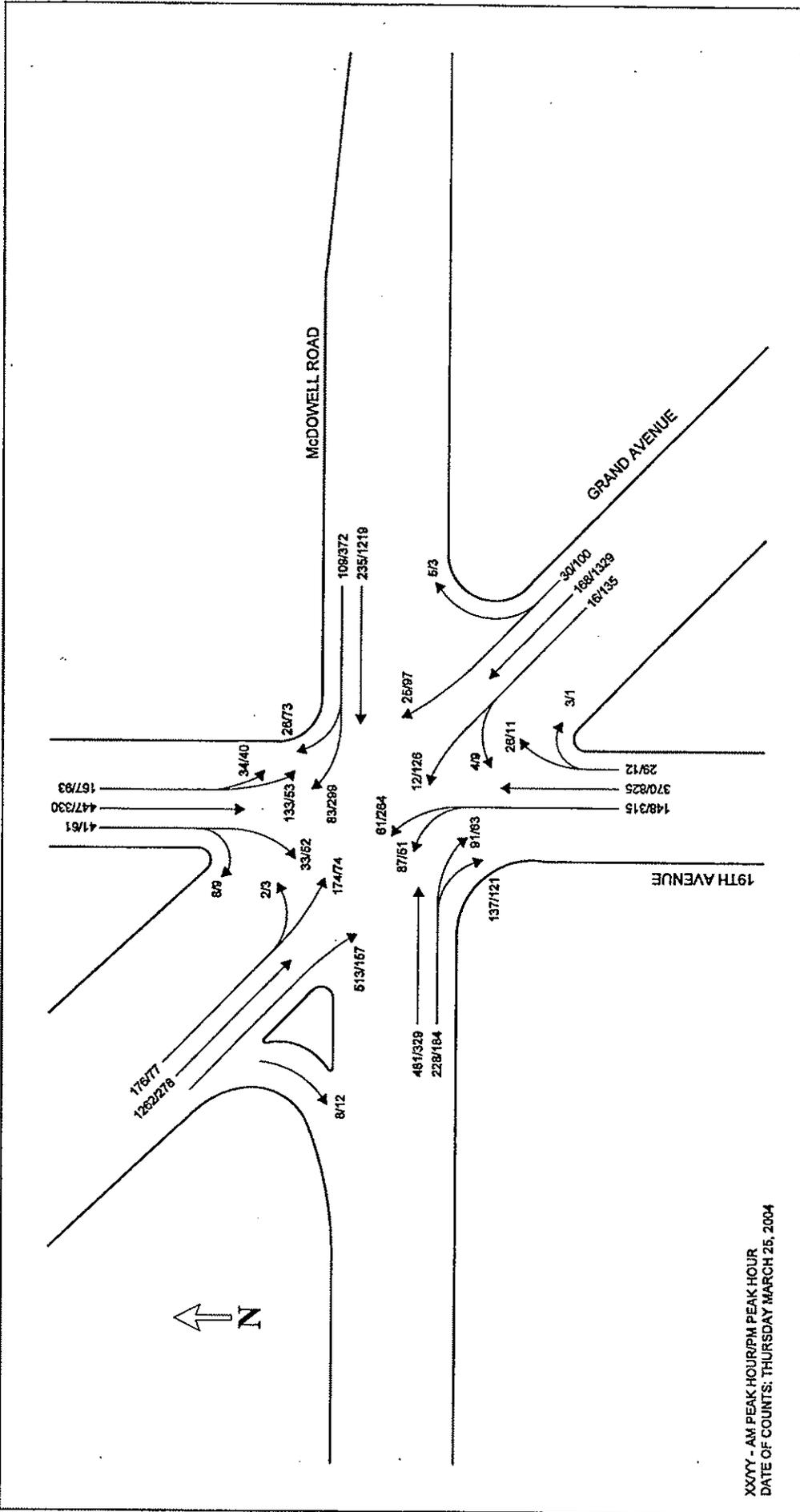
19th Avenue / Grand Avenue / McDowell Road



## Proposed Lane Configurations







XXYY - AM PEAK HOUR/PM PEAK HOUR  
 DATE OF COUNTS: THURSDAY MARCH 25, 2004



GRAND AVENUE/19TH AVENUE & McDOWELL ROAD  
 EXISTING AM AND PM PEAK HOUR  
 TURNING MOVEMENT COUNTS

## Appendix C

### Intersection of GRAND AVENUE, McDOWELL AVENUE, and 19th AVENUE

		LOS Analyses																		Inter. Delay	Inter. LOS			
		EB (McDowell RD)		WB (McDowell RD)		NB (19th AVE)		SB (19th AVE)		SE (Grand AVE)		NW (Grand AVE)		Inter. Delay	Inter. LOS									
		TH	Gr	TH	Gr	TH	Gr	TH	Gr	TH	Gr	TH	Gr											
AM		TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App		
Existing	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	104.3	F
	Optimized C (150s)	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	76.9	E
	Optimized time	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	79.6	E
Dual NB & SB Left	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	100.4	F
	Optimized C (150s)	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	65.9	E
	Optimized time	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	77.3	E
SB Drop Lane	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	101.7	F
	Optimized C (150s)	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	74.7	E
	Optimized time	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	75.0	E
Dual NB & SB Left + SB Drop	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	98.7	F
	Optimized C (150s)	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	63.7	E
	Optimized time	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	70.5	E

Existing signal timing is used

Cycle length is optimized using SINCRO

Signal timing is optimized using SINCRO, Cycle length is existing

		LOS Analyses																		Inter. Delay	Inter. LOS			
		EB (McDowell RD)		WB (McDowell RD)		NB (19th AVE)		SB (19th AVE)		SE (Grand AVE)		NW (Grand AVE)		Inter. Delay	Inter. LOS									
		TH	Gr	TH	Gr	TH	Gr	TH	Gr	TH	Gr	TH	Gr											
PM		TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App	TH	Gr	App		
Existing	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	259.1	F
	Optimized C (150s)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	246.7	F
	Optimized time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	212.7	F
Dual NB & SB Left	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	259.7	F
	Optimized C (150s)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	204.6	F
	Optimized time	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	188.6	F
SB Drop Lane	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	258	F
	Optimized C (150s)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	246.1	F
	Optimized time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	211.5	F
Dual NB & SB Left + SB Drop	Exst C and time	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	259.3	F
	Optimized C (150s)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	204	F
	Optimized time	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	187.3	F

CMAQ Project 19th Ave/McDowell Rd/Grand Ave Intersection	QUANTITY	UNIT	UNIT PRICE	AMOUNT	Fed Funds	Local Funds
					Not to Exceed 94.3%	May Exceed 5.7%
ALLOWANCE FOR EXTRA WORK	1	JOB	\$15,000	\$15,000	\$14,145	\$855
SUBGRADE PREPARATION	1,677	SY	\$8	\$13,416	\$12,651	\$765
ASPHALT CONCRETE SURFACE COURSE (D 1/2) 1-1/2" THICK	141	TON	\$50	\$7,075	\$6,672	\$403
ASPHALT CONCRETE BASE COURSE (A 1-1/2) 6" THICK	566	TON	\$45	\$25,469	\$24,018	\$1,452
EMULSIFIED ASPHALT FOR TACK COAT	1.4	TON	\$500	\$699	\$659	\$40
5' CONCRETE SIDEWALK	6,100	SF	\$5	\$30,500	\$28,762	\$1,739
CONCRETE DRIVEWAY ENTRANCE	1400	SF	\$10	\$14,000	\$13,202	\$798
CONCRETE CURB AND GUTTER, TYPE A	1380	LF	\$12	\$16,560	\$15,616	\$944
CONCRETE BUS BAY PAVEMENT (TYPE 1)	1580	SF	\$10	\$15,800	\$14,899	\$901
CONCRETE BUS SHELTER/ACCESSORY PAD	600	SF	\$10	\$6,000	\$5,658	\$342
ADJUST WATER VALVE	1	EA	\$300	\$300	\$283	\$17
RELOCATE WATER METER	4	EA	\$600	\$2,400	\$2,263	\$137
RELOCATE FIRE HYDRANT	2	EA	\$2,000	\$4,000	\$3,772	\$228
REMOVE ASPHALT CONCRETE PAVEMENT	630	SY	\$3	\$1,890	\$1,782	\$108
REMOVE CONCRETE CURB AND GUTTER	1,400	LF	\$3	\$4,200	\$3,961	\$239
REMOVE CONCRETE SIDEWALKS AND DRIVEWAYS	7,400	SF	\$2	\$14,800	\$13,956	\$844
LANDSCAPE & IRRIGATION RESTORATION	1	JOB	\$5,000	\$5,000	\$4,715	\$285
CONCRETE CATCH BASIN	2	EA	\$3,000	\$6,000	\$5,658	\$342
CATCH BASIN CONNECTOR PIPE	20	LF	\$100	\$2,000	\$1,886	\$114
REMOVE & REINSTALL ROD IRON FENCE & GATES	325	LF	\$50	\$16,250	\$15,324	\$926
REMOVE & REINSTALL CHAIN LINK FENCE & GATES	750	LF	\$30	\$22,500	\$21,218	\$1,283
BLOCK WALL REMOVAL	20	LF	\$40	\$800	\$754	\$46
RELOCATE LUMINAIRES	1	JOB	\$50,000	\$50,000	\$47,150	\$2,850
REMOVE AND INSTALL NEW TRAFFIC SIGNAL POLE	1	JOB	\$20,000	\$20,000	\$18,860	\$1,140
TRAFFIC SIGNAL INTERCONNECT & PULL BOXES	1	JOB	\$1,000	\$1,000	\$943	\$57
PAVEMENT MARKING	4,850	LF	\$1.00	\$4,850	\$4,574	\$276
PAVEMENT MARKING SYMBOLS	4	EA	\$250	\$1,000	\$943	\$57
SIGNING	1	JOB	\$2,000	\$2,000	\$1,886	\$114
MISC. REMOVALS & OTHER WORK	1	JOB	\$15,000	\$15,000	\$14,145	\$855
<b>SUB-TOTAL PROJECT CONSTRUCTION COST</b>				<b>\$318,509</b>	<b>\$300,354</b>	<b>\$18,155</b>
TRAFFIC CONTROL (20% - 6 LEG INTERSECTION)	1	JOB		\$63,702	\$60,071	\$3,631
MOBILIZATION (8%)	1	JOB		\$25,481	\$24,028	\$1,452
STORM WATER POLLUTION PREVENTION PLAN (if over 1 acre total disturbance, 5% typical)	1	JOB		\$15,925	\$15,018	\$908
CONSTRUCTION SURVEY (1%)	1	JOB		\$3,185	\$3,004	\$182
<b>SUB-TOTAL PROJECT COST</b>				<b>\$426,802</b>	<b>\$402,474</b>	<b>\$24,328</b>
CHANGE ORDERS (5%)	1	JOB		\$21,340	\$20,124	\$1,216
<b>SUB-PROJECT CONSTRUCTION COST</b>				<b>\$448,142</b>	<b>\$422,598</b>	<b>\$25,544</b>
CONSTRUCTION ADMINISTRATION (Avg. 15%)	1	JOB		\$67,221	\$63,390	\$3,832
<b>TOTAL PROJECT CONSTRUCTION</b>				<b>\$515,364</b>	<b>\$485,988</b>	<b>\$29,376</b>
CONSULTANT PRELIMINARY DESIGN, DCR and Environmental Determination Report	1	JOB		\$100,000	\$94,300	\$5,700
CONSULTANT FINAL DESIGN	1	JOB		\$100,000	\$94,300	\$5,700
CITY OF PHOENIX DESIGN COSTS - DCM and Other Internal Costs	1	JOB		\$30,000	\$28,290	\$1,710
<b>TOTAL DESIGN COST</b>				<b>\$230,000</b>	<b>\$216,890</b>	<b>\$13,110</b>
TOTAL RIGHT-OF-WAY ACQUISITION, RELOCATION, AND DEMOLITION COSTS (\$10sqft, depends upon area)	4600	SQFT		\$46,000	\$43,378	\$2,622
BILLBOARD RELOCATION (ACQUISITION PROCESS)	1	JOB	\$500,000	\$500,000	\$471,500	\$28,500
UTILITY COORDINATION (1%)	1	JOB		\$5,154	\$4,860	\$294
APS RELOCATION - 69KV & 12KV POWER POLES (PRIOR RIGHTS POSSIBLE)	7	EA	\$15,000	\$105,000	\$99,015	\$5,985
<b>TOTAL PROJECT COST</b>				<b>\$1,401,517</b>	<b>\$1,321,631</b>	<b>\$79,886</b>
Contingency @ 5%	1	JOB		\$70,076	\$66,082	\$3,994
<b>TOTAL OVERALL PROJECT COST</b>				<b>\$1,471,593</b>	<b>\$1,387,712</b>	<b>\$83,881</b>

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# APPENDIX J

## Project Evaluation - Traffic Analysis 19<sup>th</sup> Avenue/McDowell Road/Grand Avenue

## MYRTLE AVENUE CONNECTION TO GRAND

### NEED

When Grand Avenue grade separation at 59<sup>th</sup> and Glendale was developed, it basically disconnected Grand Avenue from the other streets and the surrounding area. Myrtle Avenue was identified as replacement access from Grand to 59<sup>th</sup> Avenue, Glendale Avenue and Downtown Glendale. The linkage to Glendale Avenue includes separate consideration of linkages to the east and west of 59<sup>th</sup> Avenue. The existing two-lane street does not meet the needs of this connection. Refer to Figure 1.

Subsequently, the Northern Parkway concept was developed with a free-flow connection from the Parkway to Grand Avenue east of 67<sup>th</sup> Avenue. This linkage will provide a good path for traffic from the developing western portions of Glendale and Peoria to access Grand Avenue and to access Downtown Glendale via Myrtle. The additional traffic flows from Northern Parkway will create the need for additional capacity at Myrtle Avenue. Without the additional capacity, the Myrtle intersection could be a constriction on Grand Avenue and cause traffic to back-up on Grand Avenue thus reducing the effectiveness of the investments made in Grand Avenue.

Since Myrtle will be the main access from Grand Avenue to Downtown Glendale, its width and character should be consistent with a gateway street. The existing narrow street is more residential in character and does not meet the gateway criteria.

### PLAN

To meet the expected traffic demand from Grand to 59<sup>th</sup> Avenue, Glendale Avenue (east of 59<sup>th</sup>) and Downtown Glendale access, a dual left turn lane will be needed for SE bound traffic at Myrtle. To provide this dual left, Grand Avenue will have to be widened to the northeast and Myrtle will have to be widened to four lanes to accommodate the dual lefts turning onto Myrtle. It is proposed to widen Myrtle from Grand to 59<sup>th</sup> Avenue to provide for two lanes in each direction plus a left turn lane.

It is also proposed to widen Myrtle to four lanes from 62<sup>nd</sup> Avenue to Grand Avenue. Myrtle west of Grand Avenue can be widened within the existing right-of-way and will provide a higher capacity collector street to connect Grand Avenue to Glendale Avenue via 62<sup>nd</sup> Street. Seven feet of additional right-of-way on each side will be needed to provide for a detached sidewalk and landscaping suitable for a gateway collector street.

Several alternative concepts were developed for widening Myrtle. The recommended concept provides the required number of lanes while avoiding the need to remove businesses or to take additional right-of-way from residential property.

The plan is shown in the attached plans. With some exceptions, the proposed widening can be constructed within the existing right-of-way and no homes or businesses will be displaced. The end result will be a greatly improved collector street to preserve the

capacity being built into Grand Avenue and to re-establish the connections between Grand Avenue and 59<sup>th</sup> Avenue, Glendale Avenue and Downtown Glendale.

**COSTS**

The table below provides a summary of the estimated cost for construction, utility relocation and right-of-way. The improvements to Grand Avenue are estimated to cost \$1.2 million including right-of-way. The cost of widening Myrtle is estimated to be over \$1.4 million for a total project cost of almost \$2.7 million.

The cost for widening Grand Avenue to provide the dual left turn lanes can be covered by cost already included in the MIS for the right turn lane at Myrtle Avenue.

Grand Avenue at Myrtle Avenue			
	Myrtle Improvements	Grand Improvements	Total Improvements
Construction Subtotal	\$651,000	\$295,000	\$946,000
Utilities Subtotal	\$584,000	\$300,000	\$884,000
Right-of-Way Subtotal	\$210,000	\$624,000	\$834,000
Project Total	\$1,445,000	\$1,219,000	\$2,664,000

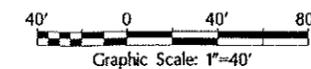
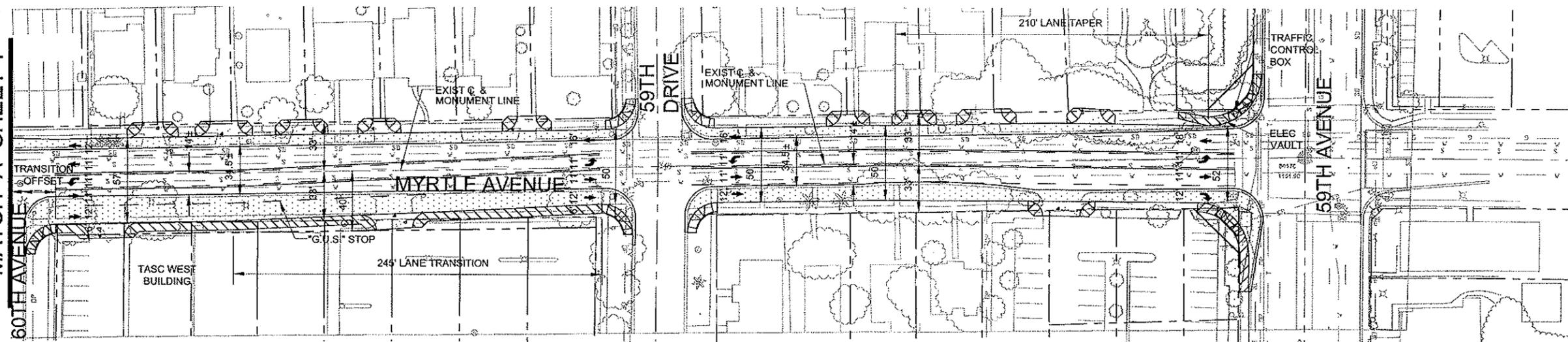


**Figure 1**  
**Vicinity Map – Grand Avenue & Myrtle Avenue**



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MATCH "A" SHEET 1



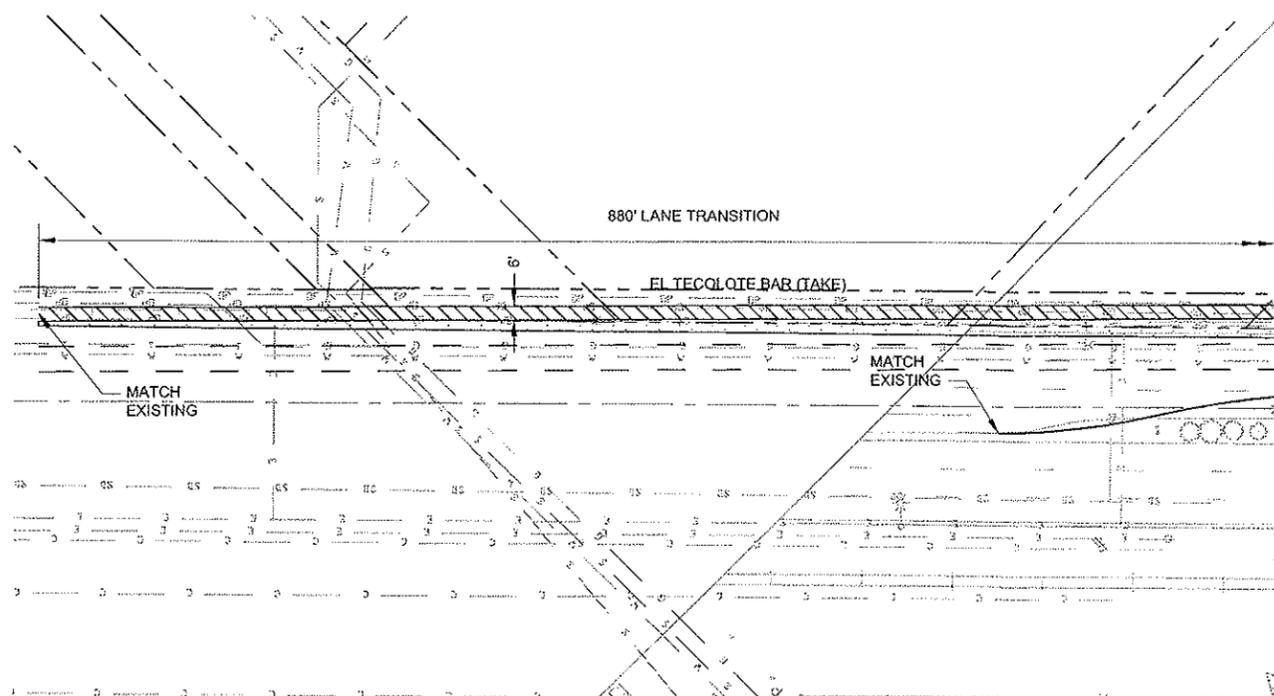
AERIAL PHOTO JANUARY 2005

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 PLOTTING DATE: \_\_\_\_\_  
 AUTOCAD VER.: 2002

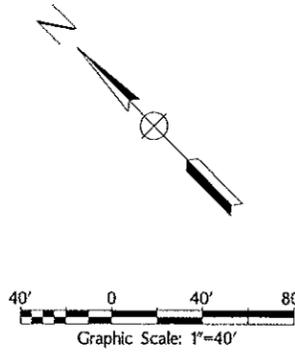
**URS**  
 7720 N. 16th Street  
 Phoenix, Arizona 85020  
 (602) 371-1100

**263-1100**  
CALL COLLECT

SHT. 2  
 OF 2



MATCH "B" SHEET 2



AERIAL PHOTO JANUARY 2005

LEGEND

- BUS ROUTE
- PCC PAVEMENT
- ASPHALT PAVEMENT
- MEDIAN PAVING
- CONCRETE SIDEWALK
- LANDSCAPING (TREES, SHRUBS)
- RIGHT-OF-WAY LINE
- PROPERTY LINE
- PROPOSED RIGHT-OF-WAY

DESIGNED	DRAWN	CHECKED	NO.	DATE	DESCRIPTION	REVISIONS
BL	MF	DH				

GLENDALE ONBOARD  
 TRANSPORTATION PROGRAM  
 MYRTLE AVE: 62nd AVE to 59th AVE  
 DESIGN CONCEPT MEDIUM OPTION

**CITY OF GLENDALE**  
 TRANSPORTATION DEPARTMENT  
 8850 W. GLENDALE AVE.  
 GLENDALE, ARIZONA 85301 (602) 920-2630

