US-60/Grand Avenue

Corridor Optimization, Access Management, and System Study (COMPASS)

Loop 303 to Interstate 10

Technical Memorandum 6: Corridor Optimization, Access Management, and Implementation Plans

Prepared for:

MARICOPA ASSOCIATION of GOVERNMENTS

Prepared by:

BURGESS & NIPLE

In association with:
Wilson & Company, Inc.
Partners for Strategic Action, Inc.
Philip B. Demosthenes, LLC

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AASHTO	American Association of State Highway and Transportation Officials
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AFB	Air Force Base
AMP	Access Management Plan
APS	Arizona Public Service
BRT	Bus Rapid Transit
CCTV	Closed Circuit Television
CDBG	Community Development Block Grant
CMAQ	Congestion Mitigation and Air Quality Improvement
COMPASS	Corridor Optimization, Access Management Plan, and System Study
D&R	Dial-A-Ride
DAR+	Dial-A-Ride Plus
DCR	Design Concept Report
DEUR	Declaration of Environmental Use Restriction
DHOV	Direct High Occupancy Vehicle
DU	Dwelling Unit
dnl	decibel noise level
DOE	Department of Energy
EECBG	Energy Efficiency and Conservation Block Grant
El Mirage	City of El Mirage
FCDMC	Flood Control District of Maricopa County
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GADA	Greater Arizona Development Authority
GL	Grand Avenue Limited
Glendale	City of Glendale
GO	Glendale Onboard
GUS	Glendale Urban Shuttle
HCT	High Capacity Transit
HELP	Highway Extension and Expansion Loan Program
HSIP	Highway Safety Improvement Program
HUD	Housing and Urban Development
HURF	Highway User Revenue Fund
I-10	Interstate 10 Papago Freeway
I-17	Interstate 17 Black Canyon Freeway
IPaC	Information, Planning, and Conservation System
ITS	Intelligent Transportation System
LRT	Light Rail Transit
LOS	Level of Service
LQG	Large Quantity Generators

LRT	Light Rail Transit
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century Act
MOC	Municipal Operating Center
MP	Milepost
MUD	Median Urban Diamond
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NRHP	National Register of Historic Places
O&M	Operation and Maintenance
Peoria	City of Peoria
PGP	Policies, Guidelines and Procedures
Phoenix	City of Phoenix
Prop	Proposition
Q/LOS	Quality/Level of Service
QOS	Quality of Service
RARF	Regional Area Road Fund
RIRO	Right-In Right-Out Only
RMA	Regional Mobility Authority
RPTA	Regional Public Transportation Authority
RTP	Regional Transportation Plan
R/W	Right-of-Way
SMART	Systematically Managed Arterial
SPF	Special Project Funds
SR-101L	State Route 101 Loop Agua Fria Freeway
SR-303L	State Route 303 Loop Bob Stump Memorial Parkway
SRP	Salt River Project
ST–LUIS	Sustainable Transportation and Land Use Integration Study
STP	Surface Transportation Program
Surprise	City of Surprise
TAB	Transportation Advisory Board
TAP	Transportation Alternatives Program
TI	Traffic Interchange
TIF/TIRZ	Tax Increment Financing/Tax Increment Reinvestment Zone
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investments Generating Economic Recovery
TIS	Traveler Information Station
TMC	Traffic Management Center
TOD	Transit Oriented Development
TRB	Transportation Research Board
TRZ	Transportation Reinvestment Zone
US-60	United States Route 60
USC	Upstream Signalized Crossover

USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
Youngtown	Town of Youngtown

1.0 Introduction

The US-60/Grand Avenue COMPASS – Loop 303 to Interstate 10 is being conducted by the Maricopa Association of Governments in order to identify a long-term solution for accommodating travel demand and adjacent property access, establish operating principles to improve the effectiveness of traffic operations, and prepare an Access Management Plan that will provide a detailed milepost-by-milepost description of adjacent property access along the US-60/Grand Avenue corridor.

A Partnering Charter was signed on February 22, 2012, by the political leadership of the communities within the US-60/Grand Avenue COMPASS corridor. The outcomes of this technical study will address the following goals that were identified in the charter:

- Cooperatively create an overall vision for the US-60/Grand Avenue Corridor that embraces the important regional function of Grand Avenue as a significant high capacity, multimodal corridor and that can recognize the unique character of different sections of the corridor and the communities it passes through.
- Cooperatively define the operational character for the US-60/Grand Avenue Corridor that will enhance economic development, maintain accessibility to adjacent land uses, improve traffic operations, and reduce highway and rail conflicts.
- Establish an access management system that provides an efficient means to accommodate intersecting roadways and access to and from adjacent properties. After the system is recommended and agreed upon, each stakeholder will incorporate the principles and recommendations into their transportation, economic development and community development.
- Develop guidelines for signage, landscaping and aesthetic treatments along the corridor recognizing the different communities along the corridor.
- Work together to provide the affected stakeholders, including daily commuters, local residents, and adjacent property owners and users with information about the project and opportunity to contribute to the study's outcome and recommendations.

1.1. Purpose of This Paper

This paper is the sixth and final Technical Memorandum in a series of US-60/Grand Avenue COMPASS documents; it was prepared to identify corridor optimization and access management recommendations for the corridor. Further, this Technical Memorandum provides a model ordinance for the US-60/Grand Avenue Corridor Zoning Overlay District. This zoning overlay, when paired with the Recommendations Map Book included in ***Appendix TM6-1***, provides for a uniform operational character, improves traffic operations, reduces conflict points, and provides an access management system for the corridor.

1.2. Study Area

The US-60/Grand Avenue COMPASS corridor begins at the TI with SR-303L in the City of Surprise, Arizona, at US-60 reference marker 138.051 (expressed in miles) and ends at the Willetta Street intersection in the City of

Phoenix, Arizona, at US-60X reference marker 161.880 (expressed in miles). The corridor is oriented northwest-southeast, and passes through portions of the City of Surprise, City of El Mirage, Town of Youngtown, City of Peoria, City of Glendale, City of Phoenix, and unincorporated Maricopa County.

US-60/Grand Avenue is a regionally significant six-lane roadway that is part of the NHS. It serves as a vital link connecting four important regional freeways: I-10, I-17, SR-101L, and SR-303L (***Figure 1***). US-60/Grand Avenue extends north to the Town of Wickenburg, where it turns west to western Arizona and California. In Wickenburg, US-60/Grand Avenue connects with US-93, which is the primary link to northwestern Arizona and Las Vegas from the Phoenix metropolitan area.

The US-60/Grand Avenue corridor includes the BNSF Railway. The BNSF Railway tracks run the full length of the corridor, parallel and adjacent to the roadway. They are situated along the roadway's southern edge south of Olive Avenue, and the northern edge to the north.

1.3. History of US-60/Grand Avenue*

US-60/Grand Avenue was first envisioned in 1887 by developer and Glendale founder, William J. Murphy. The first 18 miles of roadway connected 7th Avenue and Van Buren Street in Phoenix to the City of Glendale. Within a decade, Mr. Murphy exchanged right-of-way along Grand Avenue for construction of a rail line connecting Phoenix to Prescott, supporting the existing agricultural economy as well as enabling industrial growth. Grand Avenue was first paved in 1919.

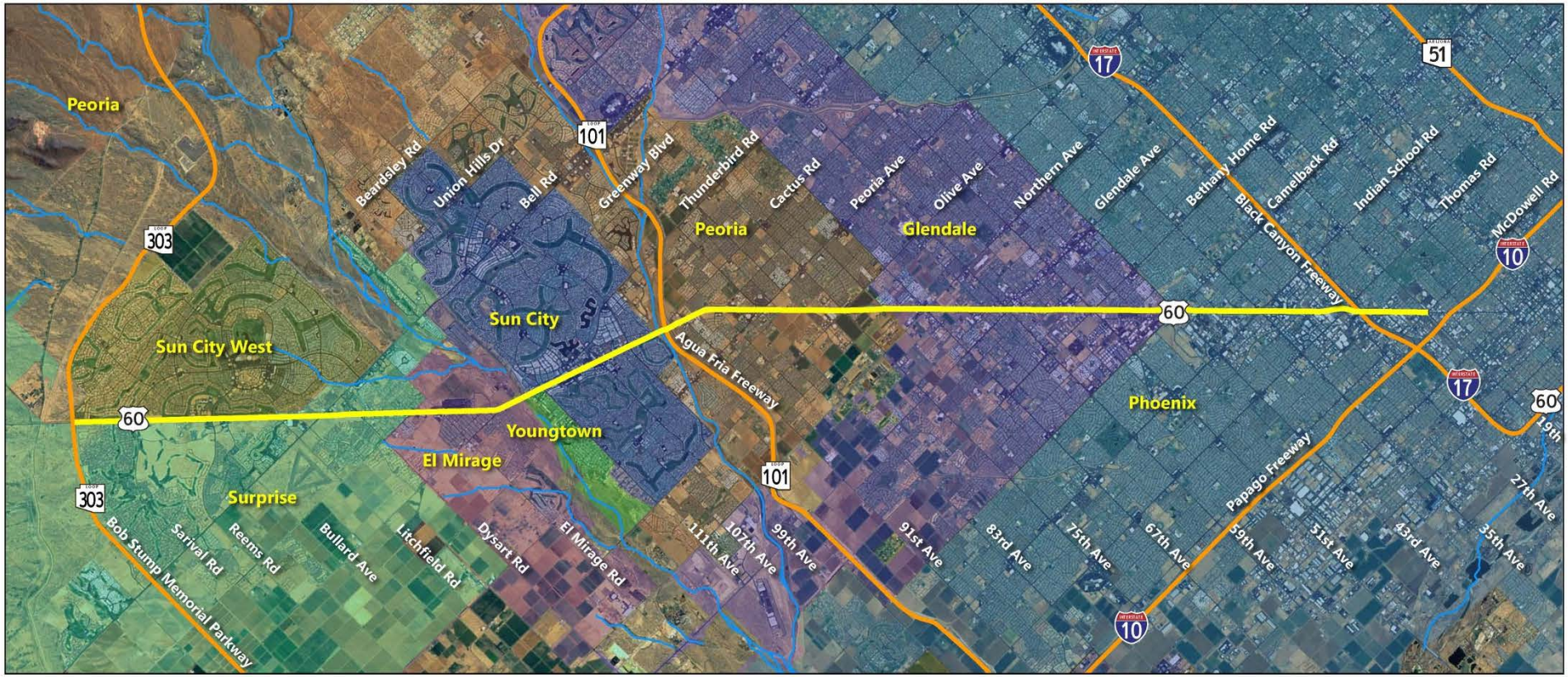
In 1926, US-60 was commissioned as one of two transcontinental highways and its earliest Arizona segments included routes from Wickenburg to Phoenix. In 1927, Grand Avenue was approved as the West Valley alignment for US-60. US-60 was quickly established as one of Arizona's most important east-west transportation routes. For many decades, US-60 was the only route through Arizona to Los Angeles until the 1950s, when construction for I-10 would begin to syphon off Los Angeles-bound traffic.

US-60/Grand Avenue is maintained by ADOT as part of the NHS. While US-60 no longer connects the Atlantic and Pacific oceans, as it terminates in western Arizona, it remains a valuable regional facility serving as the only major roadway connecting the downtown areas of Surprise, Sun City, El Mirage, Youngtown, Peoria, Glendale, and Phoenix. The corridor continues to serve multiple purposes, including local access, commuter travel and freight movement, and is a popular route to Las Vegas for residents from the Phoenix metropolitan area.

***Sources:**

City of Glendale, "Grand Avenue Corridor"; www.glendaleaz.com/planning/GrandAvenueCorridor.cfm (accessed October 21, 2014)
"U.S. Highway 60", Arizona's Historic Roads; https://www.azdot.gov/docs/default-source/historical-roads/us60_highwayhistoryEF602157047A.pdf?sfvrsn=2 (accessed October 21, 2014)

Figure 1 – Study Area



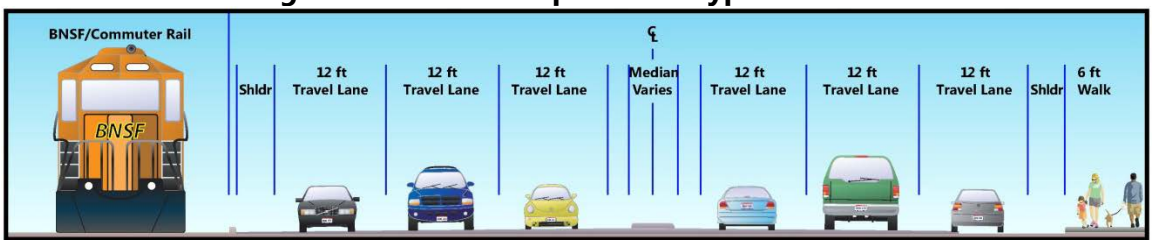
Legend
- US-60/Grand Ave COMPASS Corridor
- Freeway
- Streams/Washes

US-60/Grand Avenue: Loop 303 to Interstate 10
COMPASS
6/25/2013
0 1.5 3 6 Miles

2.0 Preferred Corridor Concept

The Blue Concept was accepted by the Charter, Management and Planning Partners. It implements commuter rail within the BNSF Railway right-of-way and includes new operational improvements, in addition to incorporating projects that are identified in the current RTP. The Blue Concept generalized corridor typical section is illustrated below in in ***Figure 2.*** It includes three lanes for each direction of travel and a typical urban raised median. The Blue Concept is shown in ***Figure 3.***

Figure 2 – Blue Concept 6-Lane Typical Section



Graphic for illustrative purposes only - not to scale.

Several new, or substantially improved, grade separated TIs were identified in the study area, including:

- Bell Road;
- Greenway Boulevard;
- 91st Avenue;
- 75th Avenue/Olive Avenue;
- 67th Avenue/Olive Avenue;
- 51st Avenue/Bethany Home Road;
- 35th Avenue/Indian School Road; and
- McDowell Road/19th Avenue.

Commuter Rail Characteristics

Commuter rail operations would be conducted within the existing BNSF Railway right-of-way and would require substantial coordination with the BNSF Railway freight movements. Additional capital investments to the rail infrastructure would be necessary.

Commuter rail station spacing, or stop frequency, is typically greater than with other HCT technologies, providing fewer opportunities for stop locations. Within the study area, commuter rail stops are located at:

- *SR-303L* – North Surprise;
- *Bell Road* – Surprise;
- *Santa Fe Lane* – El Mirage;
- *83rd Avenue* – Peoria; and
- *59th Avenue* – Glendale.

Three potential service levels in the study area were explored by the *Grand Avenue Commuter Rail Corridor Development Plan*:

- Phase A – 30 minute headways during the peak and one off-peak roundtrip;
- Phase B – 30 minute headways during the peak and three off-peak roundtrips; and
- Phase C – 30 minute headways during the peak and 60 minute headways during the off-peak.

Phase A would have an initial service year starting before 2020 and Phase B occurring prior to 2030. Phase C, or build-out, would be in place between 2030 and 2040. Daily boardings are projected at 2,400, 2,800, and 5,000 for Phases A, B, and C, respectively. Prior to commuter rail implementation, BRT or other forms of HCT may be introduced to allow the corridor to begin acclimation of its development patterns in favor of higher density employment and residential uses. This may increase ridership of commuter rail when implemented.

Red Concept – This concept, detailed in Technical Memorandum 5, continues to serve as the "no-build" alternative completing already programmed improvements.

Figure 3 – Original Blue Concept – Commuter Rail with Operational Improvements

3.0 Corridor Optimization

True corridor optimization includes both roadway and multimodal improvements to maximize throughput in the corridor. This study identifies conceptual roadway improvements. MAG is currently working to advance the efforts presented in its *Commuter Rail: Grand Avenue (BNSF)* (May 2010) study to help fulfil the future transit needs of this corridor.

The Blue Concept implements commuter rail in the US-60/Grand Avenue corridor, within the BNSF Railway right-of-way. Commuter rail would follow the recommendations of the MAG *Grand Avenue Commuter Rail Corridor Development Plan* (May 2010), which was accepted by the communities along the corridor and generally incorporated into their general plans.

3.1. Transit Considerations

Through the advancement of the Blue Concept, commuter rail is recommended for implementation in the US-60/Grand Avenue corridor, within the BNSF Railway right-of-way. MAG and the partnering agencies along the corridor are continuing to advance commuter rail in separate efforts from this US-60/Grand Avenue COMPASS project. Commuter rail is anticipated to follow the recommendations of the MAG *Grand Avenue Commuter Rail Corridor Development Plan* (May 2010), which was accepted by the communities along the corridor and generally incorporated into their general plans. This study's roadway recommendations were intended allow the advancement of commuter rail.

Additional transit considerations include:

- Bus Transit – several of this study's recommended roadway concepts are complex in nature. Accommodating connections between bus routes and other modes of travel that traverse the corridor will need further investigation following this study.
- Other HCT – studies that are being conducted by others (e.g. West Phoenix/Central Glendale Transit Corridor Study) should be accommodated.
- Pedestrians – sidewalks should be provided continuously and consistently throughout the US-60/Grand Avenue corridor.

3.2. Roadway Characteristics

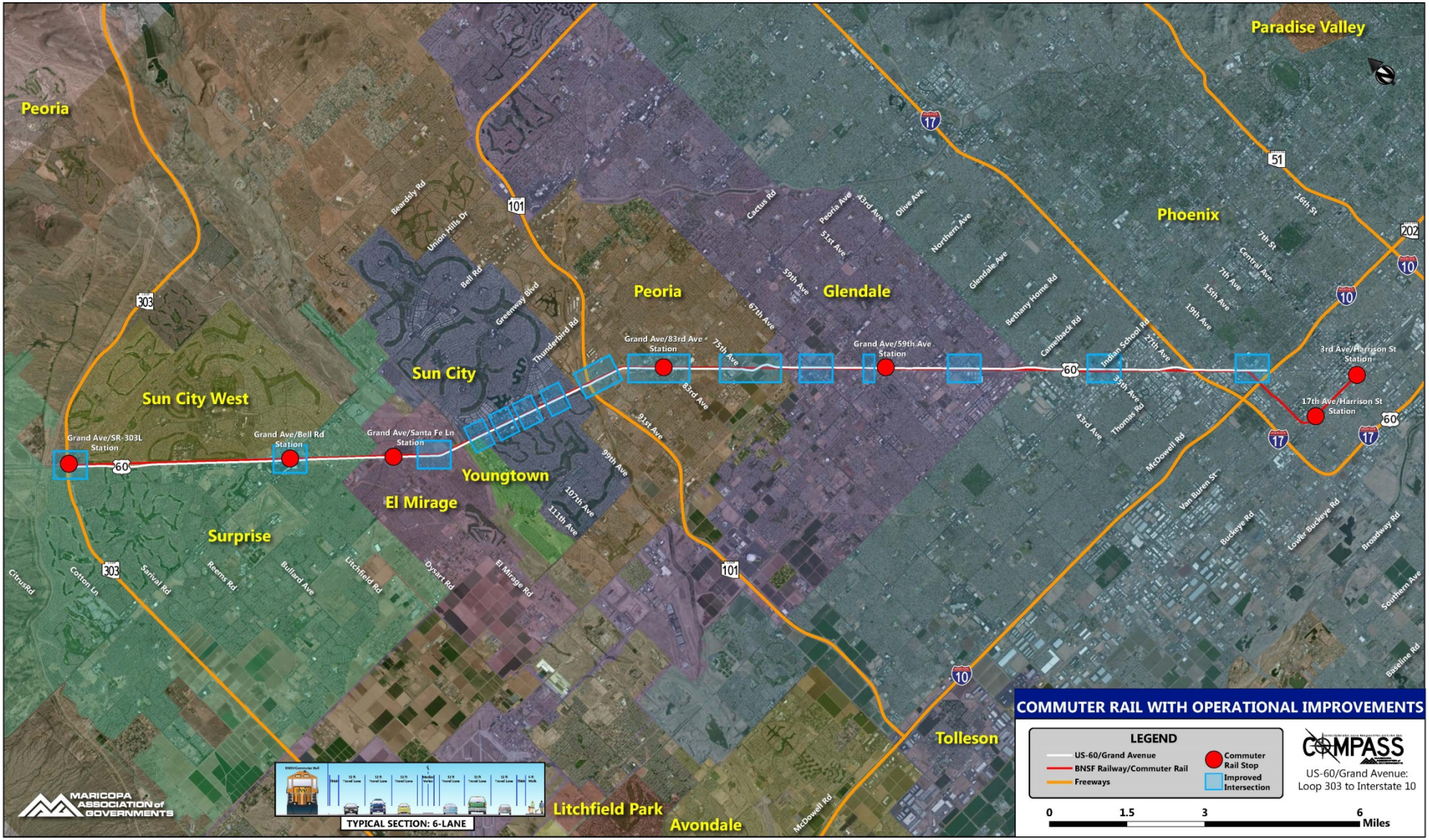
The roadway characteristics of the Blue Concept outlined in Section 2.0 above and documented in Technical Memorandum 5 were further refined based on: 1) Input received from the Planning Partners and public and 2) Further investigation of the Blue Concept. A primary focus of the refinements was to address the US-60/Grand Avenue crossroad interaction with the BNSF Railway by minimizing at-grade railroad crossings. This, along with more detailed traffic information, led to additional grade separated TIs, as well as revisions to grade separated TIs identified earlier in this study.

Recommendations for new or substantially improved grade separated TIs in the study area now include:

- Bell Road;
- 111th Avenue Overpass;
- 107th Avenue/Del Webb Boulevard;
- 103rd Avenue Overpass;
- 99th Avenue;
- 91st Avenue;
- Peoria Avenue and 83rd Avenue;
- 75th Avenue/Olive Avenue;
- 67th Avenue/Northern Avenue;
- 51st Avenue/Bethany Home Road;
- 35th Avenue/Indian School Road;
- I-17; and
- 19th Avenue/McDowell Road.

The recommended refined roadway concept is illustrated ***Figure 4*** and in the Recommendations Map Book presented in ***Appendix TM6-1***; it used for illustrative purposes to confirm the recommendations for this COMPASS project. ***The geometric recommendations are conceptual in nature; the formal ADOT Scoping Phase will need to be completed, including required typical local, state, and federal agencies approvals.*** Use of the information contained herein for right-of-way acquisition and similar activities is not recommended until the appropriate time during ADOT's project development process.

Figure 4 – Refined Blue Concept – Commuter Rail with Operational Improvements



3.3. Traffic Operations

An operational analysis of the recommended roadway concept was completed for the major intersections along the US-60/Grand Avenue corridor. The procedures for traffic volume estimation and operational analysis for the horizon year (2040) are outlined below.

3.3.1. Turning Movement Estimates

MAG performed travel demand modeling and provided turning movement estimates for the US-60/Grand Avenue corridor from the regional travel demand air quality conformity model. The model essentially includes all the approved network updates and adds the project specific updates to an already validated model. The model for the US-60/Grand Avenue COMPASS project is based on the 2035 transportation network and the 2040 land use scenario. For the US-60/Grand Avenue COMPASS corridor, MAG provided AM peak period, PM peak period, and 24-hour turning movement estimates.

Peak period to peak hour conversion factors were also provided by MAG. The AM peak period to peak hour conversion factor is 2.40 and the PM peak period to peak hour conversion factor is 3.54. These conversion factors are associated with arterial links for the MAG travel demand model. Although the proposed concept converts US-60/Grand Avenue from an arterial type facility to more of an expressway type facility, the conversion factors for arterial type facilities were used in the operational analysis. This was due to the fact that the recommended concept still retains several unsignalized and signalized intersections within the study area.

Raw travel demand output was adjusted before being used for operational analysis. Travel demand models are typically validated to link volumes and may not produce realistic turn volumes at the intersection level. Typically, validated travel demand models provide a good representation at the link level. High capacity/higher functional classification links validate well, but model performance tends to deteriorate for low capacity/lower functional classification links. Intersection turning movement volumes estimates from the travel demand models, therefore, do not provide a good representation.

The initial review of the air quality conformity model revealed that the raw travel demand output was not suitable for intersection level analysis. Several turning movements for the project area had zero volumes. Without detailed junction control implementation and assignment procedures that capture the effect of congestion, the travel demand model is unlikely to produce realistic turning movement estimates at all the intersections in the US-60/Grand Avenue COMPASS corridor. Adjustments to model estimates were essential to resolve such inconsistencies. Applying adjustments is a common practice in operational analysis of future year conditions.

Adjustments to model estimates were performed in two steps:

1. Select link analysis based adjustments; and
2. Existing turning movement count based adjustments.

3.3.2. Select Link Based Adjustments

Select link analysis was used to hand adjust model assignments so that more realistic paths were used. Select link queries and loaded network information were provided by MAG. Information in the select link analysis can be used to examine the entire model network to determine which links/zones contribute to trips on a certain link and how those trips depart from that link. Adjustments using select links were based on engineering judgment and best practice methods. The adjusted travel demand estimates were further refined in the second step using most recent traffic counts in the corridor.

3.3.3. Existing Turning Movement Count Based Adjustments

Existing turning movement counts provide the best information about how approaching traffic volume at an intersection departs from it. Existing counts for the US-60/Grand Avenue COMPASS corridor were derived from the *Grand Avenue (US-60) Traffic Signal Coordination Timing* (March 2012) memorandum. This report summarizes the intersection turning movement counts, existing (2012) LOS and LOS under a scenario with optimized and coordinated signal timing plans on US-60/Grand Avenue.

Since the travel demand model is validated mostly to link level data, it can be assumed that the air quality conformity model results in reasonable link level travel demand estimates. Select link adjustments outlined above will improve the link level estimates. By holding the incoming and outgoing link level estimates constant and adjusting the turning movement estimates using the existing turning percentages, a reasonable estimate for intersection turning movement counts can be generated. This process will usually result in eliminating zero turning movement estimates at target intersections in the travel demand model. This adjustment process follows the general principles outlined in NCHRP Report 255. This methodology begins with the existing turning movement counts and uses an iterative process to adjust them to match the select link adjusted link volumes. If the iterative process results in more than 10 percent correction to the link volume estimates, then the link volume estimates need further adjustment using engineering judgment to minimize such discrepancy.

This approach corrected many issues associated with the model data. Results from the adjusted estimates from the MAG air quality conformity model were then used in the operational models. The results from the *Grand Avenue (US-60) Traffic Signal Coordination Timing* memorandum serve as a benchmark to assess the feasibility of the recommended US-60/Grand Avenue COMPASS roadway concept. The final future turning movement estimates are provided in ***Appendix TM6-2*** part of the operational analysis output files described below.

3.3.4. Operational Analysis

Operational analysis for signalized and stop-controlled intersections was performed using SynchroTM (Version 8, Build 6) traffic analysis software. Evaluations were performed for the major intersections found in the MAG travel demand model, including network revisions for this study in order to investigate the feasibility of the concepts for the major intersections in the US-60/Grand Avenue COMPASS corridor. Weaving analysis for the roadway section between 99th Avenue and SR-101L and operational analysis for the roundabout at the intersection of 19th Avenue was performed using Transmodeler (Version 4.0). Documentation for these evaluations is included in ***Appendix TM6-2***.

The operational analysis was performed for the AM and PM peak hours using traffic volumes estimated using the procedure outlined above. Intersection LOS was used as a primary metric to assess the feasibility of the recommended concepts. An overall intersection LOS D was the target for the recommended concepts.

LOS is evaluated on the basis of control delay in seconds per vehicle. ***Table 1*** and ***Table 2*** define LOS for the different "grades" of service.

Table 1 - Signalized Intersection Level of Service

LOS	Control Delay per vehicle (sec)	Description
A	< 10	Most vehicles do not stop.
B	10 – 20	Good progression; more vehicles stop than at LOS A.
C	20 – 35	The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.
D	35 – 55	Many vehicles stop, and the proportion of vehicles not stopping declines. Occasionally, all vehicles on an approach will not clear the intersection during the green.
E	55 – 80	Considered the limit of acceptable delay. Frequently, all vehicles on an approach will not clear the intersection during the green.
F	> 80	Considered unacceptable to most drivers.

Table 2 - Unsignalized Intersection Level of Service

LOS	Control delay (sec)
A	< 10
B	10 – 15
C	15 – 25
D	25 – 35
E	35 – 50
F	> 50

Generally, all intersections from the recommended US-60/Grand Avenue COMPASS roadway concept operate at an overall LOS D or better as listed in ***Table 3***. Two locations, SR-303L TI and Thunderbird Road/Thompson Ranch Road intersection, do not meet this threshold. Both locations are currently in final design or construction and were not further investigated for potential improvements.

Table 3 - Summary of Intersection Level of Service		
Intersection with US-60/Grand Ave (unless otherwise noted)	LOS AM Peak Hour	LOS PM Peak Hour
SR-303L Southbound Ramps**	F	F
SR-303L Northbound Ramps**	D	F
N Sunrise Boulevard	D	D
W Meeker Boulevard	C	C
W Bell Road	B	B
N Dysart Road	C	D
W Greenway Road	C	D
W Thunderbird Road/W Thompson Ranch Road**	F	E
N 113th Avenue	D	D
N 107th Avenue	C	C
N 99th Avenue	B	C
SR-101L Southbound Ramp	A	A
SR-101L Northbound Ramp	B	B
N 91st Avenue Frontage Left	A	A
N 91st Avenue and Frontage Road	C	C
N 91st Avenue Frontage Right	C	C
W Peoria Avenue	D	D
N 83rd Avenue	B	B
Cotton Crossing	D	D
N 75th Avenue and W Olive Avenue	D	D
Olive Avenue Connector and W Olive Avenue	C	C
W Golden Lane and US-60/Grand Avenue	C	B
N 75th Avenue and W Golden Lane	B	A
N 71st Avenue*	B	C
W Butler Drive*	A	B
67th Avenue and W Northern Avenue	D	D
W Royal Palm and US-60/Grand Avenue	C	D
67th Avenue and W Royal Palm	B	B
W Myrtle Avenue	C	B
N 57th Drive	A	B
N 51st Avenue and W Bethany Home Road	D	D
N 51st Avenue Connector and US-60/Grand Avenue	B	C
N 51st Avenue Connector and N 51st Avenue	B	D
N 52nd Avenue and W Bethany Home Road	B	B
N 35th and W Indian School Road	D	D
N 33rd Avenue and US-60/Grand Avenue	C	D
N 33rd Avenue and Indian School Road	D	D
19th Avenue Roundabout	D	D

Table 3 - Summary of Intersection Level of Service		
Intersection with US-60/Grand Ave (unless otherwise noted)	LOS AM Peak Hour	LOS PM Peak Hour
N 18th Avenue	C	B
N 17th Drive	B	B

* This intersection is unsignalized in 2040.

** This location is currently in final design or construction.

3.4. Major Intersection Considerations

The existing US-60/Grand Avenue corridor is complicated. Its skewed alignment relative to the Phoenix metropolitan arterial street grid system results in unique intersection configurations. These intersections have traffic signals with long cycle lengths and multiple phases that affect traffic flow and interrupt progression. Major intersections are typically constricted physically by residential, commercial and industrial developments. Additional challenges are presented by the railroad tracks owned and operated by the BNSF Railway, which runs parallel and adjacent to US-60/Grand Avenue throughout the study corridor, creating at-grade crossings with major arterials.

The future vision and recommendations for the US-60/Grand Avenue corridor include prioritizing uninterrupted traffic flow along the corridor, implementing grade separations for major arterial crossroads to increase corridor capacity, while minimizing potential movement conflict points, reducing cycle length and signal phases, and eliminating the BNSF Railway at-grade crossings. Where practicable, recommendations were developed to achieve a roadway configuration that facilitated a two- or three-phase traffic signal operation on US-60/Grand Avenue. Two general approaches, with some exceptions, are recommended for major intersection grade separations:

SR-303L to SR-101L General Approach – The MUD TI is generally recommended for new grade separations from SR-303L to SR-101L for its: 1) Reduced right-of-way footprint; 2) High-capacity three-phase traffic signal operation on the crossroad; 3) Ability to provide business access along US-60/Grand Avenue where necessary; and 4) Uninterrupted flow on US-60/Grand Avenue. The MUD TI connects two intersecting roadways (e.g. US-60/Grand Avenue and Bell Road), which is generally found through this segment of the study area. Substantial traffic volumes are projected for the segment between the Agua Fria River and SR-101L, primarily due to the lack of an alternate nearby river crossing. Through this specific segment, a series of MUD TIs and overpasses are recommended to balance local access with projected traffic volumes, and facilitate driver expectancy with a consistent TI type.

SR-101L to McDowell Road General Approach – The addition of a third intersecting roadway (e.g. US-60/Grand Avenue, 51st Avenue, and Bethany Home Road) creates an additional layer of complexity. The general approach applied consists of creating a new grade-separated intersection between the crossroads on a level above US-60/Grand Avenue, and using a quadrant roadway to connect the two levels. The intersection with US-60/Grand Avenue would then be configured with a continuous green T-intersection (also known as "Florida T"), permitting uninterrupted flow in one direction on US-60/Grand Avenue and limited interruption in the opposing direction.

Specific recommendations for each major intersection are explained in the following sections.

Exceptions – There are locations throughout the US-60/Grand Avenue corridor with recommendations that differ from the above general approaches, due unique site constraints, input from the Planning Partners, and/or lack of need for improvements from a traffic operations perspective.

3.4.1. SR-303L TI

The SR-303L TI is currently under construction and is anticipated to be completed in summer 2016. A new partial cloverleaf (folded diamond) TI will be constructed as an interim condition. A new bridge over US-60/Grand Avenue will carry eastbound traffic, while the existing bridge over US-60/Grand Avenue will carry westbound traffic. Both off-ramps will provide dual left-turn lanes and a single right-turn lane. Additionally, dual left-turn lanes and an exclusive right-turn lane will be provided on US-60/Grand Avenue to access the SR-303L on-ramps. The operational analysis of the interim concept in future indicated an unacceptable overall LOS F in both AM and PM peak hours for the southbound ramps and overall LOS D and F for the northbound ramps in the AM and PM peak hours, respectively. Due to the interim status and plans for a more robust future configuration, no further investigation for potential improvements was performed.

3.4.2. Sunrise Boulevard/R.H. Johnson Boulevard

No improvements are recommended for this intersection. The operational analysis of the future condition indicated an acceptable overall LOS D in both AM and PM peak hours.

3.4.3. Reems Road/Meeker Boulevard

No improvements are recommended for this intersection. The operational analysis of the future condition indicated an acceptable overall LOS C in both AM and PM peak hours.

3.4.4. Bell Road

The Bell Road intersection is in the early stages of being reconstructed as a MUD TI. ADOT is in the process of selecting a design-build team for this effort. Construction is scheduled to begin in early 2016 and be completed in summer 2017. The intersection was identified in this study as a hot spot location with the second highest number of crashes for the US-60/Grand Avenue COMPASS corridor. High existing and forecast volumes and concerning crash history will be addressed through ADOT's improvement project. The MUD TI will grade separate Bell Road over US-60/Grand Avenue and the BNSF Railway. The operational analysis of the concept in the future indicated an acceptable overall LOS B in both AM and PM peak hours. Due to the current status of ADOT's efforts at the intersection, no further investigation for potential improvements was performed.

3.4.5. Dysart Road

No improvements are recommended for this intersection. The operational analysis of the future condition indicated an acceptable overall LOS C and LOS D in the AM and PM peak hours, respectively. Several movements will operate at an unacceptable LOS E or F, especially during the PM peak hour; however, dual left-turn lanes and exclusive right-turn lanes are present on US-60/Grand Avenue at this location.

3.4.6. Greenway Road

A new right-turn lane for eastbound US-60/Grand Avenue is recommended at the Greenway Road intersection. Greenway Road is currently a minor, two-lane roadway. The BNSF Railway crossing is less than 10 feet north of the intersection. The current complex geometry and low existing and forecasted traffic volumes indicate no need for major design changes at this location, except the addition of a right-turn lane to provide better traffic flow, safety, and enhance the character of the facility. The operational analysis of the future condition indicated an acceptable overall LOS C and D in the AM and PM peak hours, respectively.

3.4.7. Thompson Ranch Road/Thunderbird Road

The Thompson Ranch Road/Thunderbird Road intersection is in the early stages of being reconstructed to add turn-lanes to US-60/Grand Avenue and realign Thunderbird Road and the frontage road. ADOT is now in the final design process, with construction scheduled to begin in early 2016. The proposed improvements were incorporated into this study. With these improvements, the operational analysis of the future condition indicated an unacceptable LOS F and E in the AM and PM peak hours, respectively. Due to the status of ADOT's efforts at the intersection, no further investigation for potential improvements was performed.

3.4.8. 111th Avenue

The intersection at 111th Avenue is recommended to be grade separated and reconstructed as an overpass, with no connections to US-60/Grand Avenue. 111th Avenue, currently a four-leg intersection, was identified in this study as a hot spot with 85 car crashes in the last three years. Existing and forecasted traffic volumes are high, with existing operations at an unacceptable LOS F. The turning movements from 111th Avenue will be accommodated via 113th Avenue and US-60/Grand Avenue, which is recommended to be modified to a continuous green T-intersection, permitting westbound traffic on US-60/Grand Avenue to travel without stopping. Additional investigation and improvements will likely be necessary to accommodate increased traffic volumes on 113th Avenue. Additional access to and from eastbound US-60/Grand Avenue is provided via 111th Drive, which would remain a right-in right-out (RIRO) access. The operational analysis of the future condition at 113th Avenue shows the intersection will operate at an acceptable LOS D in both AM and PM peak hours.

3.4.9. Del Webb Boulevard/ 107th Avenue

The intersection at 107th Avenue is recommended to be grade separated as a MUD TI, with Del Webb Boulevard/ 107th Avenue depressed under US-60/Grand Avenue. Travel demand modeling forecasts over 76,000 daily vehicles on US-60/Grand Avenue at this location. With no improvement, this intersection is projected to provide a failing LOS. Close proximity of existing development and right-of-way constraints led to the recommendation of a MUD TI. The operational analysis of the concept in the future shows the intersection will operate with an acceptable LOS C in both AM and PM peak hours.

3.4.10. 103rd Avenue

Similar to 111th Avenue, the recommended 103rd Avenue intersection treatment is grade separation with no direct connections to US-60/Grand Avenue. This recommendation is consistent with prior recommendations for this location in prior studies. These improvements will improve traffic operations

of US-60/Grand Avenue, accommodate substantial golf cart traffic, and provide faster emergency vehicle access to the medical facilities located on north side of US-60/Grand Avenue. Four existing locations (Coggins Drive, 105th Avenue, 102nd Avenue and 101st Avenue) will continue to provide eastbound US-60/Grand Avenue access to the area. The outbound access for the westbound traffic on US-60/Grand Avenue will be provided via Santa Fe Drive and the 107th or 99th Avenue TIs.

3.4.11. 99th Avenue

The intersection at 99th Avenue is recommended to be grade separated as a MUD TI. The MUD TI will grade separate 99th Avenue over US-60/Grand Avenue and the BNSF Railway. The existing segment of US-60/Grand Avenue between 99th Avenue and SR-101L was identified as the second worst operational segment for the corridor. The operational analysis of the concept in the future shows the overall intersection will operate at an acceptable LOS C or better in both AM and PM peak hours. Due to the MUD TI configuration and proximity of the TI to SR-101L, a weave analysis was conducted and outlined in ***Table 4*** below.

Table 4 - Weave Analysis between 99th Avenue and SR-101L

	Eastbound Ave Speed	Westbound Ave Speed	Eastbound LOS	Westbound LOS
AM Peak	33.66 mph	46.04	D	C
PM Peak	38.25 mph	44.25	D	D

3.4.12. SR-101L TI

A new right-turn lane for eastbound US-60/Grand Avenue is recommended at the SR-101L TI ramp to improve operations and enhance the expressway-like character of the corridor. The SR-101L TI is a split-diamond interchange, with the US-60/Grand Avenue location providing access to and from the south on SR-101L. The north half of the split-diamond is located at 91st Avenue, which puts travel demand pressure on the 91st Avenue intersection with US-60/Grand Avenue. SR-101L is currently an underpass to US-60/Grand Avenue, and the BNSF Railway is at the same level as US-60/Grand Avenue, immediately to the north, putting constraints on the location. The travel demand model select link analysis indicated that high levels of local traffic use the SR-101L ramps at US-60/Grand Avenue to commute south via SR-101L to I-10 during the AM peak hour and in the reverse direction during the PM peak hour. The future operational analysis indicates an acceptable LOS B or better during both peak hours.

3.4.13. 91st Avenue

The intersection at 91st Avenue is recommended to be reconstructed as a new TI with two-phase traffic signals on US-60/Grand Avenue. Travel demand modeling forecasts project high traffic volumes at this intersection. This intersection was also identified as a hot spot location, with 104 total crashes (61 rear-end) in the recent 3 year period. 91st Avenue provides access to and from the north on SR-101L. The concept grade separates 91st Avenue over US-60/Grand Avenue and the BNSF Railway and realigns US-60/Grand Avenue closer to the railroad. The concept includes a new one-way eastbound access road on the south side of US-60/Grand Avenue, providing access to 91st Avenue and the local area. Westbound traffic on US-60/Grand Avenue accesses 91st Avenue via a signalized wide U-turn movement onto the eastbound access road (Map Book intersection S88.1). 91st Avenue traffic accesses US-60/Grand Avenue

via the one-way eastbound access road (Map Book intersection S91.1). The operational analysis of the concept in the future shows the intersection will operate at an acceptable LOS C or better in both AM and PM peak hours.

The goal of this concept is to provide full access between US-60/Grand Avenue and 91st Avenue with improved traffic operations by minimizing traffic signal phases, eliminating the at-grade railroad crossing, and minimizing additional right-of-way needs. The use of two-phase traffic signals for the eastbound US-60/Grand Avenue traffic is expected to reduce delay and provide uninterrupted westbound traffic flow. This location is complex due to its close proximity to the SR-101L TI, right-of-way constraints, and presence of the railroad. A full diamond interchange at SR-101L was considered to alleviate travel demand pressure on 91st Avenue from SR-101L to and from the north; however, it was determined to be impractical at this time due to the close proximity of the railroad tracks. Future investigation may further evaluate this study's recommended concept and potential variations; however, improvements should be consistent with the operational and access goals of this study. Careful signing should be developed for this location.

3.4.14. Peoria Avenue and 83rd Avenue

The intersections at Peoria Avenue and 83rd Avenue are recommended to be grade separated, which is consistent with the City of Peoria's *Old Town Peoria Revitalization Plan* (2008) implementation strategy and recent City efforts. Grade-separating US-60/Grand Avenue under a cap would create an at-grade public space between Peoria Avenue and 83rd Avenue. Closure of 83rd Avenue and keeping US-60/Grand Avenue at-grade was investigated with the City of Peoria, but eventually stopped due to inconsistencies with prior City efforts. The City of Peoria expressed concerns regarding a potential lack of access to the Old Town Peoria area due to the recommended grade separation. The concept was modified to include low-speed ramps and access roads that intersect with 83rd Avenue and Peoria Avenue. The operational analysis of the concept in the future shows that both intersections will operate at an overall acceptable LOS D or better in both AM and PM peak hours.

Close proximity of the concept's ramp connections with US-60/Grand Avenue and Cotton Crossing create potential issues with weaving. Placing the ramp connections on the outside of US-60/Grand Avenue precludes eastbound traffic to turn right onto Cotton Crossing. A similar issue would occur if the ramp connections were made in the median, similar to a MUD TI, where eastbound left-turns would be precluded. Due to potential travel demand and the presence of several access routes to the south of US-60/Grand Avenue, this study recommends placing the ramps on the outside, precluding the right-turn to Cotton Crossing, and therefore preserving the left-turn movement.

As part of the operational and access management approach for this area, and through coordination with the City of Peoria, it is recommended that the intersection with 87th Avenue be reconstructed as a continuous green T-intersection. This concept permits uninterrupted traffic flow for westbound US-60/Grand Avenue and limited interruption in the eastbound direction. To implement this concept, 87th Avenue, currently a half-street roadway between Peoria Avenue and Jefferson Street, should be considered for widening and realignment to provide full capacity along the corridor.

3.4.15. Cotton Crossing

It is recommended that the eastbound US-60/Grand Avenue right-turn at Cotton Crossing is eliminated to accommodate a new local access road and ramps to the nearby 83rd Avenue intersection. The intersection at Cotton Crossing is close to 83rd Avenue and the recommended ramps for local access to Old Town Peoria. This proximity presents a challenge to maintain all traffic movements at Cotton Crossing. Several concepts were considered for the 83rd Avenue ramps. The access road and ramps in the recommended concept for Peoria Avenue and 83rd Avenue preclude the right-turn movement from eastbound US-60/Grand Avenue to southbound Cotton Crossing. The operational analysis of the concept in the future shows the overall intersection indicated an acceptable LOS D in both AM and PM peak hours.

3.4.16. 75th Avenue/Olive Avenue

The TI at 75th Avenue/Olive Avenue is recommended to be reconstructed to form a single four-leg intersection between 75th Avenue and Olive Avenue, grade separated above US-60/Grand Avenue and the BNSF Railway. Quadrant roadways would be used to connect the two levels. The concept addresses the high traffic volumes, poor operation, and the future vision for US-60/Grand Avenue. The concept includes a RIRO at 71st Avenue and a new Golden Lane connection from the south to US-60/Grand Avenue, providing connections between US/60-Grand Avenue and the two major arterials. These new connectors were also analyzed for operational performance. The operational analysis of the concept in the future indicated an acceptable LOS D or better in both AM and PM peak hours.

3.4.17. 67th Avenue/Northern Avenue

The TI at 67th Avenue/Northern Avenue is recommended to be reconstructed to form a single four-leg intersection between 67th Avenue/Northern Avenue, along with a two-way flyover ramp between the west leg of Northern Avenue and east leg of US-60/Grand Avenue. The 67th Avenue/Northern Avenue intersection is grade separated above US-60/Grand Avenue and the BNSF Railway. The flyover ramp is to be consistent with prior Northern Parkway (Avenue) study recommendations. 63rd Avenue and Orangewood Avenue are utilized for access from US-60/Grand Avenue to Northern Avenue and 67th Avenue, respectively. Royal Palm provides a connection between 67th Avenue and US-60/Grand Avenue via a continuous green T-intersection at US-60/Grand Avenue. The operational analysis of the concept in the future indicated an acceptable LOS D or better in both AM and PM peak hours.

A signing concept was developed and included in ***Appendix TM6-3*** for this location to demonstrate the use of guide signs to direct motorists to and from US-60/Grand Avenue. Additional information on signing is included below in Section 3.5.

3.4.18. Myrtle Avenue

The intersection at Myrtle Avenue was investigated to develop concepts that improved traffic operations through minimizing traffic signal phases; however, the City of Glendale, Valley Metro, and others are investigating the potential of extending HCT from downtown Glendale to the Westgate Entertainment District. At the request of the City of Glendale, recommendations were withdrawn from this study to provide flexibility for future HCT improvements.

3.4.19. 51st Avenue/Bethany Home Road

The TI at 51st Avenue/Bethany Home Road is recommended to be reconstructed to form a single four-leg intersection between 51st Avenue/Bethany Home Road, grade separated above US-60/Grand Avenue and the BNSF Railway. The existing US-60/Grand Avenue at-grade intersection with Bethany Home Road was identified as a hot spot location with the highest number of crashes (133 crashes in recent 3 year period). The recommendation is based on the high existing and forecast traffic volumes, concerning crash history, as well as the future vision for the study corridor. The existing 51st Avenue connector will be modified to connect 51st Avenue and US-60/Grand Avenue via two signalized intersections. The 52nd Avenue connector will be realigned and used to provide another connection between 51st Avenue and Bethany Home Road. The use of guide signs, in the same vein as the signing concept developed for the 67th Avenue/Northern Avenue recommendations, will be important at this location. The operational analysis of the concept in the future indicated an acceptable LOS D or better in both AM and PM peak hours

3.4.20. 43rd Avenue/Camelback Road

US-60/Grand Avenue is currently grade-separated over the intersection of 43rd Avenue/Camelback Road; therefore, the intersection was not analyzed or investigated for potential recommendations.

3.4.21. 35th Avenue/Indian School Road

The TI at 35th Avenue/Indian School Road is recommended to be reconstructed to form a single four-leg intersection between 35th Avenue/Indian School Road, grade separated above US-60/Grand Avenue and the BNSF Railway. The recommendation is based on the focus to optimize progression along the US-60/Grand Avenue corridor. In addition to the existing ramp connections between US-60/Grand Avenue and Indian School Road, the concept focuses on 33rd Avenue to provide the connection between US-60/Grand Avenue and 35th Avenue/Indian School. The use of guide signs, in the same vein as the signing concept developed for the 67th Avenue/Northern Avenue recommendations, will be important at this location. The operational analysis of the concept in the future indicated an acceptable LOS D or better in both AM and PM peak hours

3.4.22. 27th Avenue/Thomas Road

US-60/Grand Avenue is currently grade-separated over the intersection of 27th Avenue/Thomas Road; therefore, the intersection was not analyzed or investigated for potential recommendations.

3.4.23. I-17

US-60/Grand Avenue is currently grade-separated over I-17. During the course of this study, the potential for a DHOV connection between I-17 to and from the north with US-60/Grand Avenue to and from the east was identified. The Interstate 10/Interstate 17 Corridor Master Plan Study is investigating the potential of this DHOV connection.

3.4.24. 19th Avenue/McDowell Road

The intersection at 19th Avenue/McDowell Road is recommended to be reconstructed as a new grade separated intersection. The concept grade-separates McDowell Road over Grand Avenue and the BNSF Railway. A local access road is provided to maintain property access. The Grand Avenue intersection

with 19th Avenue is reconstructed as a roundabout. Potential concepts were investigated that gave travel priority to Grand Avenue to and from the west and 19th Avenue to and from the south. Input from the City of Phoenix and the public indicated an interest in maintaining the direct connection, yet recognized the change in character of Lower Grand Avenue. The recommended concept addresses these interests, and at the same time, addresses the study's overarching objectives. The operational analysis of the concept in the future indicated an acceptable LOS D in both AM and PM peak hours

3.5. Signing Guidelines

US-60/Grand Avenue is a regional roadway that calls for an intermediate level of signing, more advanced than that required for a conventional roadway, however less demanding than that required for a freeway. For the last fifteen years, this section of US-60/Grand Avenue has undergone over 50 roadway related projects and studies; existing signing on US-60/Grand Avenue and its major crossroads is lacking uniformity and consistency. Even a brief evaluation indicates incomplete and often inadequate signage which creates challenges for the motorists traveling through the corridor. Developing clear and standardized signing guidelines to ensure safe and efficient travel is critical for the implementation of this study's recommended concepts.

3.5.1. Current Applicable Signing Standards

All future sign design, placement, and application shall adhere to the latest editions of the following:

- The MUTCD published by FHWA – establishes national standards that promote uniformity and aid in driver grasp of traffic control devices. Part 2 of the MUTCD is specific to signs, their shapes, sizes, colors, placement and other details. ADOT adopted the MUTCD 2009 Edition and also provides the Arizona Supplement to the 2009 MUTCD.
- ADOT Traffic Engineering Policies, Guidelines and Procedures (PGP) – provide guidance to help establish uniform guidelines and procedures for traffic control devices.
- ADOT Traffic Engineering Manual of Manual of Approved Signs – establishes standard codes and designations for Arizona state-specific signs.
- ADOT Signing and Marking Standard Drawings – detail specific signing and marking parameters currently adapted in the state of Arizona.

3.5.2. General Signing Guidelines

All future signage within the US-60/Grand Avenue corridor must be coordinated with ADOT. The guidelines contained herein provide a general approach. Further study and design steps are needed to fully define elements, including specific sign placement, clearances, and sizes, which are beyond the scope of this study. Further proposals are to be discussed with both ADOT and appropriate local agencies having jurisdiction over the affected roadways.

Signs should be designed for multiple travel lanes and higher operating speeds, which requires:

- Higher visibility by day and night;
- Higher legibility (adequate size of letters and symbols); and
- Shorter legends (for quick comprehension).

3.5.3. Guidelines for Guide Signs

Signing should be uniform and consistent throughout the corridor and for each type of traffic interchange or intersection. Ground mounted signs are preferred, however overhead placement may be required where justified by site conditions and design features. Median sign placement within corridor should be evaluated where median widths are sufficient.

For at-grade intersections, signs applicable to Conventional Roads could be utilized, however their size should be compatible with the other signs on the roadway. Where unusual geometrics exist, sign modifications may be justified, but held to a minimum to preserve uniformity and clarity. The feasibility and benefit to implementing exit numbering for interchanges and exits along US-60/Grand Avenue should be discussed with ADOT. Specific considerations for traffic interchanges and major intersections include:

- Major intersections advance guide signs may be placed not more than 1/2 mile in advance of an intersection or not beyond a previous intersection, whichever is less ***(Figure 5)***.

Figure 5

- Traffic interchange and major intersection guide signs should be placed in advance of traffic interchange/intersection deceleration (right/left turn) lanes. They should provide information necessary for motorists to navigate from US-60/Grand Avenue to a major crossing arterial roadway ***(Figure 6)***.

Figure 6

- Traffic interchange and major intersection sequence series identification signs with or without community names may be useful along the corridor ***(Figure 7)***.

Figure 7

- Distance signs may be used to identify the names of cities, towns and communities served by US-60/Grand Avenue. These signs consist of two or three lines containing the names and distances to significant destination points. Typically, distances to the same destination should not be shown more frequently than five miles ***(Figure 8).***

Figure 8

An example of a signing concept for the recommended US-60/Grand Avenue intersection with 67th Avenue/Northern Avenue is included in ***Appendix TM6-3***.

3.5.4. Guidelines for Other Signage:

All existing regulatory and warning signs along the corridor should be evaluated and updated to the current signing standards. Efforts shall be made to identify and prevent wrong-way usage along US-60/Grand Avenue. Specific considerations for other signs include:

- US-60/Grand Avenue should be clearly be identified by U.S. route sign M1-4 and shall consist of black numerals "60" on a white shield surrounded by a black background without a border.
- Trailblazer Assemblies shall be installed by placing route signs M1-4, arrow auxiliary sings (M5-1, M5-2 and M6 series), and cardinal direction auxiliary signs (M3-1 through M3-4) to navigate to and from US-60/Grand Avenue and other roadways in the vicinity.
- Street name sign design along US-60/Grand Avenue should be evaluated and coordinated between ADOT and local agencies with consideration to uniformity as well as a potential of adding a unique identity to each town or city street name design recognizing the different communities along the corridor ***(Figure 9).***
- Usage of way-finding signs (see ADOT PGP 338) and tourist-oriented signs to provide information and direction to key civic, cultural, visitor and recreational destinations, if desired by local agencies and businesses, should be considered ***(Figure 10)***.

Figure 9

Figure 10

3.5.5. Traveler Information Station

Due to the complexity of the existing and proposed US-60/Grand Avenue corridor roadway network, it may be appropriate to implement a TIS and place signs in the corridor alerting drivers to tune to an AM radio station for help with directions within the corridor.

3.6. Planning Level Cost Estimates

Planning level cost estimates were developed to provide an "order of magnitude" cost for the corridor optimization recommendations within the study area.

Commuter Rail

The *Grand Avenue Commuter Rail Corridor Development Plan* estimated transit capital costs for Phase A at $434 million, including $31 million for right-of-way, and O&M costs of $7.4 million annually. Phase B capital costs are $600 million with O&M costs of $10.8 million annually. Phase C capital costs are $701 million with O&M costs of $50 million annually.

Roadway

The planning level construction cost estimate is estimated at $525M, which broken into the current MAG Regional Transportation Plan funding segments is:

- $100M between SR-303L and SR-101L; and
- $425M between SR-101L and Willetta Street (McDowell Road).

The planning level costs were developed utilizing 2015 dollars and are based on the concept illustrated in the Recommendations Map Book included in ***Appendix TM6-1***. The planning level cost estimate considered the following factors:

- Rough measurement of construction item quantities for new pavement, curb, gutter, sidewalk, driveways, bridge, barrier, retaining walls, embankment, and traffic signals.
- Miscellaneous work percentages for landscape (20%), lighting (5%), drainage (5%), signing and pavement marking (5%).
- Project wide percentages for maintenance and protection of traffic (8%), dust and water palliative (0.75%), quality control (0.75%), construction survey (1.5%), erosion control (0.3%), and mobilization (8%).
- Unidentified items contingency of 30%.
- Other costs for construction engineering (9%), construction contingencies (5%), indirect cost allocation (8%), engineering design (8).

The planning level construction cost estimates ***does not*** include the following:

- Projects currently under final design or construction (SR-303L TI, Bell Road TI, and Thompson Ranch Road/Thunderbird Road intersection);
- Acquisition of new right-of-way;
- Acquisition of access rights; and
- Operations and maintenance activities.

As this study's recommendations proceed in the project development process, more detailed project cost estimates will need to be developed.

Potential roadway operations and maintenance costs for the corridor were estimated utilizing the maintenance cost per lane mile tool previously developed for MAG as part of the *Roadway Operations and Maintenance Cost Study* (2012). This study developed typical annual operating and maintenance cost factors to recognize the full cost of providing roadway services during the planning process. Cost estimates were developed for application at a regional level for arterial roadways and freeways. The cost model was used based upon a 23.83 miles of urban six-lane facility; a 20% allowance for complexities at the major intersections was added. The estimated annual operations and maintenance cost, including the allowance, was inflated to 2015 dollars using the Bureau of Labor Statistics Consumer Price Index Inflation Calculator. This yielded an estimated operations and maintenance cost of $2.5 million annually.

4.0 Access Management Principles

An access management program is a coordinated set of plans, regulations, capital improvements, and other actions necessary to achieve identified objectives. Principal among these objectives is achievement of safe and efficient traffic flow while preserving reasonable access to properties fronting the roadway as well as intersecting roadways. A program to create reasonable access management is by its very nature regulatory in practice and effect. This Technical Memorandum 6 and its appendices serve as the Access Management Plan for US-60/Grand Avenue.

An access management workshop series was conducted with the Planning Partners March 4 and 5, 2014. The presentation is included as ***Appendix TM6-4***. This workshop reviewed techniques and results of access management, as well as how these techniques could be applied to US-60/Grand Avenue. The workshop included an interactive discussion in which participants marked up roll plots and investigated different concepts along the corridor. Finally, the workshops addressed techniques and strategies that should be successful on US-60/Grand Avenue and presented a corridor zoning overlay as a method to manage access on US-60/Grand Avenue.

4.1. Access Management Benefits and Considerations

Access management is the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway. The purpose of access management is to provide access to land development in a manner that preserves the safety and efficiency of the transportation system. Access management provides a cost effective approach to improve roadway safety and reduce congestion. Failure to manage access creates adverse social, economic, and environmental impacts. Successful access management results include:

- Reduced vehicular crashes and collisions involving pedestrians and cyclists.
- Reduced travel delays, fuel consumption, and vehicular emissions as numerous driveways and traffic signals intensify congestion and delays along major roads.
- Reduced cut-through traffic in residential areas due to overburdened arterials.
- Reduced unsightly commercial strip development.

Access management helps preserve long-term property values and the economic viability of abutting development. According to the Urban Land Institute's Shopping Center Development Handbook, "poorly designed entrances and exits not only present a traffic hazard but also cause congestion that can create a negative image of the center." In contrast, well-designed circulation systems promote efficient travel and can improve the aesthetics of a corridor. Motorists are more likely to travel a corridor that is aesthetically pleasing, has efficient traffic movement, and is safer to drive. This results in increased economic vitality for the area. Other access management benefits to commercial corridors include:

- More attractive corridors increase property values and enhance economic opportunity.
- The need for roadway widening is reduced, which minimizes construction blocking or restricting access.
- Service roads allow customers to enter and exit businesses more safely.

- Pedestrian and bicycle access is dramatically enhanced.

Conflict points are the points at which a roadway user can cross, merge, diverge, etc. with another roadway user. Drivers make more mistakes and are more likely to have collisions when they are presented with complex driving situations created by numerous conflicts. Simplifying the driving task results in fewer collisions, improves safety, and reduces congestion. A less complex driving environment is accomplished by limiting the number and type of conflicts between vehicles. There are 48 additional conflict points at intersections when considering pedestrian-vehicle and bicycle-vehicle conflicts.

Inadequate access management can result in traffic operation and safety problems, such as blocked movements into and out of driveways, conflicting and confusing turns at intersections, and insufficient distance for vehicle maneuvers. Research suggests that:

Proper spacing, design, and location of driveways can improve average travel speeds by up to 5 to 10 mph.

Transportation Research Board, Access Management Manual, 2003

- Crash rates increase as the number of driveways per mile increases.
- Crash rates are lower on roadways with a non-traversable median than roads with two-way left turn lanes or no medians.
- U-Turn movements are generally safer than direct left turns and result in fewer accidents resulting in injuries or fatalities.
- Drivers making U-turns experience less delay than drivers making a direct left turn under high volume conditions.
- Medians improve pedestrian safety because they provide a refuge as pedestrians cross the road.

Approximately 72% of the crashes at a driveway within the physical area of an intersection involve a left-turning vehicle. Of these left-turn crashes, 47% are attributed to the egress (exiting) movement conflicting with the near-side through movement, approximately 39% are attributed to the ingress (entering) movement, and 14% are attributed to the egress movement merging with the far-side through movement. This indicates that reducing or eliminating left turns to or from driveways where possible, enhances safety. ("Access Management", Issue Briefs No. 13, FHWA, 2009.)

Numerous studies over the past 40 years have shown accident rates rise with greater frequency of drive-ways and intersections. Accident rates on a roadway will increase by approximately 4% for every additional access point over 10 access points, per mile (Transportation Research Board, NCHRP Report 420, Impacts of Access Management Techniques, 1999.)

"Corridors with completed access management projects performed better in terms of retail sales than the surrounding communities."

Transportation Research Board, Access Management Manual, 2003

Access management helps to preserve long-term property values and the economic viability of abutting development. Properly designed entrances shared by multiple businesses allow for more on-site parking, more customer options to access the site, and improved landscaping or other site amenities.

Frontage roads allow customers to enter and exit businesses conveniently and safely, away from the faster moving traffic on the main roadway.

4.2. Access Management Techniques

The following sections identify access management techniques that were presented to the Planning Partners during the Access Management workshops held on March 4 and 5, 2014. These methodologies represent a sample of potential practices.

4.2.1. Roadway Median

Reducing the number of permitted left-turns reduces potential conflicts within a corridor. The generalized typical section along US-60/Grand Avenue includes three lanes for each direction of travel and a varying width median, generally maintaining the existing configuration. The recommended median limits the location and frequency of left-turns, and provides a space for left-turning vehicles. This increases roadway capacity and improves operations. Further, crash rates of six-lane roadways with a nontraversable median have been shown to be 25% less than six-lane roadways with a two-way left-turn lane (Transportation Research Board, Access Management Manual, 2014).

4.2.2. Signal Spacing

Reducing the number of traffic signals and equalizing the spacing between them allows for timing plans that facilitate traffic flow during peak and off-peak demand. Studies have shown that "a four-lane divided arterial with one-half mile signal spacing and a high level of access control has the same ability to carry traffic as six lanes with one-quarter mile spacing and a low level of access control," (Transportation Research Board, Access Management Manual, 2014). The access management plan for the US-60/Grand Avenue corridor calls for a reduced number of traffic signals and overall fewer left-turns. Fewer left-turns results in fewer traffic signal phases, which decreases the duration of signal cycles and improves progression through the corridor.

4.2.3. Driveway Geometrics

Driveway design geometrics impact progression through a corridor. The design of access points must consider the type of vehicle that will utilize the driveway. For example, large trucks have a large turning radius and need more room to turn. Similarly, they require greater storage lengths to queue. The time of day (peak travel time vs. off peak) and number of large vehicles should be considered when selecting a driveway type. Recommended driveway curb radii should range from 20-50 feet based on site use on a higher-speed roadway (Transportation Research Board, Access Management Manual, 2014).

4.2.4. Turn Bays

Turn bays provide a protected area for turning vehicles, which in turn improves traffic operations and safety of the through lanes. "Left-turn bays have been shown to reduce crashes at unsignalized median openings by 50% to 75% and at signalized locations by roughly 20% to 50%," (Transportation Research Board, Access Management Manual, 2014).

5.0 Access Management in the US-60/Grand Avenue Corridor

5.1. Existing Access Management Plans within the US-60/Grand Avenue Corridor

Existing access management practices vary within the corridor and are described in Technical Memorandum 4. A brief summary follows:

- MAG provides five general guidelines for justifying implementation of an access management program. MAG ascribes to ten principles of access management outlined by the Transportation Research Board Committee on Access Management, which published an Access Management Manual in 2014.
- Surprise does not have a formal AMP; however, the City prepared an *Access Control Plan for Bell Road* in 2007, and can apply the techniques developed for Bell Road to other roadways in Surprise. Access control is an integral element of the "Build a Better Bell" initiative of the City. In addition, the Surprise Transportation Plan (2005) indicates subsequent actions by the Surprise Transportation Commission, which prepared the plan, which will include review of regional AMPs. The plan also cites access management as an important method for increasing the carrying capacity of roadways.
- Peoria has published "Access Management Guidelines" (2011);
- Glendale has engaged in implementing access control techniques for US-60/Grand Avenue, including extending raised medians, reducing the number of access points, adding new perimeters walls, and adding right-turn lanes.

5.2. Disposition of Access Points

In Technical Memorandum 1, each access point along US-60/Grand Avenue was documented and categorized into one of the following three access types:

1. RIRO – Only two traffic movements, right-in and right-out, are permitted with a side street or driveway. Intersections are typically controlled by either STOP or YIELD signs on the side street; driveways typically are not signed. RIRO access points along US-60/Grand Avenue commonly provide access to private properties.
2. Three-Quarter Intersections – Three-quarter intersections provide RIRO and left-in access only and are generally controlled by either STOP or YIELD signs.
3. Full Access Intersection – Full access intersections generally allow all traffic movements on all approaches. These intersections are either STOP controlled on both side street approaches or traffic signal controlled.

Existing access points along the corridor were evaluated for potential consolidation or closure based upon the following criteria:

- Driveway within 500 feet of traffic signal;
- More than two driveways per parcel;
- More than three driveways per business;
- Parcel with side street access / cross access available;

- Unused driveways; and
- Change in intersection configuration (at grade to grade separated).

At the study initiation, a corridor inventory identified 462 access points within the US-60/Grand Avenue COMPASS corridor. Of those, 271 access points are recommended for closure, leaving 191 access points along the corridor. The Recommendations Map Book in ***Appendix TM6-1*** illustrates and tabulates the proposed closures and access changes**.**

5.3. Exceptions

The following requests were made as an exception to the above criteria (Access ID per the Recommendations Map Book):

- Access ID S38 – Per a request from the City of Surprise, this RIRO driveway should remain open to permit circulation on the Walmart site as intended.

- Access ID S47 and S49 – Per a request from the City of Surprise, these access points are to remain as they currently exist per prior agreement with the City, MAG, and ADOT.

6.0 Implementation

This US-60/Grand Avenue COMPASS project provides: 1) Focus for the agencies along the corridor and 2) Direction for future projects. In order to protect the Vision for the corridor, the following general steps should be taken:

Accept the Recommendations into the Regional Transportation Plan – The recommendations and implementation strategies of this US-60/Grand Avenue COMPASS project should be accepted by the MAG Regional Council and adopted as illustrative projects in the Regional Transportation Plan.

Revise the Partnering Charter to Extend through Implementation – A Partnering Charter was signed on February 22, 2012, by the political leadership of the communities within the US-60/Grand Avenue COMPASS corridor. A Vision statement was developed, and a guiding principal from the visioning process was to collaboratively revise the Partnering Charter to create and adopt an implementation partnering agreement that defines how the US-60/Grand Avenue corridor is developed, including a corridor-based funding strategy. Each agency will be impacted by decisions by other agencies along the corridor; in order to ensure success, these agencies should take a uniform approach.

Adopt the Zoning Overlay District Model Ordinance – Agencies along the corridor should adopt the model ordinance for the zoning overlay district, included in ***Appendix TM6-5***. The ordinance was designed to promote development, public safety and maintain a high level of access management along US-60/Grand Avenue that:

- Will enhance City growth by preserving the mobility of this community asset;
- Will encourage creative solutions in the utilization of land to accomplish a more efficient, aesthetic, safe and desirable development;
- Improves the overall transportation efficiency of the corridor;
- Will increase the safety of the traveling public;
- Maintains vehicle speeds at acceptable levels for regional mobility;
- Improves the location and design of all vehicular access connections;
- Promotes shared parking and connectivity between existing and future developments;
- Improves the overall streetscape and livability of the corridor;
- Encourages and promotes alternative modes of transportation, including pedestrian, biking and public transit;
- Provides safe and functional access between US-60/Grand Avenue and the surrounding area;
- Ensures that all property is provided reasonable and suitable access to the public street system;
- Supports orderly economic development and redevelopment of the surrounding area; and
- Supports the continuing development of a coordinated state and local road network.

Incorporate Recommendations into Existing and Future Studies and Planning Documents – The study area traverses six municipalities and unincorporated Maricopa County; in order to maintain consistency throughout the corridor, each agency needs to adopt the recommendations of this study. In turn, any proposed changes to the corridor need to follow the guidance provided herein.

Complete ADOT Scoping Phase (Design Concept Report) – The recommended roadway concepts, which are illustrated in the Recommendations Map Book presented in ***Appendix TM6-1***, should be carried forward as Design Concept Alternatives in ADOT's project development process. ***The geometric recommendations are conceptual in nature; the formal ADOT Scoping Phase will need to be completed, including required typical local, state, and federal agencies approvals.*** Use of the information contained herein for right-of-way acquisition and similar activities is not recommended until the appropriate time during ADOT's project development process. Potential additional Design Concept Alternatives that may surface through ADOT's process should be consistent with the operational and access goals of this study.

Prior to the final design of any improvements, additional investigation and analyses should be conducted, including necessary environmental/NEPA evaluations, geotechnical investigations, and others. Special consideration will be needed for potential environmental impacts, especially environmental justice, natural resources, contaminated sites, and underground storage tanks.

The Partnering Charter identified the desire for a unified approach to aesthetic treatments within the corridor. This should be addressed during the ADOT Scoping Phase.

Coordinate Transit Operations – Existing multimodal facilities and services are limited in the study area. Future additional transit services are being planned; potential connections and linkages between routes and modes should be considered.

Complete ITS/Traffic Management Plan – MAG has initiated a Traffic Management and Operations Plan for the US-60/Grand Avenue corridor that would identify: 1) The infrastructure improvements necessary to create the ITS traffic management infrastructure across multiple jurisdiction within the corridor; and 2) overall Concept of Operations which describes in detail how this ITS infrastructure is to be utilized and roles and responsibilities of jurisdictions within the corridor. The anticipated ITS infrastructure would typically include enhancements to existing traffic signal systems (new controllers, sensors, strategically placed CCTV cameras, Dynamic Message Signs), with communications to a central TMC from which the entire corridor is managed.

Project Funding – Funds for implementing the study recommendations have not yet been identified. Agencies will need to develop a collaborative approach to funding. Potential sources have been identified and are outlined in Section 6.3.

At the completion of this study, the Planning Partners submitted comments regarding various aspects of the study recommendations. Most comments were resolved or identified throughout this document; however, several remain and should be addressed during the next stages of implementation. Comments and responses are included as ***Appendix TM6-6***.
Specific examples of comments include:

- The potential for the BNSF Railway to lower the railroad track grade between the Agua Fria River and New River.
- The elimination of the eastbound US-60/Grand Avenue right-turn lane at Cotton Crossing.
- The potential for elevated bus stops at some locations.
- The potential for enhanced bus routing in the Thomas Road area (Routes 27 and 29).

6.1. Adoption

A model ordinance for the US-60/Grand Avenue Corridor Zoning Overlay District was developed for access management implementation and is included as ***Appendix TM6-5***. The Zoning Overlay District will provide clear guidance for property owners along the corridor and will provide an enforcement mechanism for municipalities. The purpose of this overlay district is to enhance the safety, function, and capacity of the US-60/Grand Avenue corridor. The zoning overlay includes provisions for the following:

- Development standards;
- Consistency with plans and studies;
- Non-conforming access;
- Coordination with affected road authorities;
- General considerations;
- Standards for all street and driveway connections;
- Private access;
- Subdivision standards;
- Site design standards;
- Conditions of approval; and
- Bicycle, pedestrian, and transit facilities.

6.2. Permitting and Design of Future Access Points

Access to US-60/Grand Avenue should be in conformance with the Recommendations Map Book ***(Appendix TM6-1)*** and the provisions of the US-60/Grand Avenue Zoning Overlay District. Per the model ordinance for the Zoning Overlay District,

> "No new or existing tract of land within the US-60/Grand Avenue Zoning Overlay District shall be provided direct access to US-60/Grand Avenue when adequate alternative access can be provided by way of a secondary, primary, collector or marginal access street or through joint access with a neighboring property already provided with access. All individual uses shall be accessed from an internal circulation system designed to serve the development of which they are a part. Potentially negative impacts on the quality and character of surrounding properties or neighborhoods shall be satisfactorily mitigated by the landowner/developer."

The Zoning Overlay District provides design guidance for access along US-60/Grand Avenue, while the Recommendations Map Book provides a disposition of access for all points along the corridor and illustrates access management techniques within the right-of-way and planned roadway geometric improvements.

6.3. Potential Funding Sources

Potential funding sources for the conceptual improvements identified in this plan are outlined in the following subsections. These represent a starting point and should not preclude the use of other funding mechanisms, should they become available, such as a potential future extension of Maricopa County Transportation Sales Tax (Proposition 400).

6.3.1. Federal Funds

Community Development Block Grant (CDBG) (funded through United States Department of Housing and Urban Development (HUD)) – CDBG funds are dispersed with a prioritization to benefit low- and moderate-income persons. The objective of CDBG funding is to provide improved community facilities and services, which may include eliminating imminent threats to health and wellness or eliminating slums or blight. Relevant to this Study, eligible activities include construction or reconstruction of streets and other public facilities.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program (funded through MAP-21) – CMAQ provides a flexible funding source to State and local governments for transportation projects and programs to help reduce congestion and improve air quality for nonattainment and maintenance areas. Eligible activities include, but are not limited to: projects that improve traffic flow, such as improving signalization, constructing high-occupancy vehicle (HOV) lanes, improving intersections, and adding turning lanes. Other approved activities include projects to improve incident and emergency response or improve mobility. Funds may be used for projects that shift traffic demand to nonpeak hours or other transportation modes, increase vehicle occupancy rates, or otherwise reduce demand. There is some expanded authority to use funds for transit operations. Funds may not be used for projects that increase the number of single occupant vehicles in the network.

Energy Efficiency and Conservation Block Grant (EECBG) Program (funded by U.S. Department of Energy (DOE)) – This program, modeled after the CDBG program, funds energy efficiency and conservation projects and programs. A few of the targets identified for eligible projects include reduction of fossil fuel emissions and total energy use, improving energy efficiency in the transportation, building, and other appropriate sectors, and creating and retaining jobs. Eligible activities include, but are not limited to: development of an energy efficiency and conservation strategy, building energy audits and retrofits, transportation programs to conserve energy and support renewable fuel infrastructure, and installation of energy efficient traffic signals and street lighting.

Highway Safety Improvement Program (HSIP) (funded through MAP-21) – HSIP provides funding to improve safety on public roads and to reduce accident related injuries and deaths.

Surface Transportation Program (STP) (funded through MAP-21) – STP provides funding to states and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals. Eligible activities are numerous and include: intersections with high accident rates or levels of congestion; construction and operational improvements for a minor collector in the same corridor and in proximity to an National Highway System (NHS) route (if the improvement is more cost-effective than an NHS improvement and will enhance NHS level of service and regional traffic flow), and TAP projects. In general, STP projects may not be on local or rural minor collectors; however, there are a number of exceptions to this requirement.

Transportation Alternatives Program (TAP) (funded through MAP-21) – TAP combines funding from several previous programs, including Transportation Enhancements, Recreational Trails, Safe Routes to School, and other discretionary programs. TAP funds may be used for planning, design, and construction of surface transportation features. This includes, among other things, infrastructure to provide safe routes to non-drivers, such as children, older adults, and individuals with disabilities to access daily needs.

Transportation Infrastructure Finance and Innovation Act (TIFIA) – TIFIA was established in 1998 and provides secured (direct) loans, loan guarantees, and/or standby lines of credit for eligible surface transportation projects, including highway and rail projects, of regional or national significance. TIFIA helps large scale projects progress that might otherwise be delayed or deferred due to size, complexity, or uncertainty regarding revenue timing. Eligible transit projects include the design and construction of stations, transit-related infrastructure, purchase of transit vehicles, and intercity bus vehicles and facilities. In order to qualify, projects must cost at least $50 million, the project must have a dedicated revenue source to repay the loan, senior debt obligations must have an investment grade rating, and Federal funding cannot exceed 33% of eligible costs or the amount of senior debt if the TIFIA loan does not have an investment grade rating.

Transportation Investments Generating Economic Recovery (TIGER) (funded through Consolidated Appropriations Act) – Competitive grant program funding infrastructure projects that promote economic competitiveness, improve energy efficiency, reduce greenhouse gas emissions and improve safety, quality-of-life and working environments in communities. No planning grants will be awarded this year; all funding will be for project implementation.

6.3.2. Federal Transit Administration

Section 5307 – Urbanized Area Formula Grants (funded through MAP-21) – Urbanized Area Formula Grants can be used for capital projects, planning, and Job Access and Reverse Commute (JARC) projects. The JARC program was added to this section with the passage of MAP-21. JARC projects focus on providing services to low-income individuals to access jobs. These grants can also be used for operating costs with certain restrictions.

Section 5309 – Fixed Guideway Capital Investment Grants (funded through MAP-21) – As applicable to this study, Fixed Guideway Capital Investment Grants may be used for new fixed guideway

capital projects, fixed guideway BRT projects, or small start projects. New fixed guideway capital projects represent the minimum operable segment or extension to an existing fixed guideway or BRT system. Corridor-based bus rapid transit projects are small start projects that utilize buses in a defined corridor that emulate the services provided by rail fixed guideway public transportation systems, including but not limited to defined stations, traffic signal priority for public transportation vehicles, and other features that support a long-term corridor investment. Small start projects are new fixed guideway capital projects or corridor-based bus rapid transit projects that receive less than $75 million in Federal assistance with a total estimated cost less than $250 million.

Section 5310 – Formula Grants for the Enhanced Mobility of Seniors and Individuals with Disabilities (funded through MAP-21) – These formula grants have many of the same requirements as Section 5307 formula grants, but include additional requirements to improve transportation alternatives for seniors and individuals with disabilities. They are intended to fund projects that meet the special needs of seniors and individuals with disabilities when public transportation is insufficient, inappropriate, or unavailable. Examples include public transportation projects that exceed the requirements of the Americans with Disabilities Act of 1990; public transportation projects that improve access to fixed route service and decrease reliance by individuals with disabilities on complementary paratransit; and alternatives to public transportation that assist seniors and individuals with disabilities with transportation.

Transit-Oriented Development Planning Pilot (funded through MAP-21) – The Transit-Oriented Development Planning Pilot is a discretionary program that provides planning grants on a competitive basis for efforts that support TOD associated with new fixed-guideway and core capacity improvement projects. Planning efforts should address economic development, ridership, and other goals established during the project development and engineering processes; facilitate multimodal connectivity and accessibility; increase access to transit hubs for pedestrian and bicycle traffic; enable mixed-use development; identify infrastructure needs associated with the eligible project; and include private-sector participation.

6.3.3. State Funds

Arizona Gaming Sources (Proposition 202) – Proposition (Prop) 202 allowed new gaming compacts between the State and tribes. An important provision of Prop 202 was the sharing of gaming revenues with the State. Prop 202 allows an Indian tribe to distribute twelve percent (12%) of its total annual contribution to cities, towns, or counties for government services that, among other things, benefit the general public, including public safety, or promotion of commerce and economic development.

Greater Arizona Development Authority – Managed by WIFA, GADA's goals are to lower the costs of financing and help accelerate project development for public facilities owned, operated and maintained by a political subdivision, special district or Indian tribe. To accomplish this, GADA is authorized under statute to offer both financial and technical assistance programs. Grants are typically used for early stage project development; loans typically are used for technical assistance in the final phases of project development. Due to funding limitations, no loan or grant opportunities are currently available.

Highway Extension and Expansion Loan Program - This program provides the State and communities with a financing mechanism to stretch limited transportation dollars for eligible highway projects in Arizona and bridge the gap between needs and available revenues. The minimum loan amount is $250,000; grants are not available. HELP loans are not currently available due to budget limitations.

Highway User Revenue Fund – The Highway User Revenue Fund (HURF) provides funding to cities, towns, counties, and to the State Highway Fund for highway construction, improvements, and other related expenses.

State Assistance for Regional Public Transportation Activities – ADOT has the authority to cooperate with counties and other governmental authorities, including regional planning agencies, to plan and coordinate regional public transportation services in and adjoining a vehicle emissions control area. This planning and coordination may be for the purpose of extending public transportation services across jurisdictional boundaries or into poorly served or unserved portions of urbanized areas and their suburban communities. ADOT may make grants to governmental authorities to improve existing transit services and for the implementation of intermodal transportation projects, pedestrian related projects and bicycle related projects. Support is also available to increase carpooling and vanpooling.

6.3.4. Local Funds

Maricopa County Transportation Sales Tax (Proposition 400) – Maricopa County voters approved Proposition 400, a 20-year extension of the half-cent sales tax for transportation projects in November 2004. Funds are divided between the Regional Area Road Fund (RARF) and a public transportation fund. ADOT administers the RARF, while the Maricopa County Regional Public Transportation Authority administers the public transportation funds. The RARF may be used for freeways and routes on the state highway system, including projects included in the Regional Transportation Plan for Maricopa County. Funds may also be used for major arterial streets and intersection improvements. The public transportation funds are to be used for a light rail system.

MAG Design Assistance Program – The MAG Design Assistance Program was initiated in 1996 to encourage the development of pedestrian facilities according to the MAG Pedestrian Policies and Design Guidelines. The intent of the program has been to stimulate integration of facilities into the planning and design of all types of infrastructure and development. In 2006, MAG initiated the Bicycle Facilities Design program encouraging MAG members and private sector professionals involved in transportation and land use design to utilize the AASHTO Guide for the Development of Bicycle Facilities. Both bicycle and pedestrian projects consider the needs of seniors according to the Federal Highway Administration: Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians.

In 2011, the Design Assistance Program combined pedestrian and bicycle facilities into one program and included shared-use facilities. The program was also redefined to clarify that projects through this program can proceed only up to the Preliminary Engineering/Scoping Phase.

MCDOT TAB Special Project Funds – The Maricopa County Board of Supervisors approved the implementation of the TAB SPF. This fund provides budget for projects that are not readily handled by

the MCDOT annual TIP. Projects must provide a specific benefit to the County and must be on a county highway.

City of Glendale - Glendale Onboard (GO) Transportation Program – Voters approved a half cent sales tax for transportation improvements throughout the City in November 2001. The tax funds street, transit, bicycle, and safety education programs in Glendale.

City of Peoria - Proposition 300 – Peoria voters approved Proposition 300, which increased the city sales tax for transportation purposes on September 13, 2005. Transportation sales tax revenues are deposited into a separate fund from which expenditures are made for various transportation purposes. The city earmarks in its forecasts each year $1 million for pavement maintenance, $1.6 million for transit operations, and $500,000 for operational support. Any unspent monies in these three areas are allocated to street capital projects, along with the balance of revenues collected.

City of Phoenix – Transit 2000 – City of Phoenix voters passed a 4/10ths of a cent sales tax to fund Transit 2000 in March 2000, which extends for 20 years. Approximately 66 percent of the funds are apportioned to capital projects and operation of local bus, RAPID, Dial-a-Ride, and neighborhood circulators. The remaining 33 percent supports light rail construction and operations in the City of Phoenix.

Development Impact Fees – Development impact fees are one time fees typically assessed at the time building permits are issued and are intended to financially support infrastructure costs associated with new development. The fees are paid by the developer, and are typically in turn passed to the homebuyer or commercial property owner.

Developer Contributions – Funds that are provided by a developer through a development agreement.

General Funds – General funds are non-dedicated funds that may be used for any lawful purpose.

Improvement Districts – Improvement districts are authorized by the State legislature for the construction of a wide range of public works facilities. Improvement districts are initiated by property owners who combine resources with a county and/or town to finance improvements. The property owners are then assessed over multiple years to repay their share of the cost of the improvement.

Revenue Bonds – Counties and municipalities can issue bonds against their revenues to accelerate project construction. This can reduce the impacts of funding capital improvement projects and distributes the costs over the life of the project.

County excise tax – The County may create a sales tax with a term of no more than twenty years to fund street and highway projects.

6.3.5. Other

BNSF Railway – The BNSF Railway typically contributes funds to projects where at-grade railroad crossings are eliminated. Input from the Planning Partners suggested that, due to the scope of the recommendations made by this study, the BNSF Railway would potentially be a substantial funding partner.

Public-Private Partnerships – Public private partnerships are allowed under Title 28 of the Arizona Revised Statues and enable a public agency and a private-sector entity to enter into an agreement allowing the private-sector partner to have an increased level of participation in a public project. This may include funding, design, construction, operation, and/or management and will extend as agreed upon by the two entities.

Toll Road – A toll road allows a private party to construct a roadway and collect a toll for a period of up to twenty years. At the end of that time, the roadway reverts to public ownership. Toll roads cannot be constructed within one mile of one another and cannot interfere with existing roadway operations. Further, the route cannot conflict with an existing or proposed state highway or state route or with an existing or planned County highway.

6.3.6. Funding Mechanisms Used Elsewhere:

Alternative funding strategies are used in other regions of the country, which could be used in Arizona if appropriate legislation was passed. Examples of these include:

Fuel Revenue Indexing – Numerous states have restructured their gas tax to generally grow over time in order to generate additional transportation funds. Potential approaches include indexing gas tax to inflation rates (construction cost or general inflation), gas prices, or a combination of them both.

Regional Mobility Authority – RMAs, popular in Texas, are political subdivisions formed by cities and/or counties to finance, acquire, design, construct, operate, maintain, expand, or extend transportation projects, including highway, rail, ferry, parking projects, and others. RMAs have the authority to generate revenue through tolls, fares, or other fees related through transportation projects, as well as the sale or lease of a transportation project of property adjoining a transportation project.

Tax Increment Financing/Tax Increment Reinvestment Zone (TIF/TIRZ) – TIFs are intended to provide funding for underdeveloped or blighted lands that would otherwise remain unimproved. A tax district is established around the proposed area of improvement, and once improvements are complete, increased property values are attributed to said improvement. The property tax revenue collected on properties within the tax district when the improvement is complete continues to be funneled through existing channels; the incremental property tax increase due to increased property value is collected into a separate fund used to repay the cost of improvements.

Transportation Reinvestment Zone (TRZ) – TRZs are similar to TIF/TIRZ, but require the tax increment funding collected be used for transportation projects. TRZs in Texas are focused on improvements using pass-through financing.

7.0 Conclusion

The goals of the Partnering Charter and US-60/Grand Avenue COMPASS Vision can be achieved through continued collaboration of the agencies along the corridor and implementation of the recommendations outlined herein. Specifically, this includes the pairing of the Recommendations Map Book with the US-60/Grand Avenue Zoning Overlay District Model Ordinance.

This study investigated and determined a wide variety features for the US-60/Grand Avenue, including:

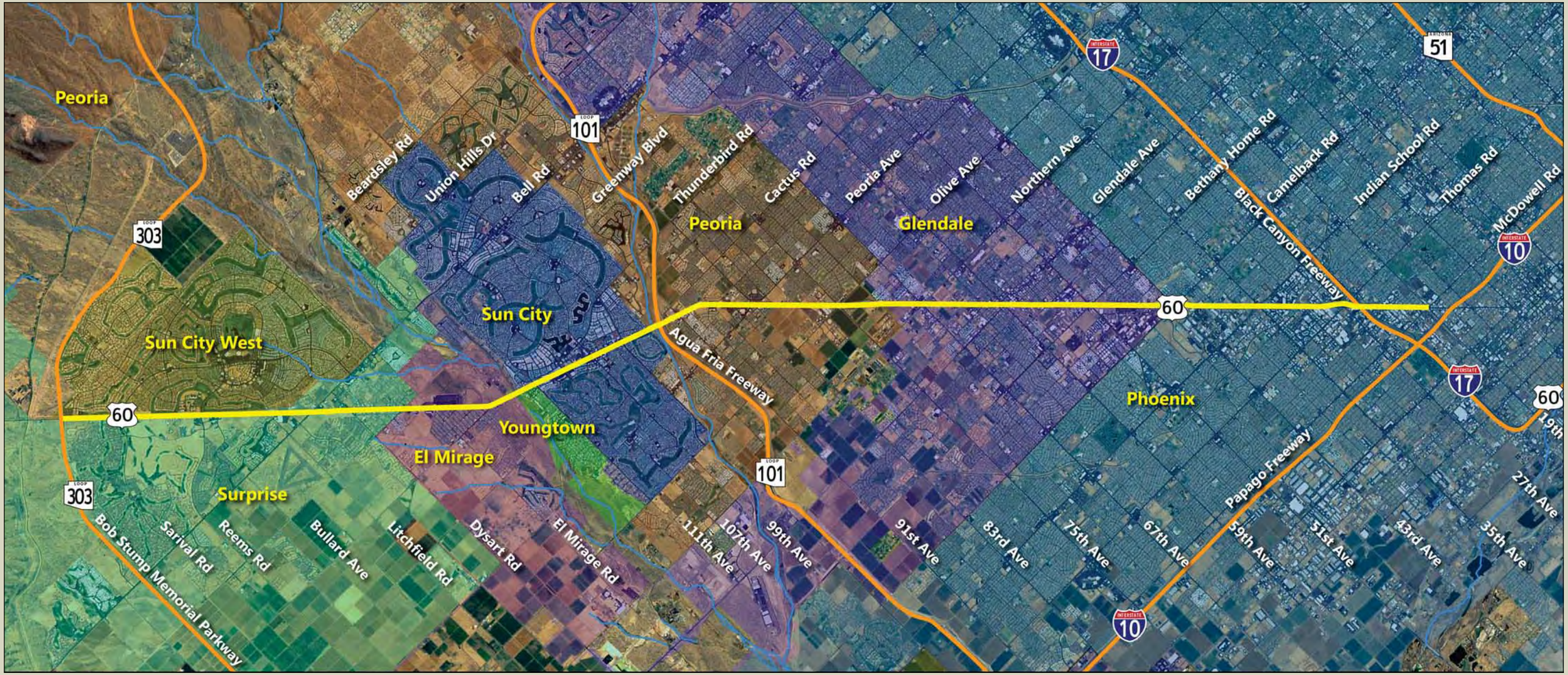
- The vision and character of the corridor;
- Corridor operating principles;
- Approach to access management;
- Potential and advancement of HCT (commuter rail);
- Environmental overview;
- Uniform signing guidelines;
- Potential funding sources; and
- Implementation plan.

Throughout the study, stakeholders and the public were engaged for guidance and input. This input was combined with technical analysis to help form study recommendations. Continuing this engagement will be critical to the success of future efforts.

APPENDIX TM6-1

Recommendations Map Book

Recommendations Map Book



Legend
- US-60/Grand Ave COMPASS Corridor
- Freeway
- Streams/Washes

Corridor Optimization and Access Management Plan, and System Study
COMPASS
MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue:
Loop 303 to Interstate 10

Map Book Legend

Recommended Disposition of Access	
Access Type Codes	**Definition**
F	Full Movement Access
T	3/4 Movement Access
R	Right-In Right-Out Access
C	Access Recommended for Closure
OF	Off-Ramp Access from US-60
ON	On-Ramp Access to US-60
Median Type Codes	**Definition**
R	Raised Median
N	No Median
DI	Divided Median
MB1	Median Break
TW	Two-Way Left-Turn Lane
D	Dedicated Left-Turn Lane

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

MAP BOOK INDEX		
City	**Map Book Page No.**	**US-60 Milepost Range**
Surprise	1-13	138.50 - 144.28
El Mirage	13-17	142.76 - 146.20
Sun City	17-22	146.20 - 148.70
Youngtown	17-18	146.20 - 146.58
Peoria	22-31	148.70 - 152.72
Glendale	31-41	152.72 - 157.52
Phoenix	41-51	157.52 - 162.20

Aerial Imagery was obtained from the Maricopa Association of Governments in August 2012

DISCLAIMER: While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability of the accuracy thereof. Alignments for new facilities, including but not limited to new freeway, highway, parkway, arterial, high occupancy vehicle, bridge, transit, and rail facilities will be determined following the completion of appropriate corridor planning, design, and environmental studies. All locations should be considered preliminary and subject to review and approval from the Arizona Department of Transportation, the Federal Highway Administration, Maricopa County, and MAG Member Agencies where applicable. Sidewalks are intended to be provided throughout the corridor.

Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

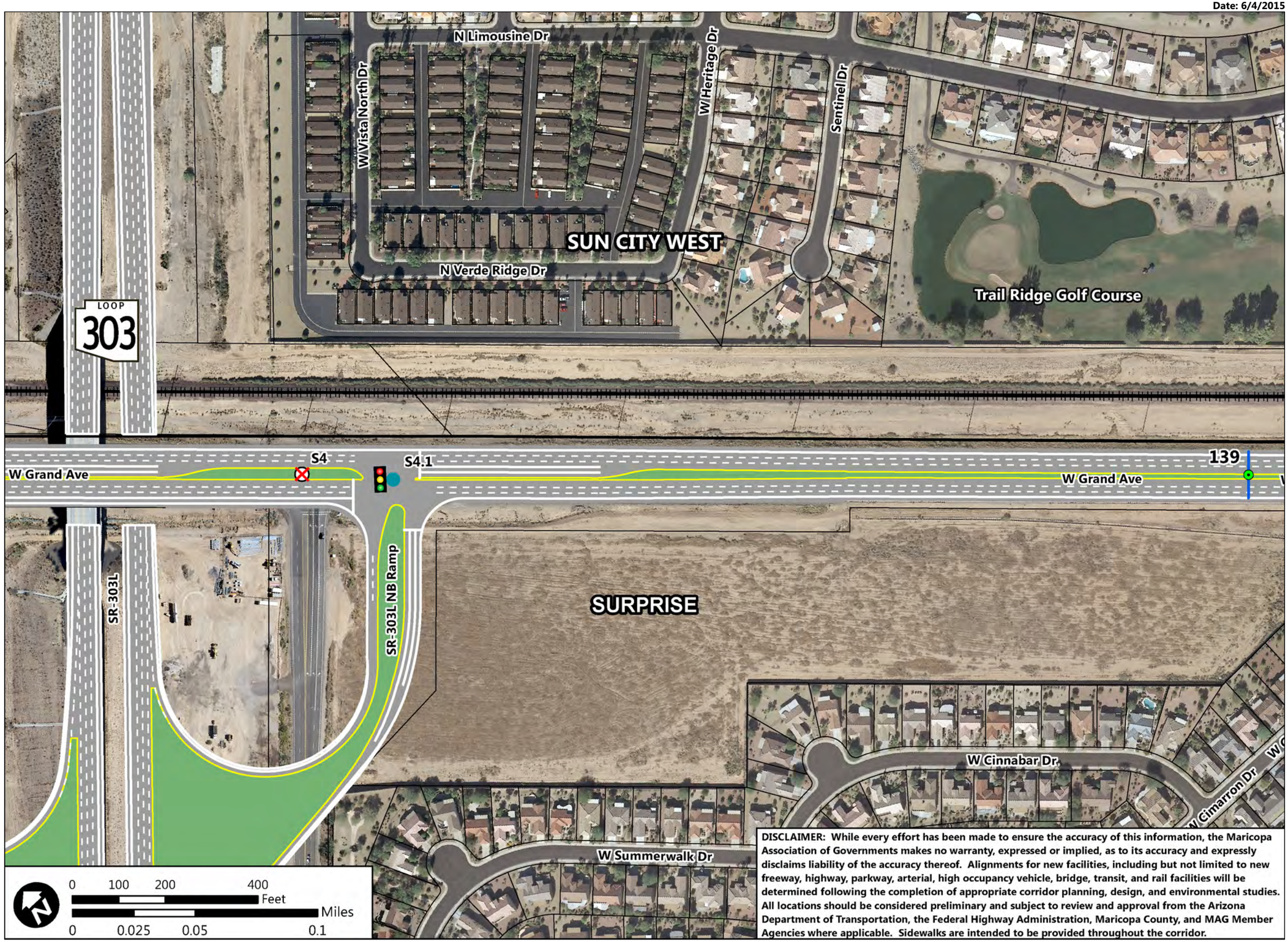
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S4	C	R
S4.1	F	N



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

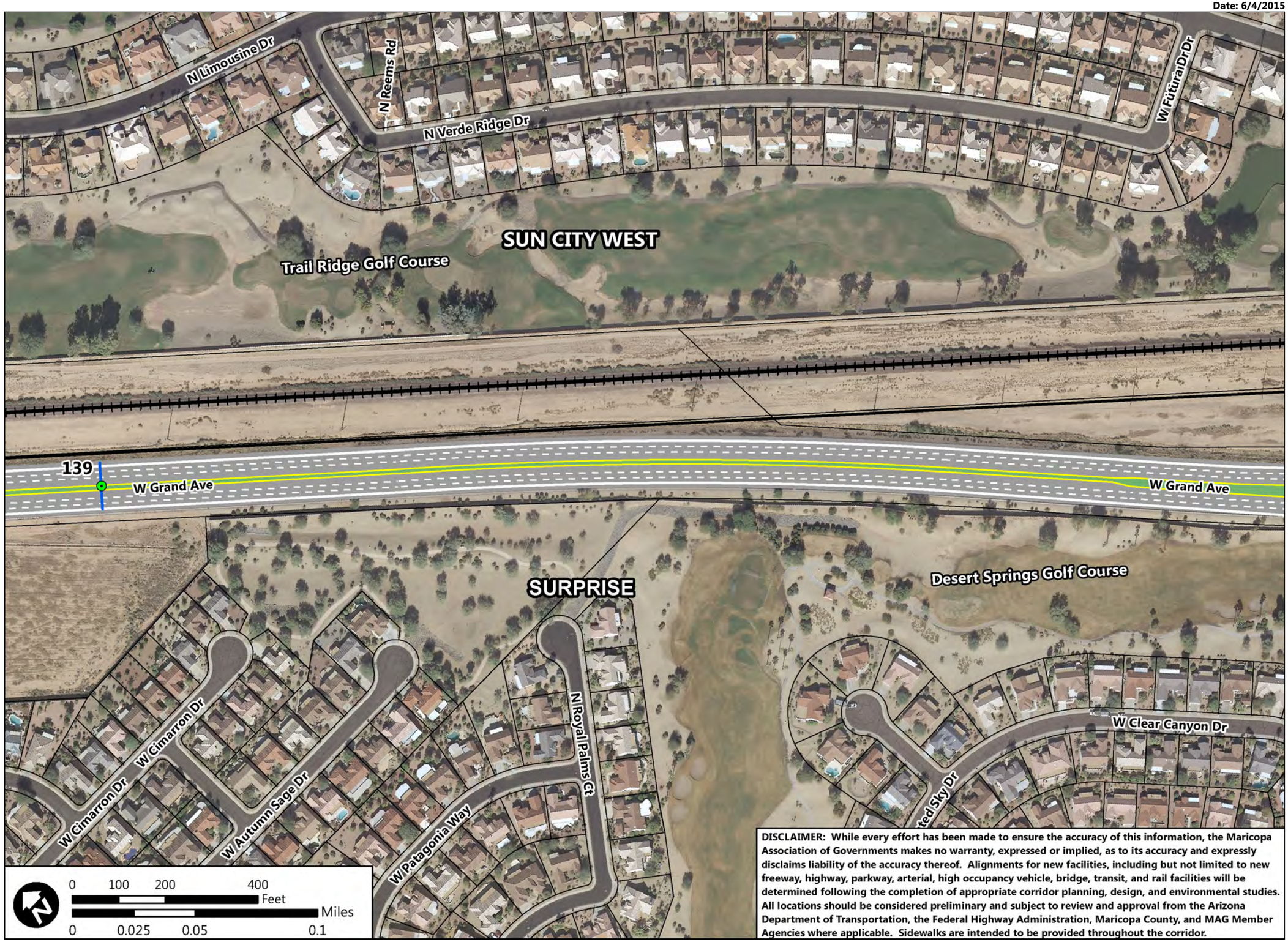
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

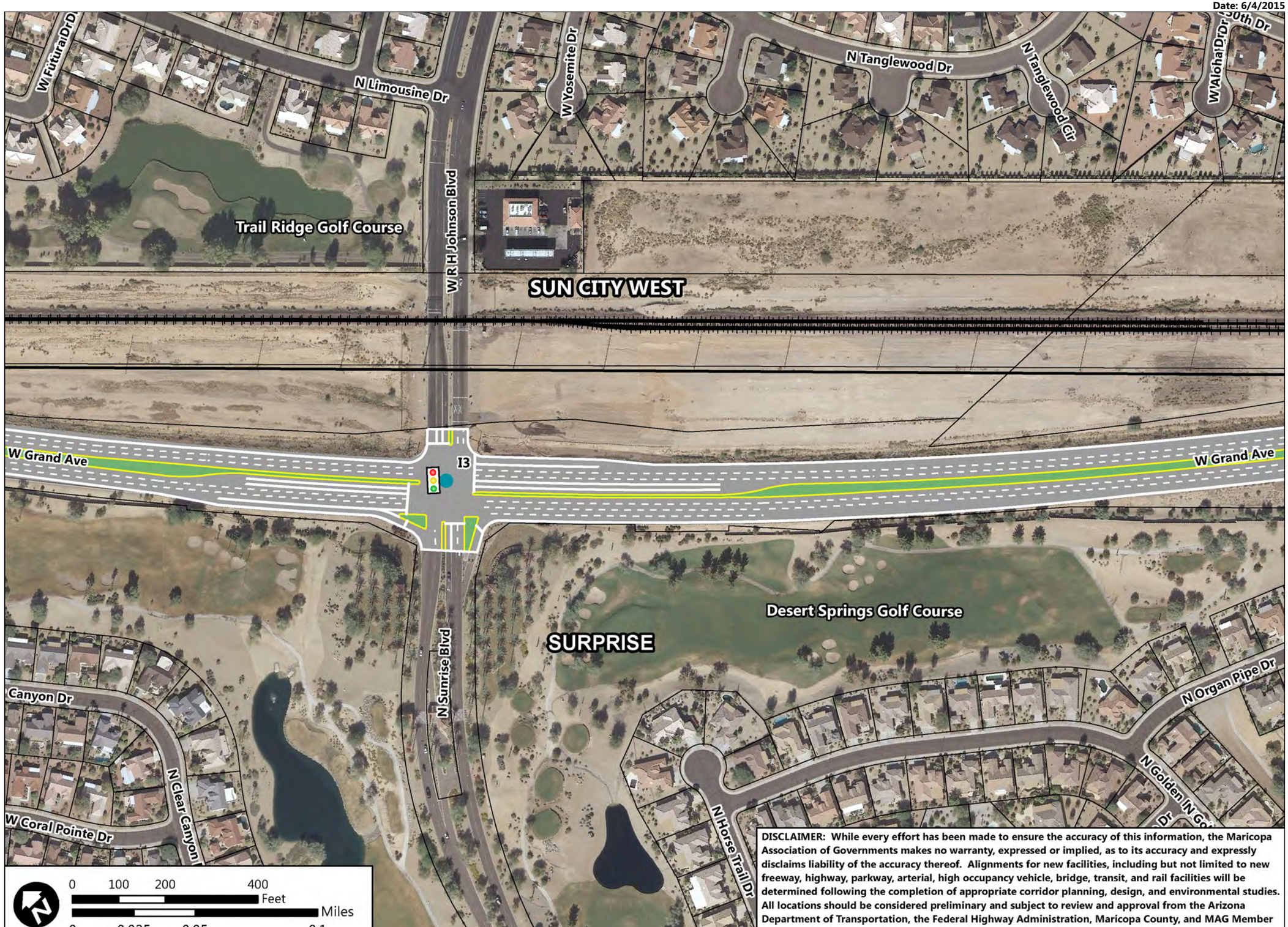
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I3	F	N



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

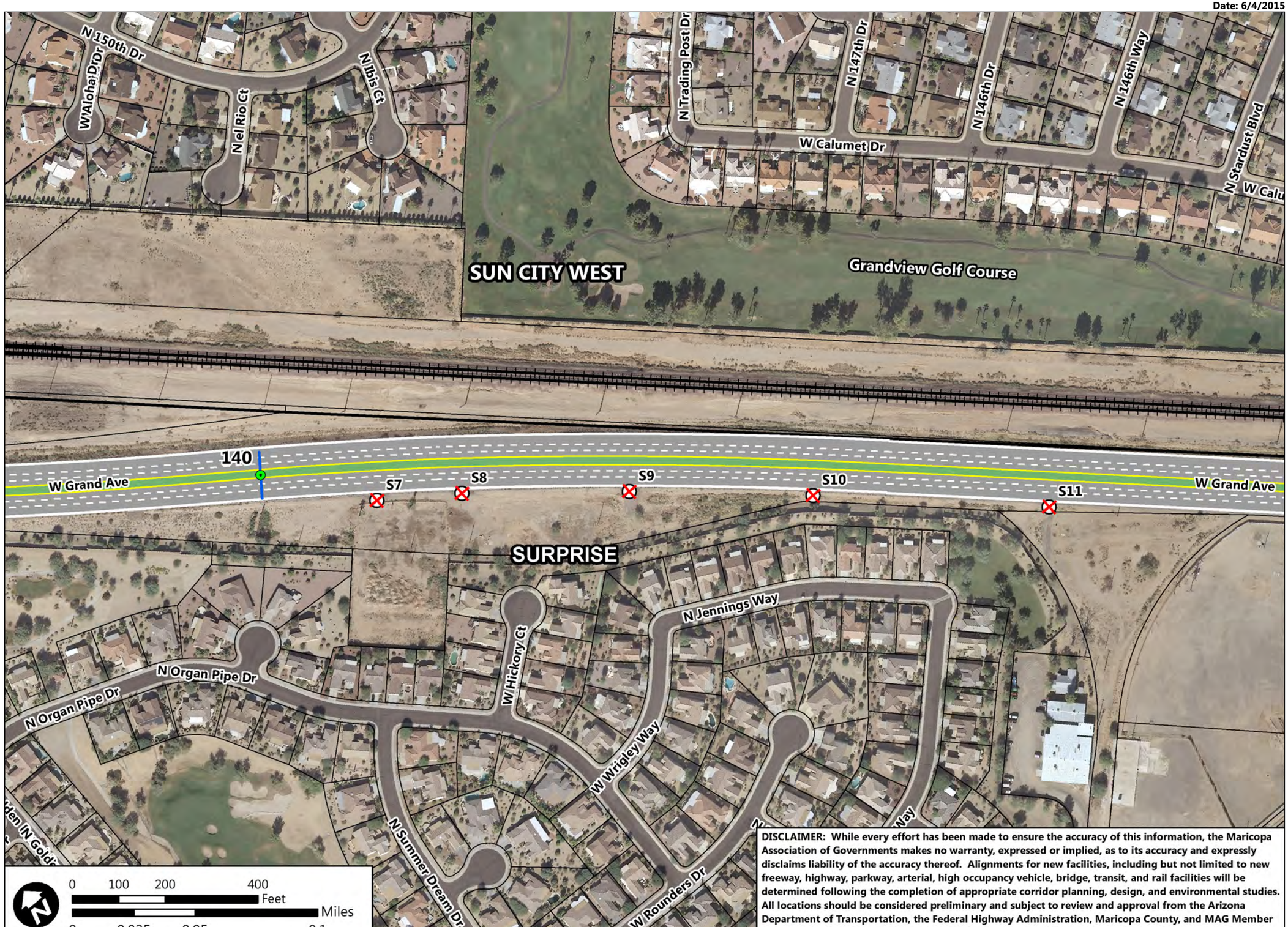
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S7	C	R
S8	C	R
S9	C	R
S10	C	R
S11	C	R

Point S6 deleted in between TM 1 and 6



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

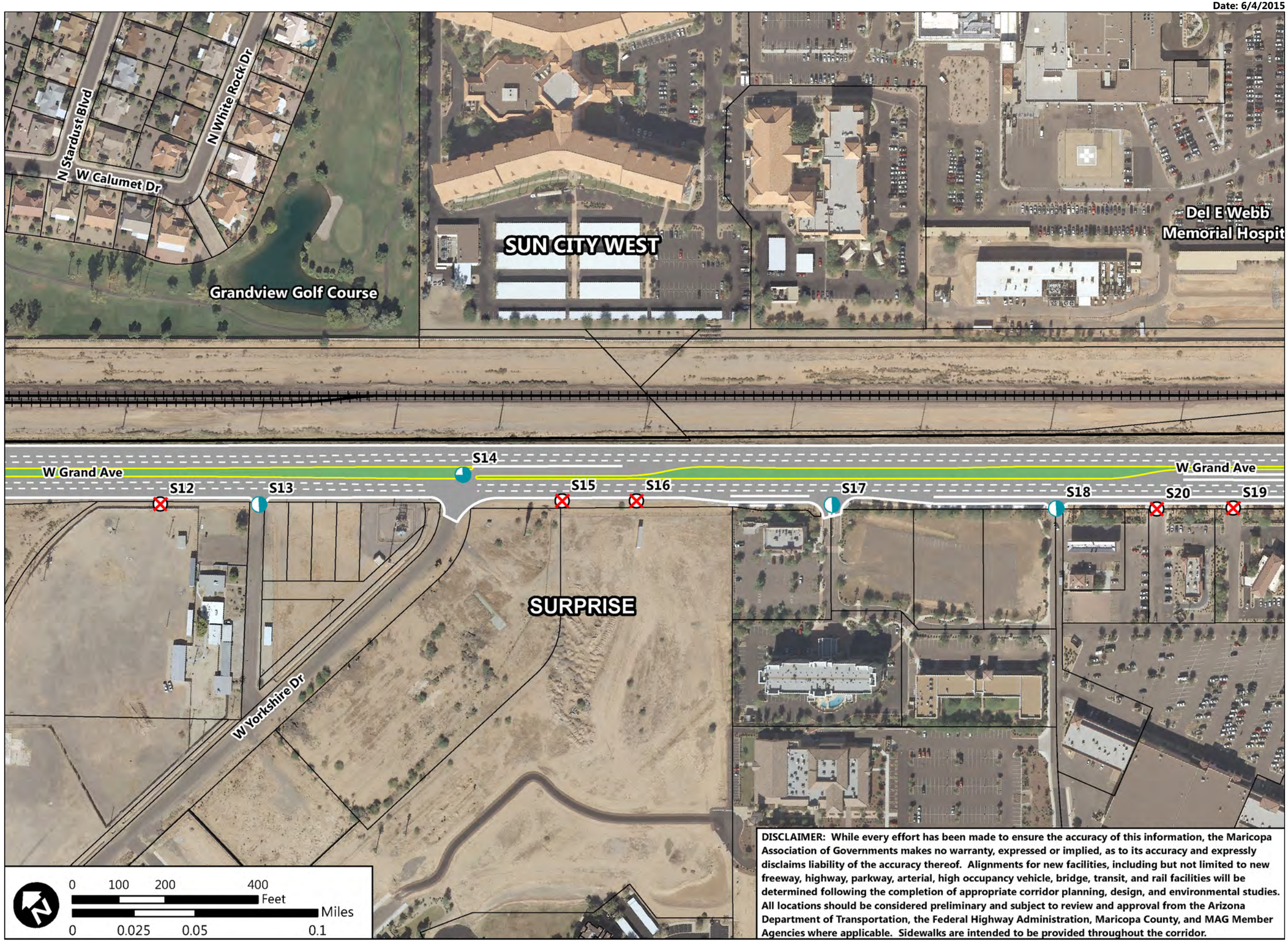
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S12	C	R
S13	R	R
S14	T	MB1
S15	C	R
S16	C	R
S17	R	R
S18	R	R
S20	C	R
S19	C	R



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

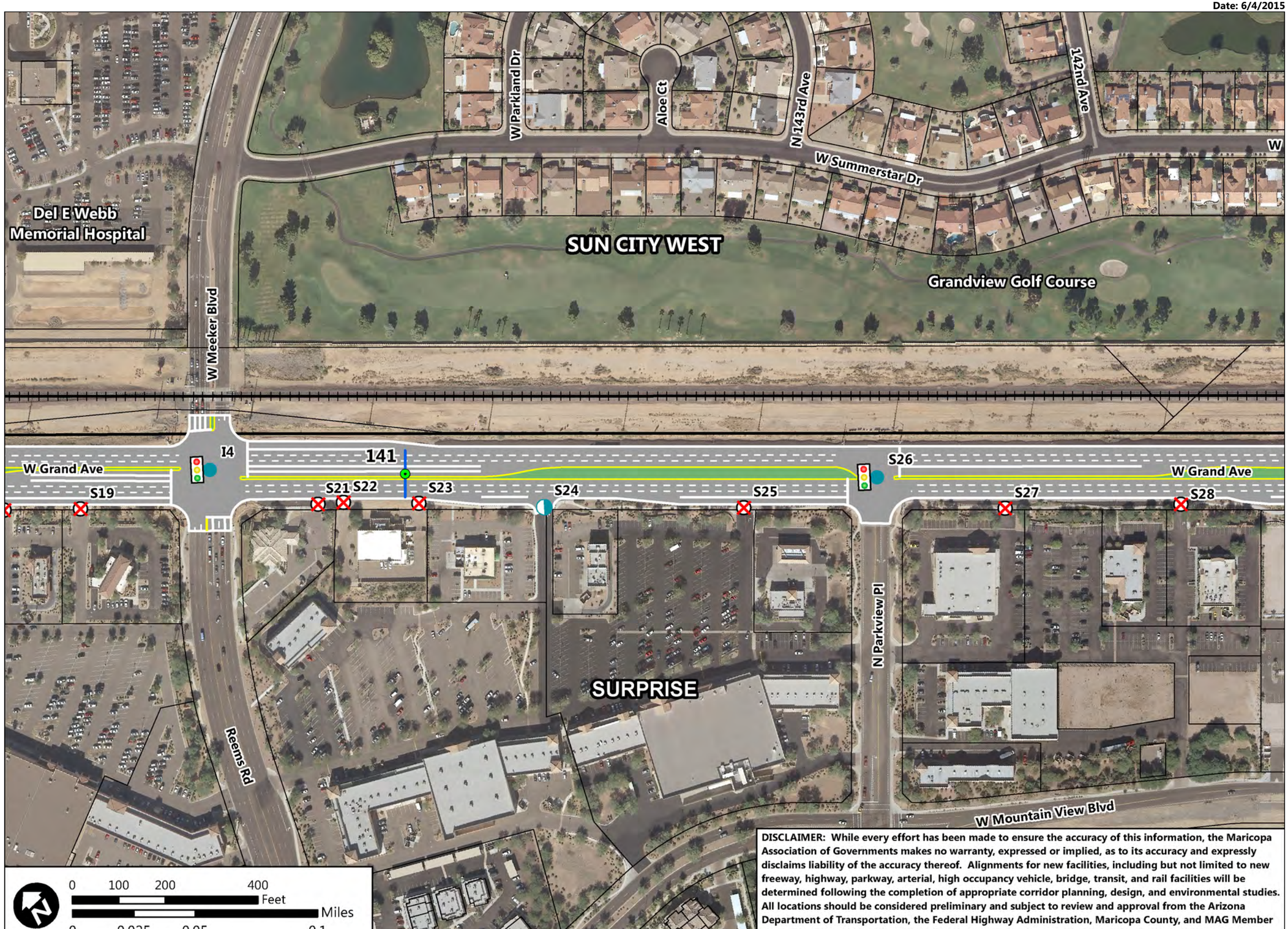
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S19	C	R
I4	F	N
S21	C	R
S22	C	R
S23	C	R
S24	R	R
S25	C	R
S26*	F	N
S27	C	R
S28	C	R

*S26 is an existing signalized intersection



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

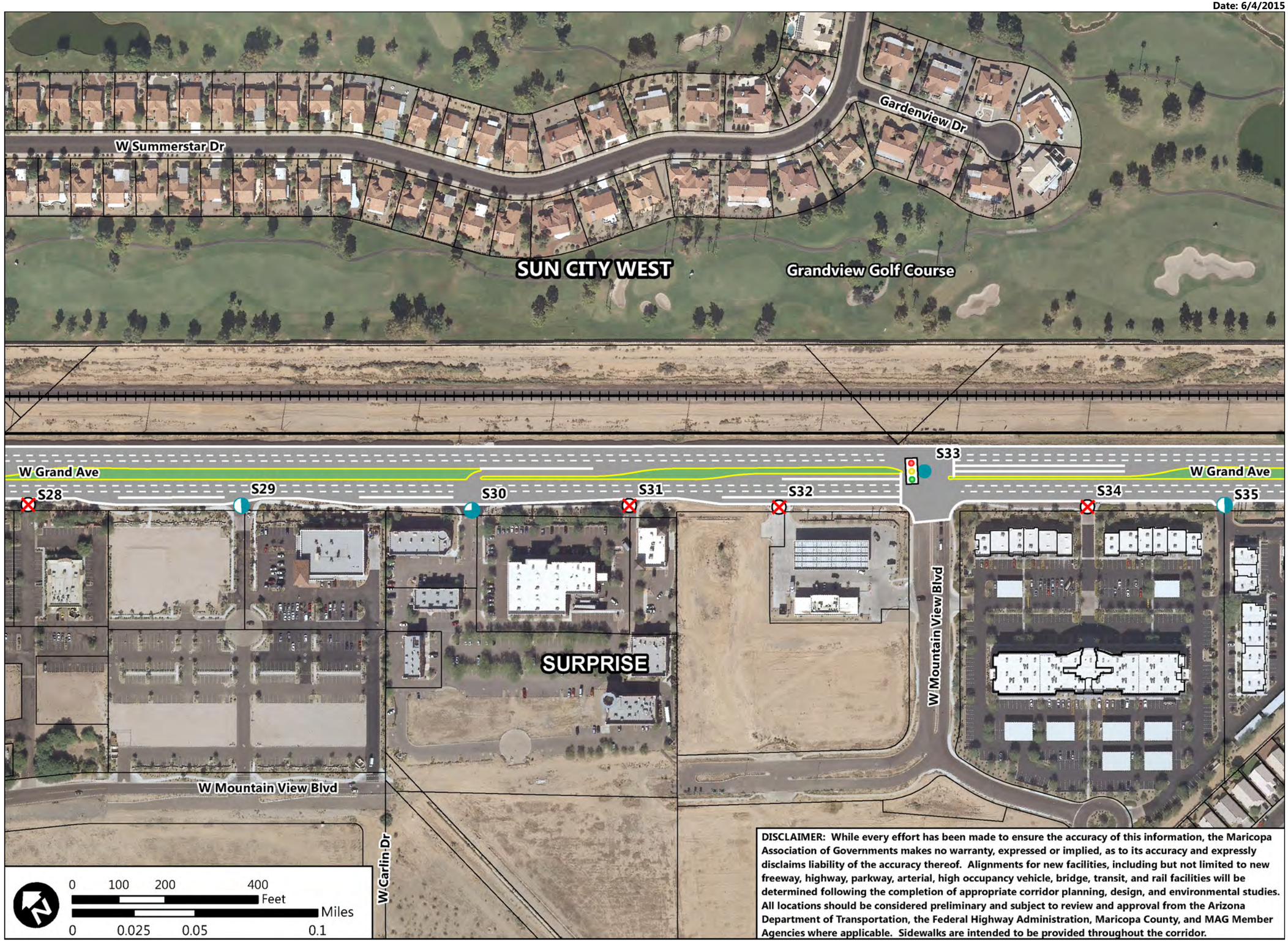
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S28	C	R
S29	R	R
S30	T	MB1
S31	C	R
S32	C	R
S33*	F	N
S34	C	R
S35	R	R

*S33 is an existing signalized intersection



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

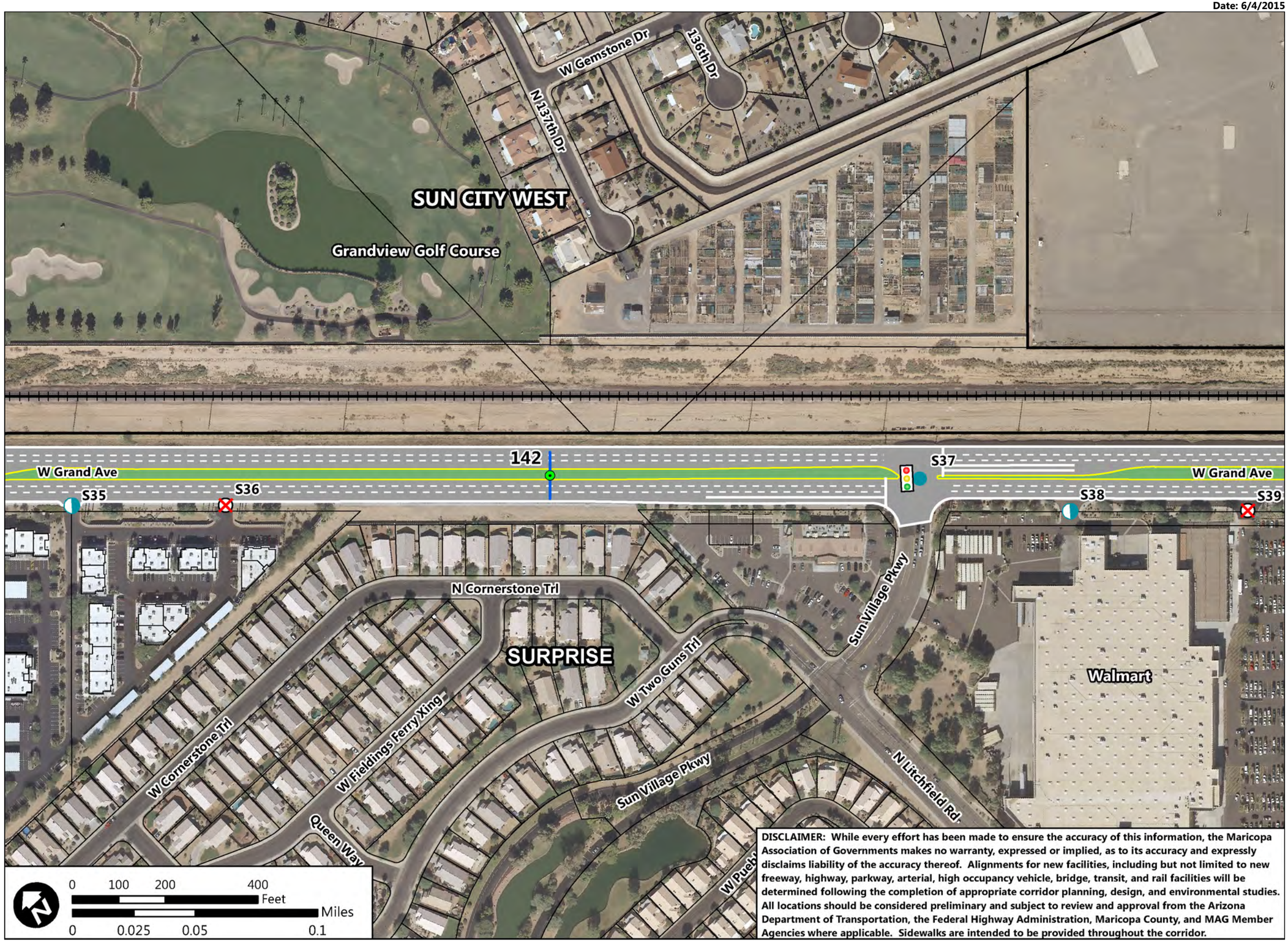
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S35	R	R
S36	C	R
S37*	F	N
S38	R	R
S39	C	R

*S37 is an existing signalized intersection



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

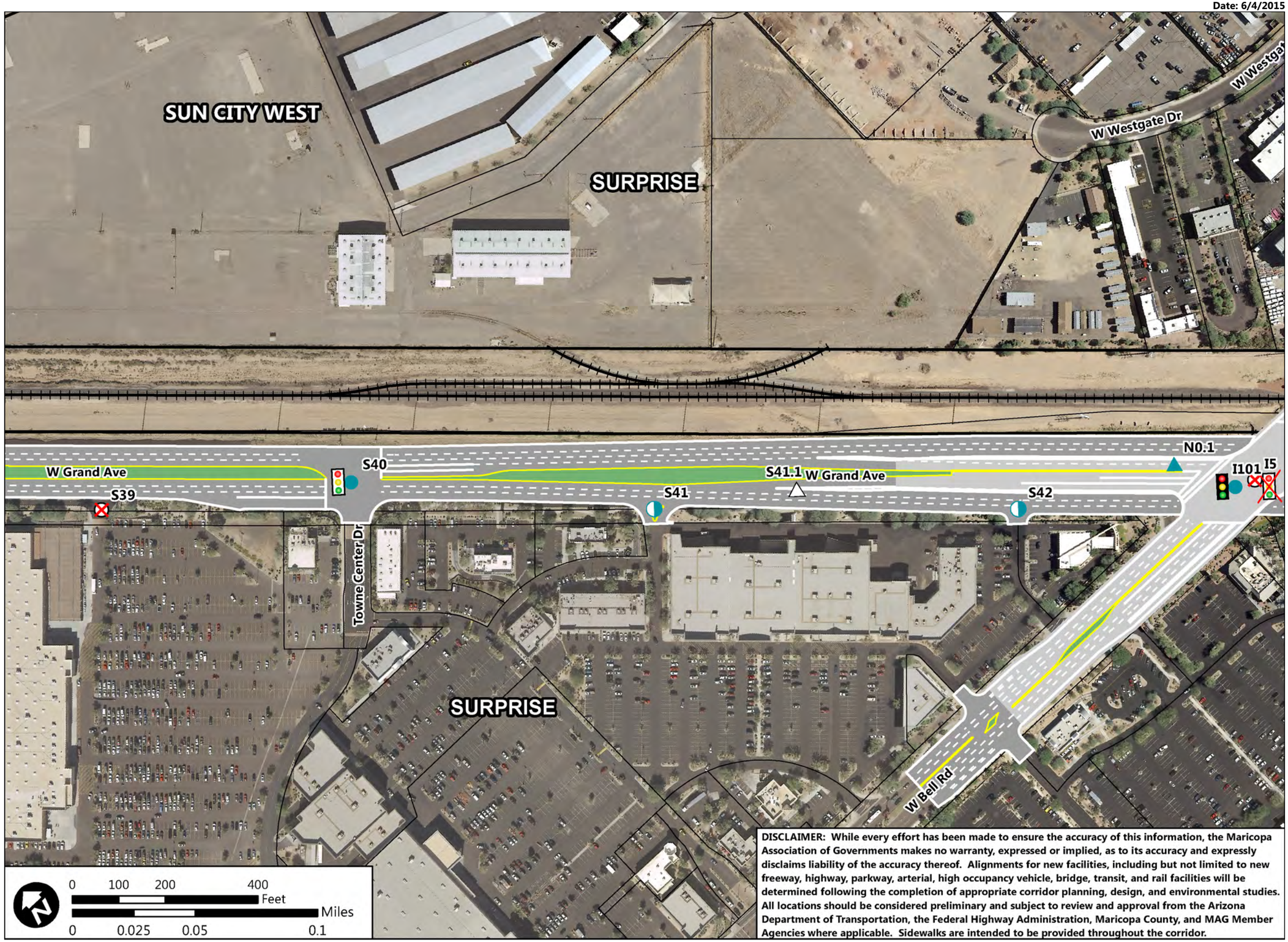
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S39	C	R
S40*	F	N
S41	R	R
S41.1	OF	R
N0.1	ON	R
I101	F	N
S42	R	DI
I5	C	DI

*S40 is an existing signalized intersection



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

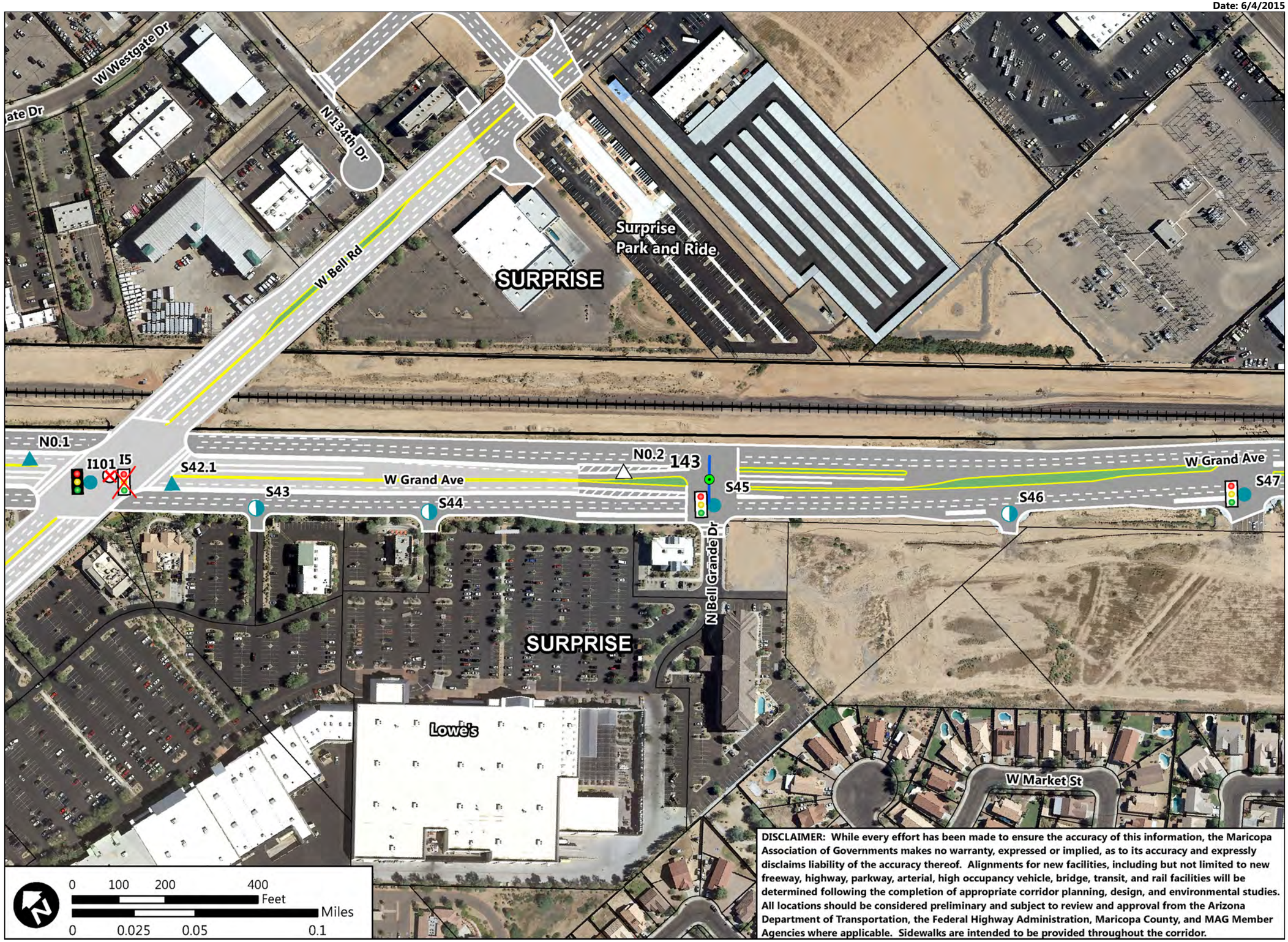
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I5	C	DI
S42.1	ON	R
S43	R	DI
S44	R	DI
N0.2	OF	R
S45	F	N
S46	R	R
S47	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

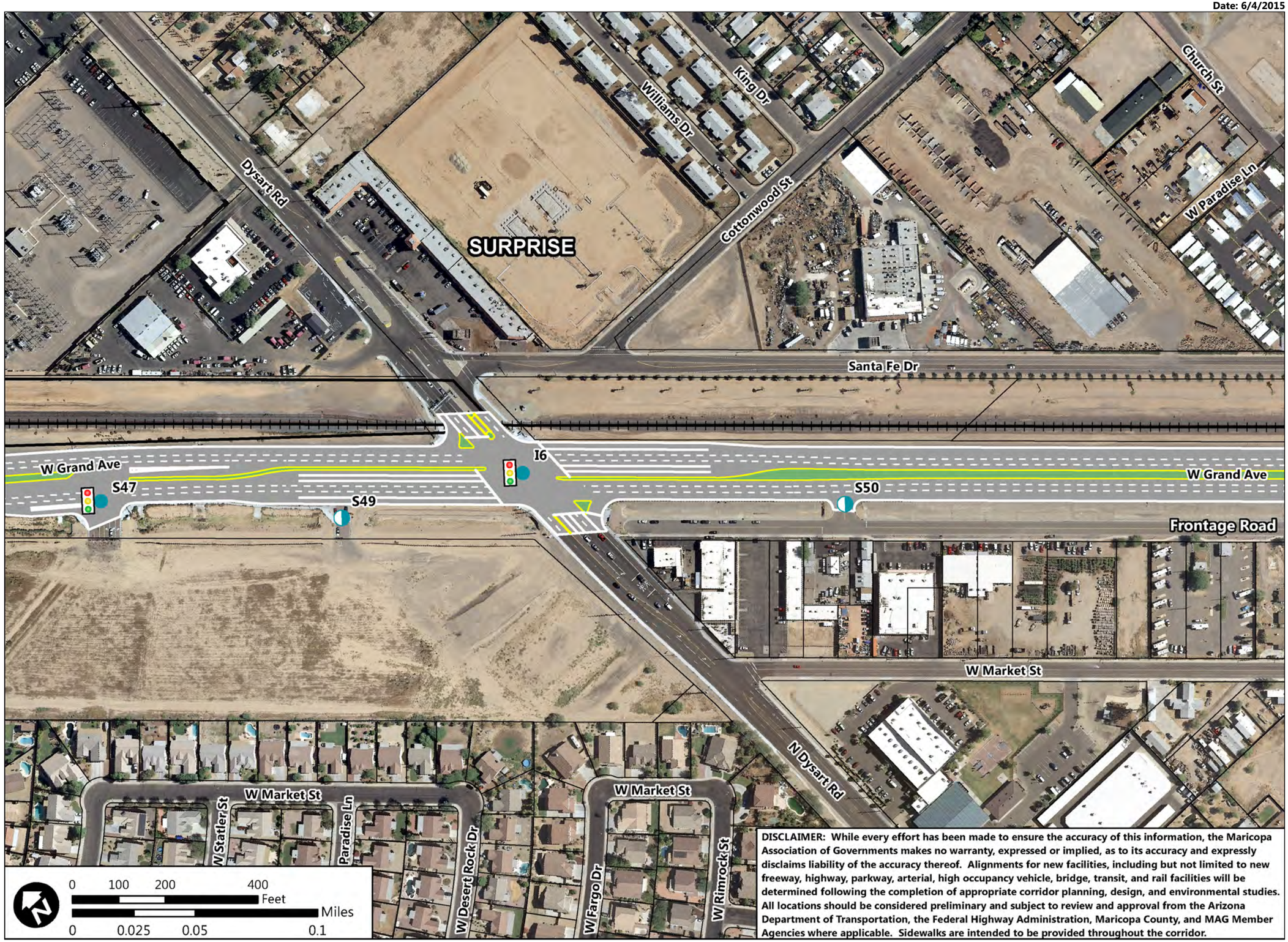
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S47	F	N
S48*	C	R
S49	R	R
I6	F	N
S50	R	R

*S48 deleted in between TM 1 and 6



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

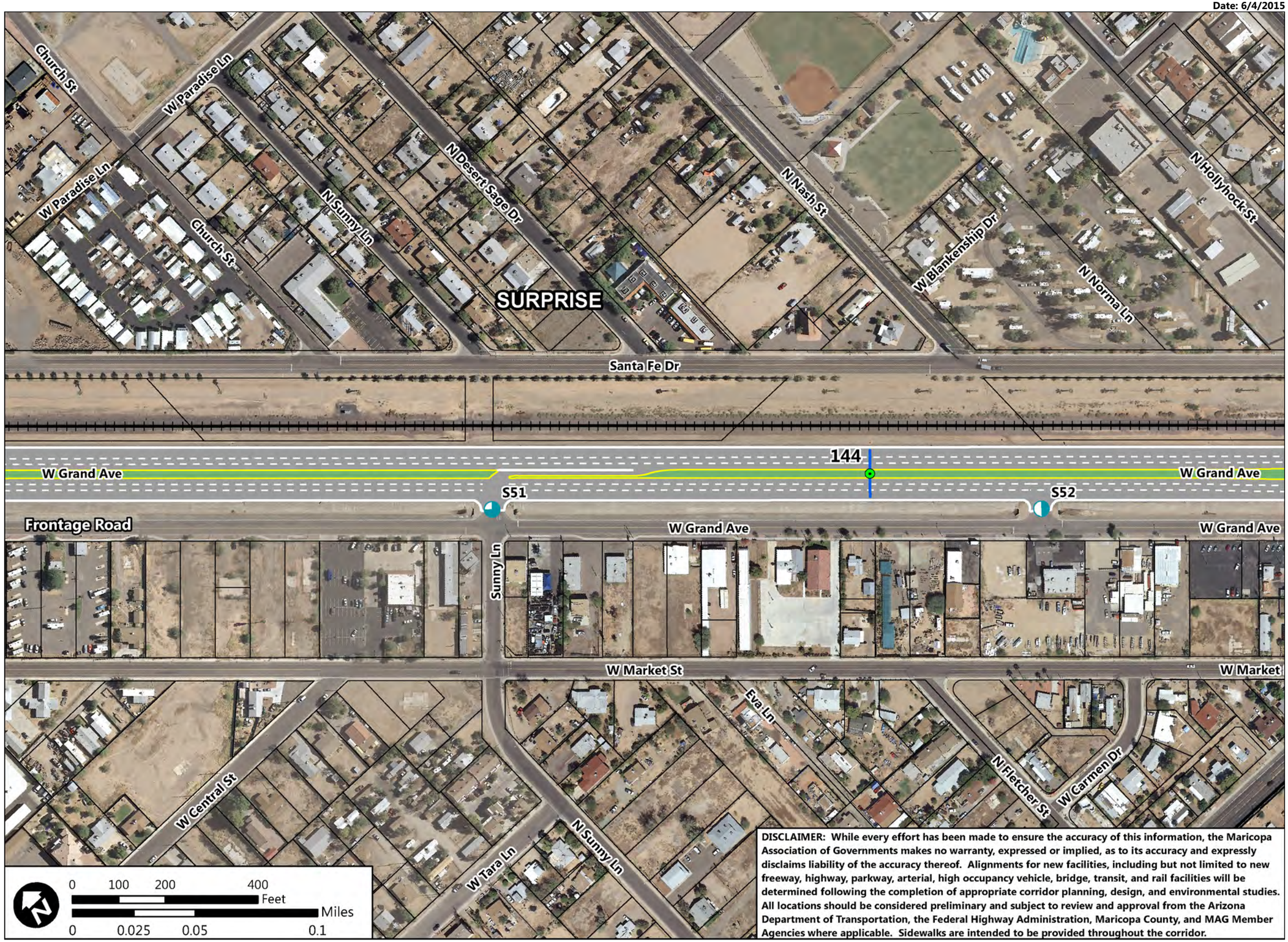
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S51	T	MB1
S52	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

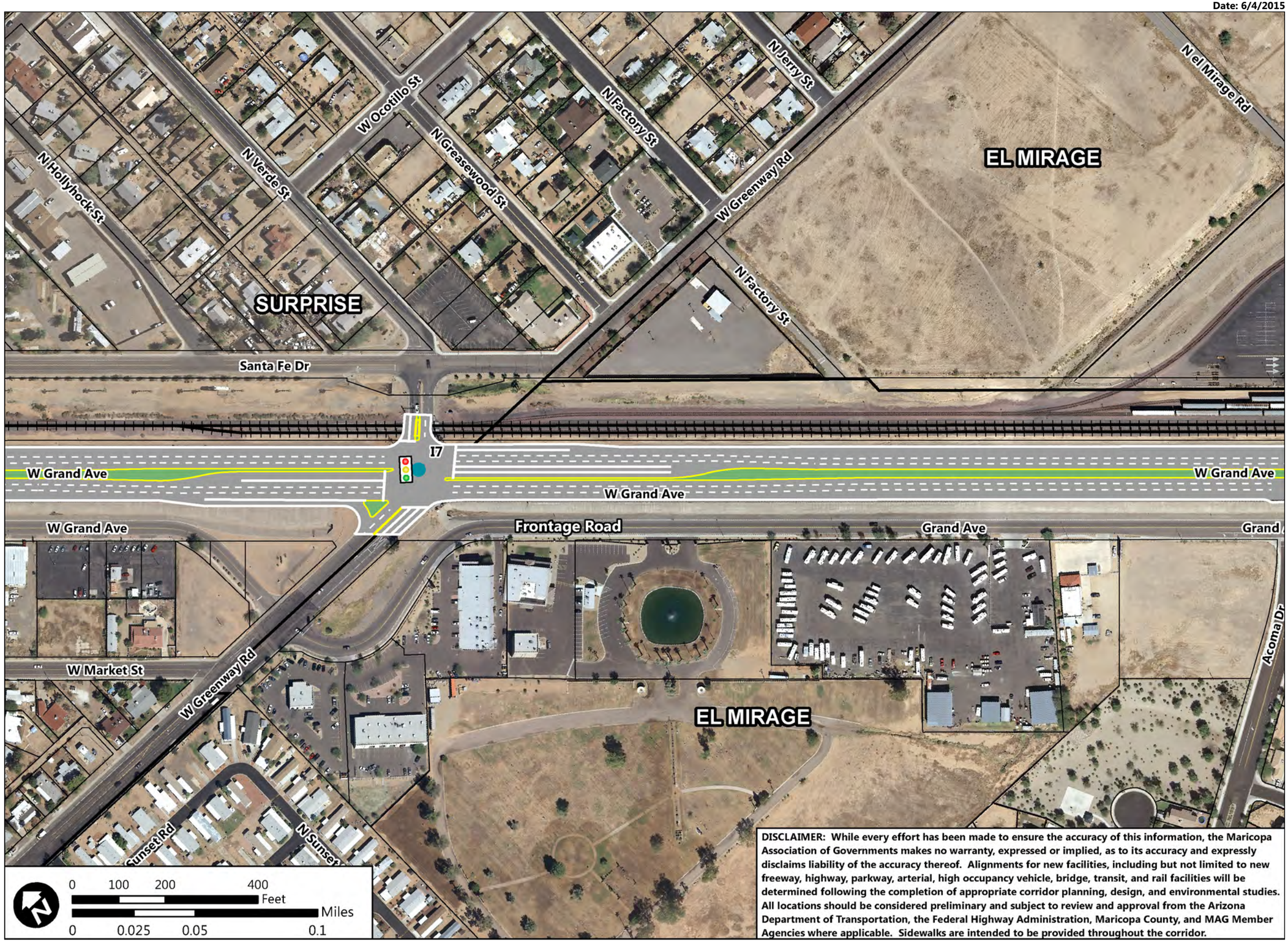
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I7	F	N



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

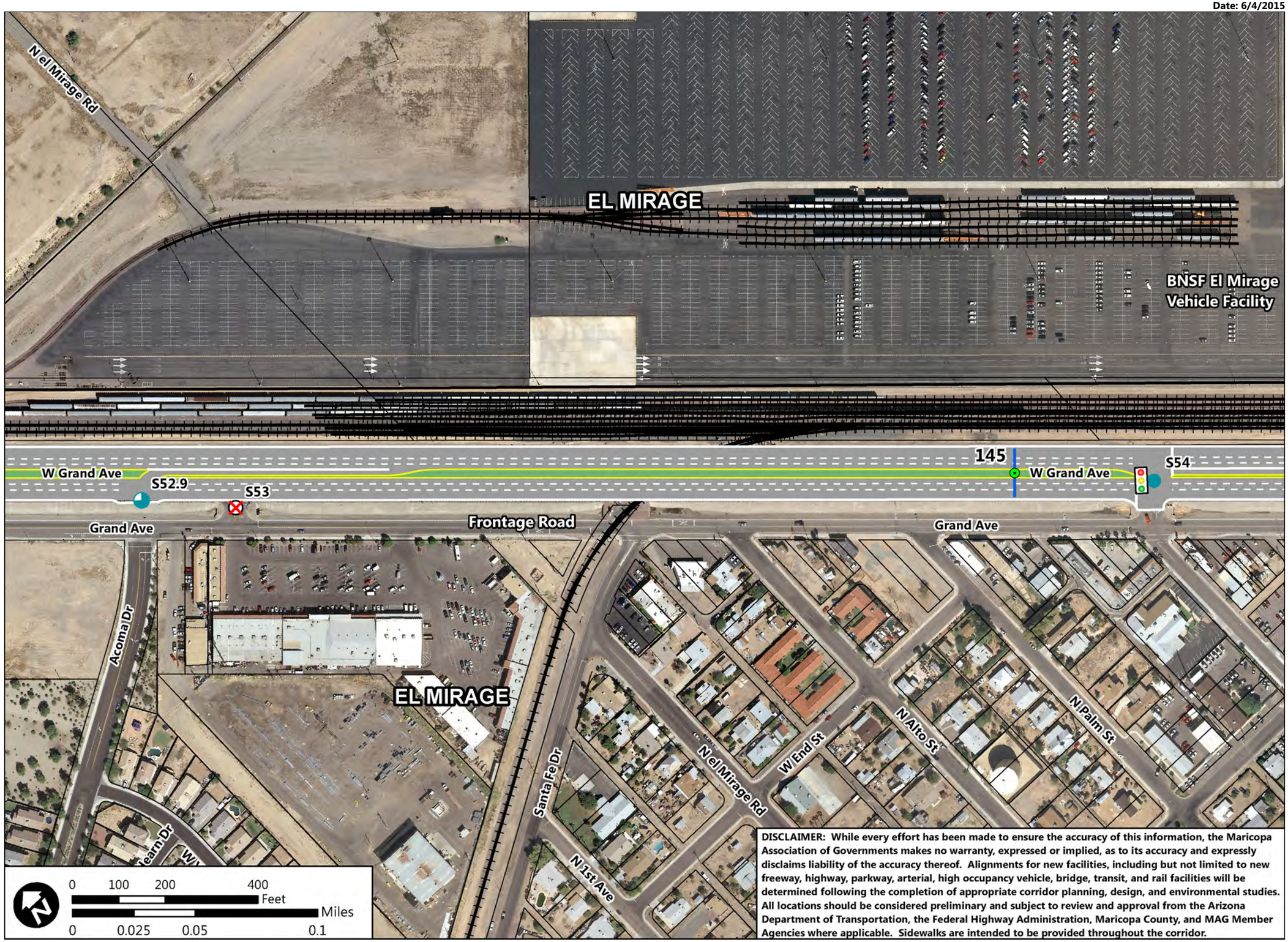
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S52.9	T	MB1
S53	C	R
S54*	F	N

*S54 is 3/4 access - EB traffic cannot go south



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
- ADOT Mile Post
- Full Movement Access
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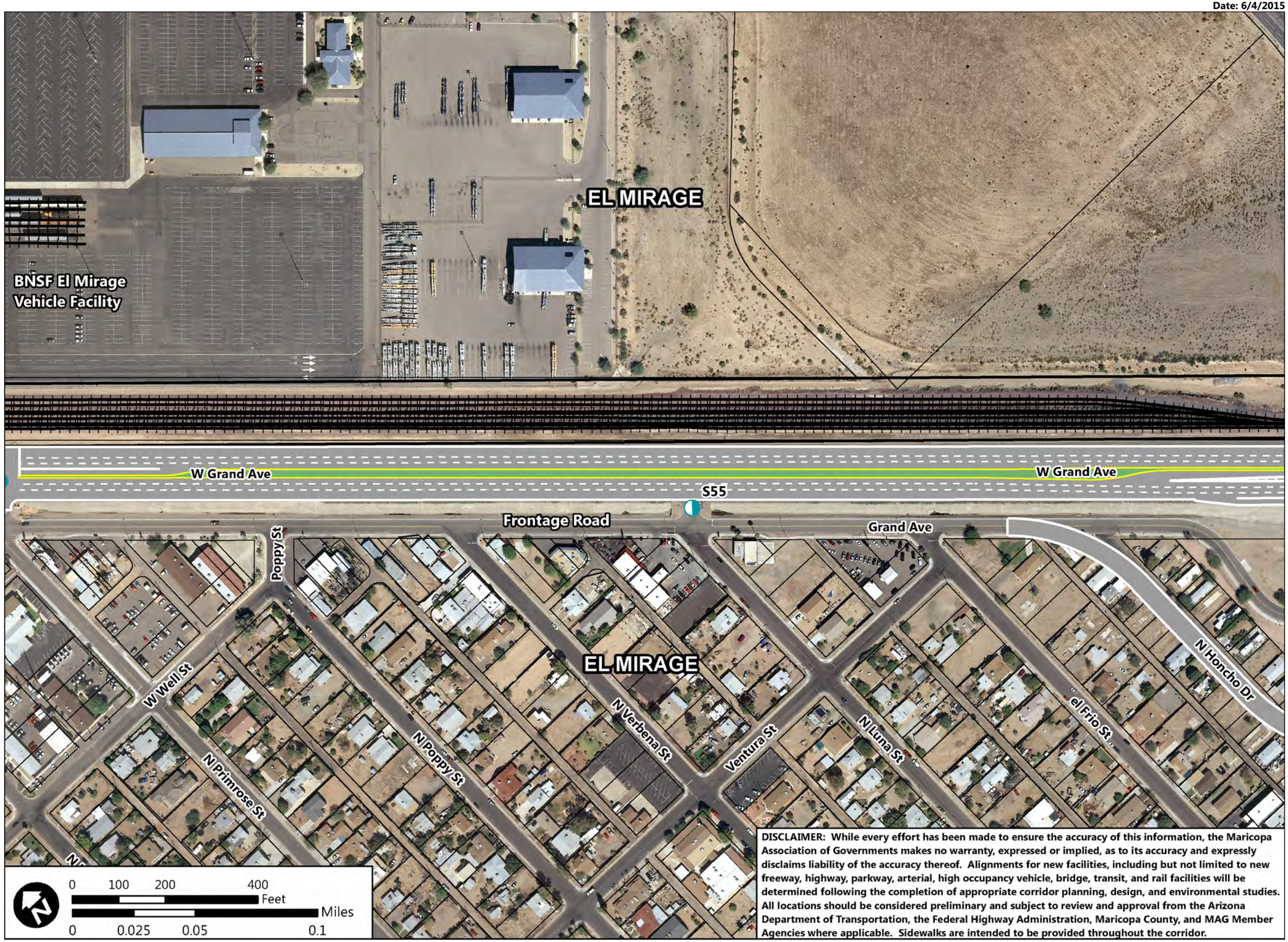
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S55	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

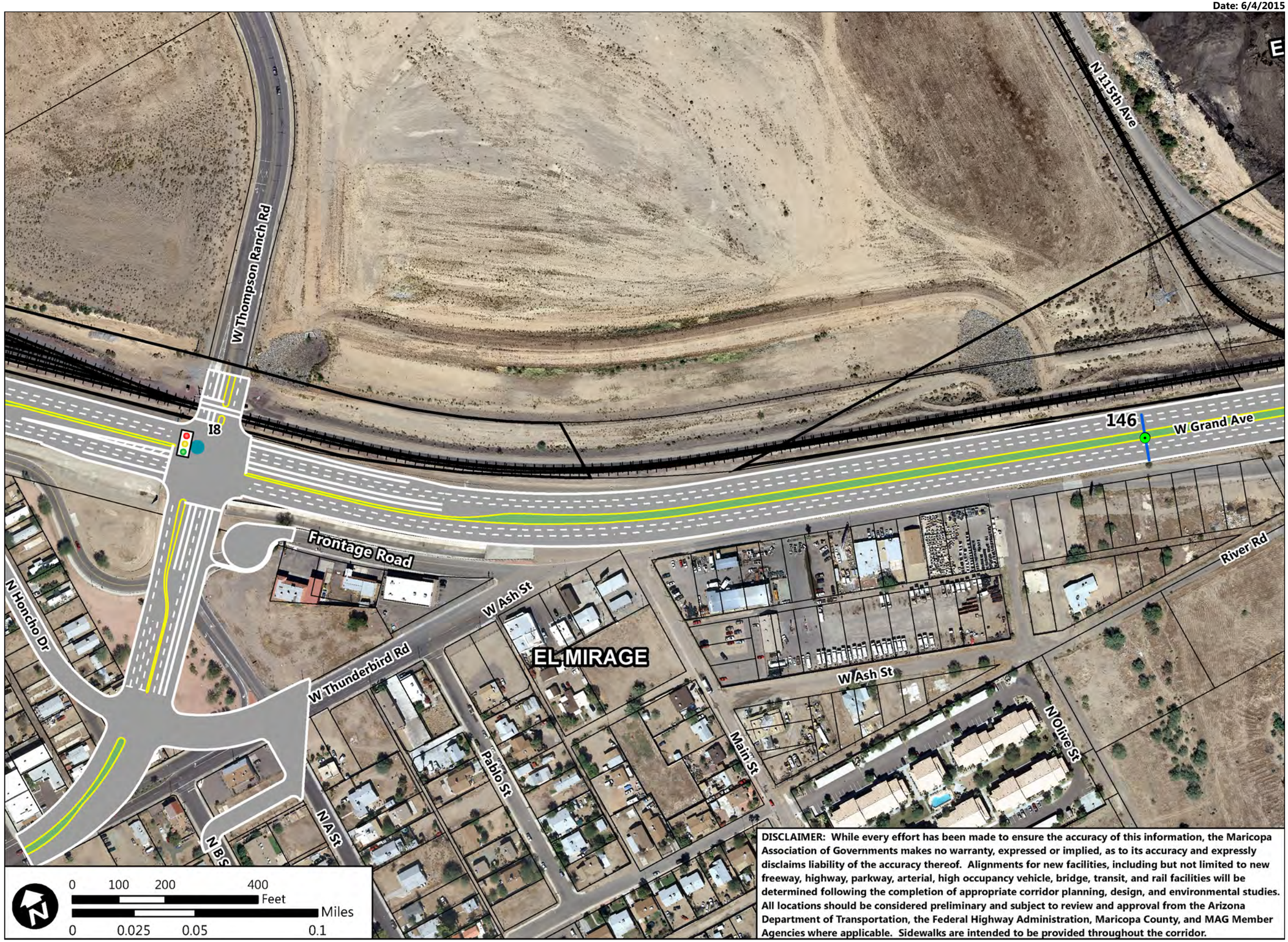
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I8*	F	N

*I8 is an existing signalized intersection that is being reconfigured in place



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Legend

- Railway
- City Boundary
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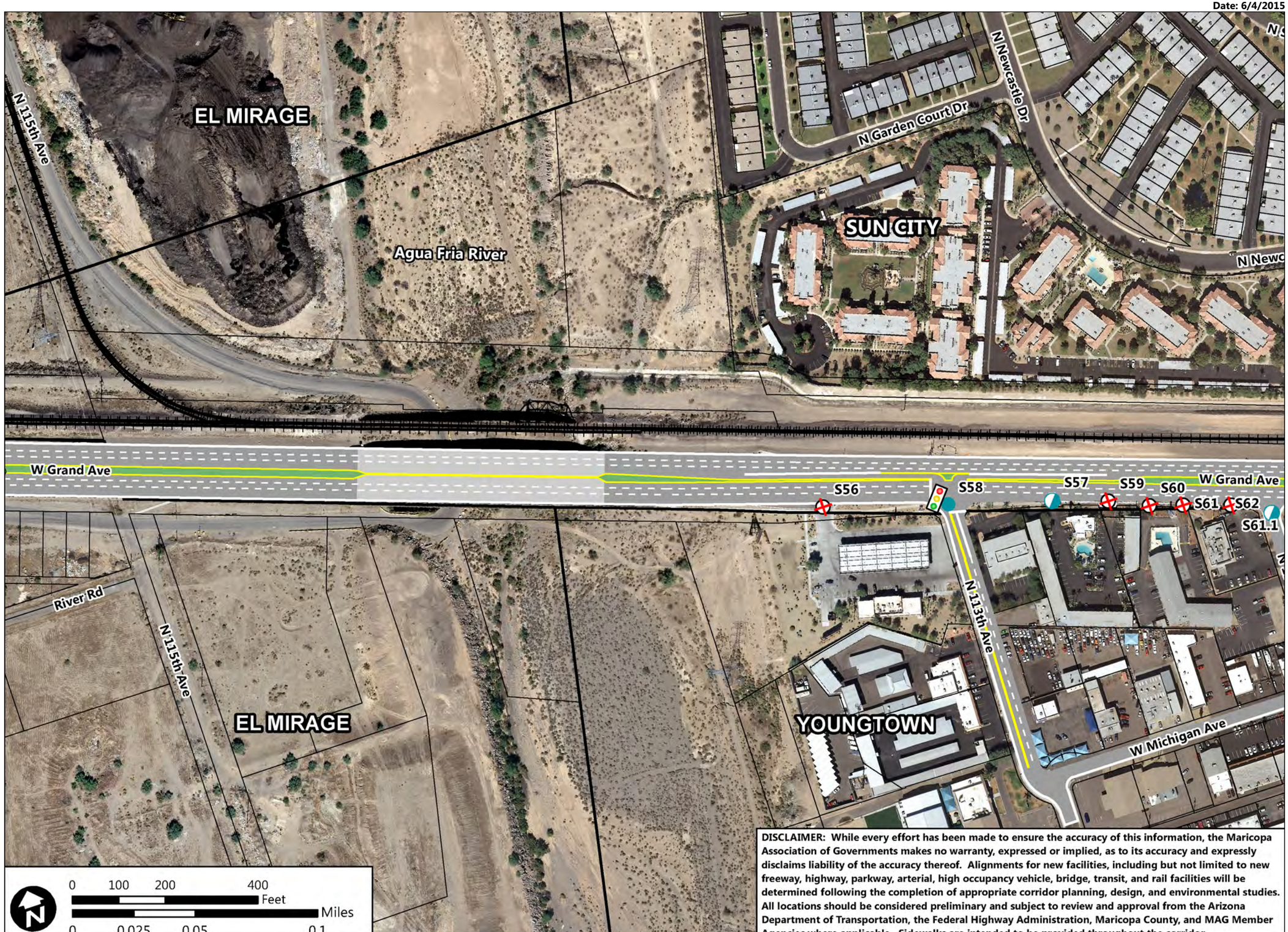
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S56	C	R
S58*	F	MB1
S57	R	R
S59	C	R
S60	C	R
S61	C	R
S61.1	C	R
S62	R	R

*S58 is Florida T



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US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
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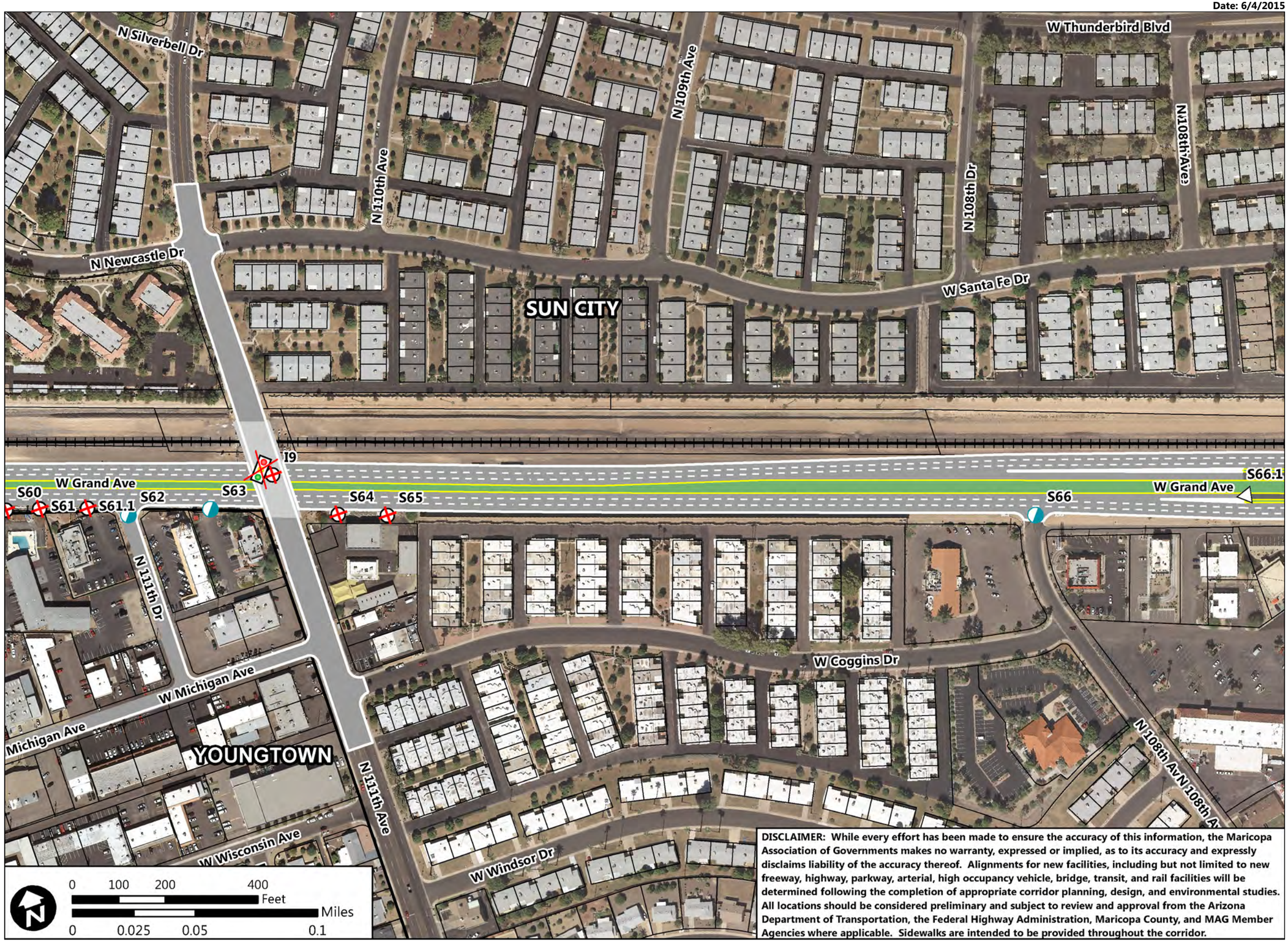
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S60	C	R
S61	C	R
S61.1	C	R
S62	R	R
S63	R	R
I9	C	R
S64	C	R
S65	C	R
S66	R	R



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

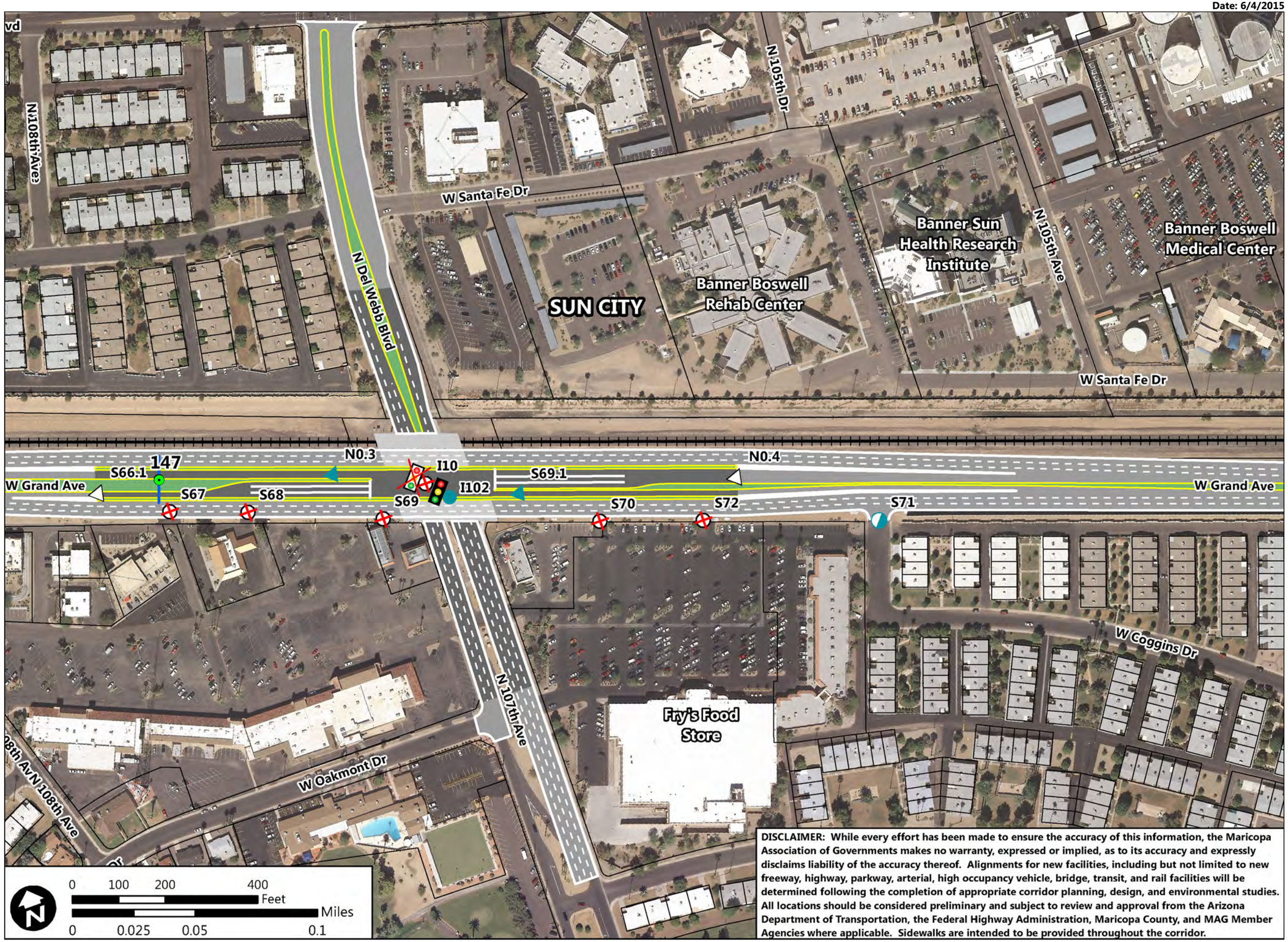
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S66.1	OF	R
S67	C	DI
S68	C	DI
N0.3	ON	R
S69	C	DI
I10	C	DI
I102	F	N
S69.1	ON	R
S70	C	DI
S72	C	DI
N0.4	OF	R
S71	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
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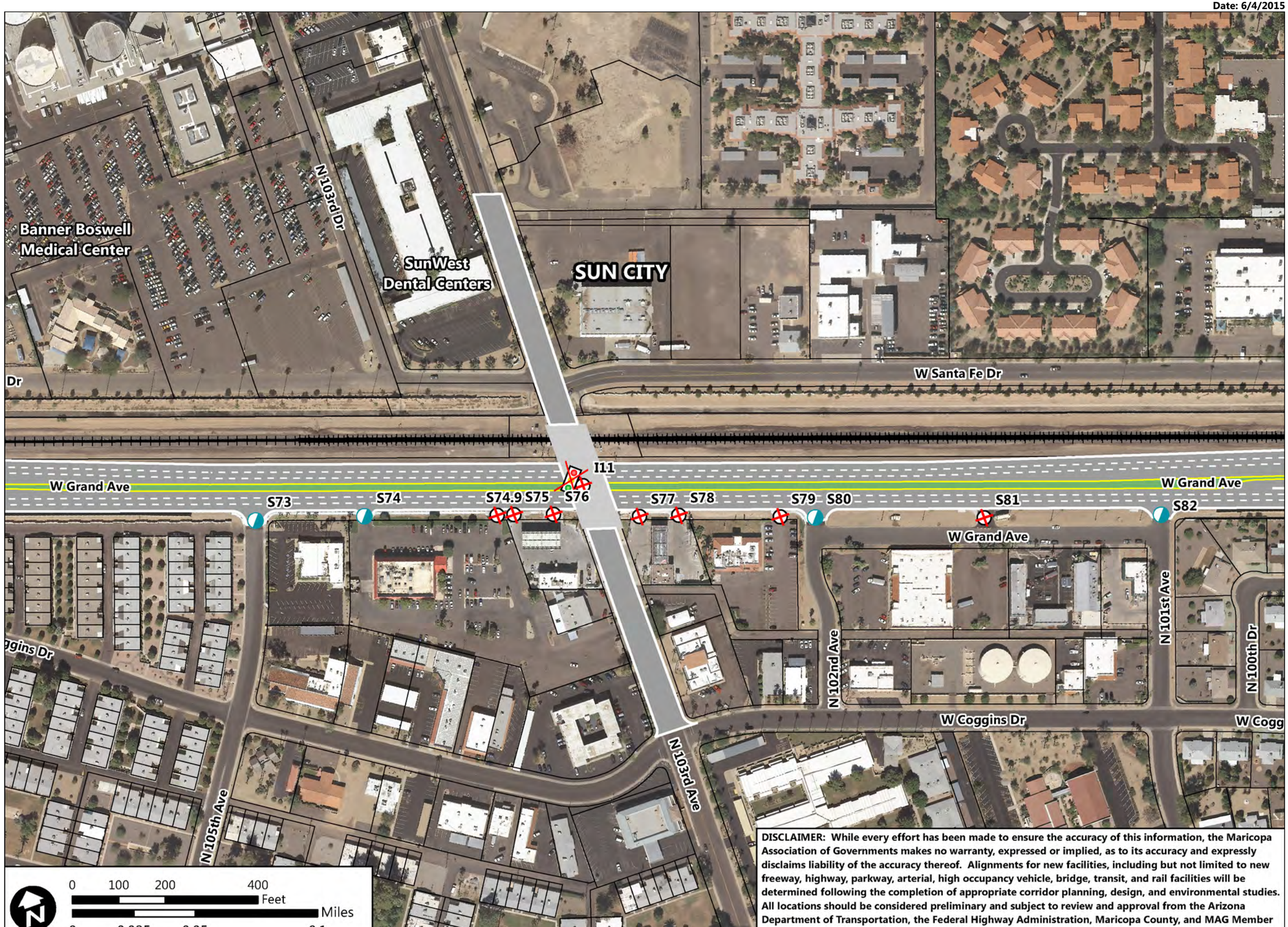
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S73	R	R
S74	R	R
S74.9	C	R
S75	C	R
S76	C	R
I11	C	R
S77	C	R
S78	C	R
S79	C	R
S80	R	R
S81	C	R
S82	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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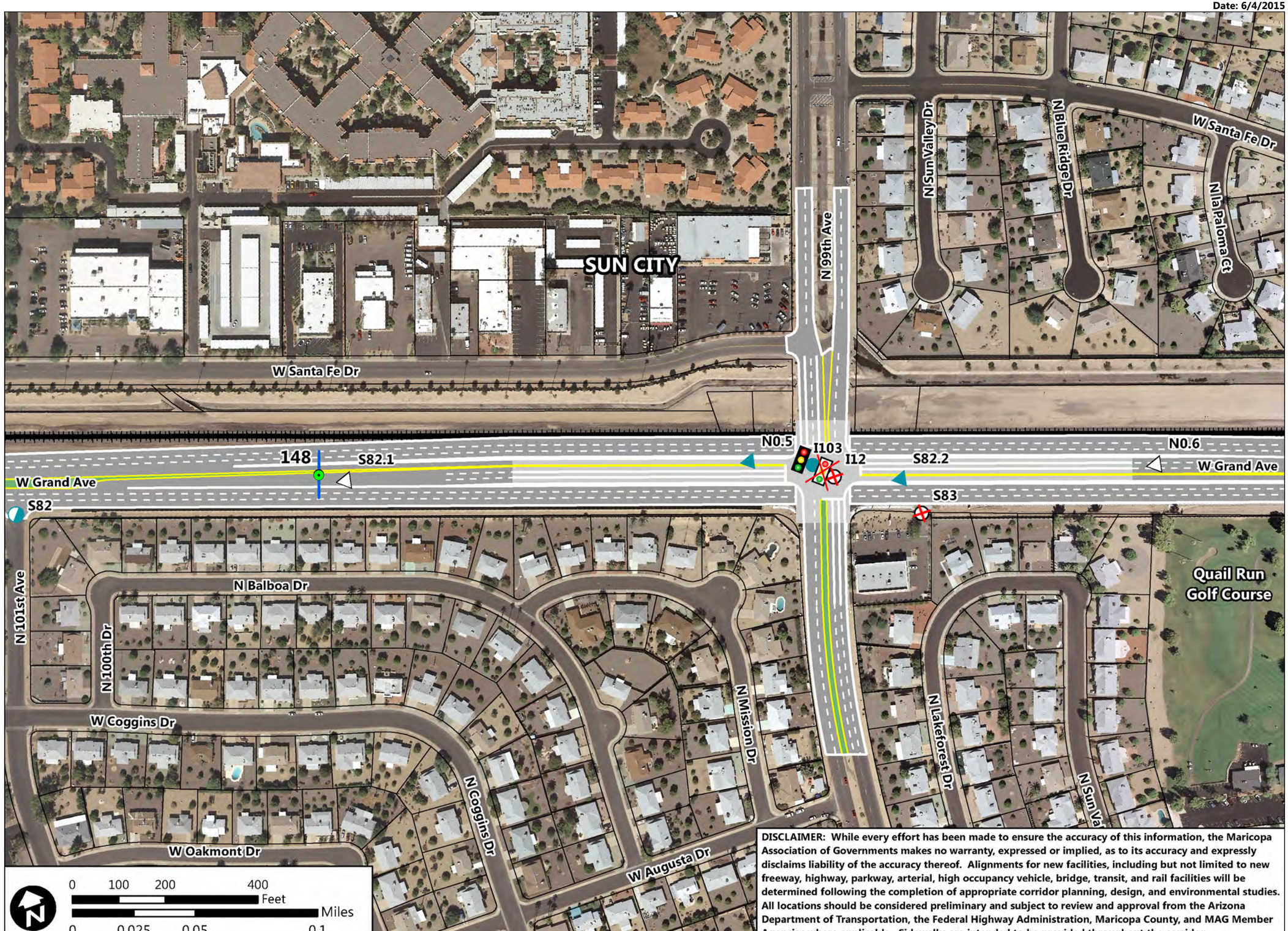
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S82	R	R
S82.1	OF	R
N0.5	ON	R
I12	C	DI
I103	F	N
S82.2	ON	R
S83	C	DI
N0.6	OF	R



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US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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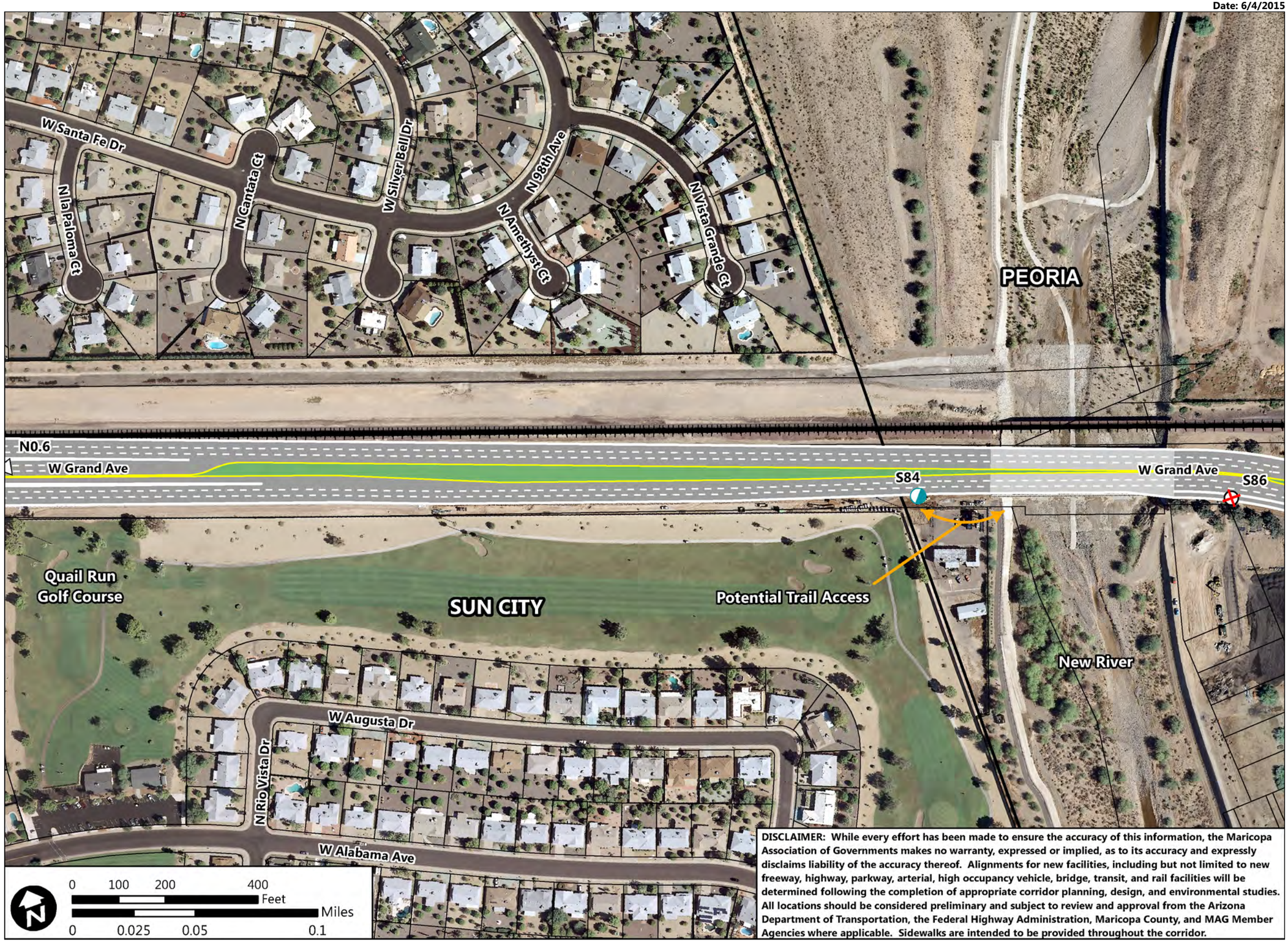
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S84	R	R
S86	C	R



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
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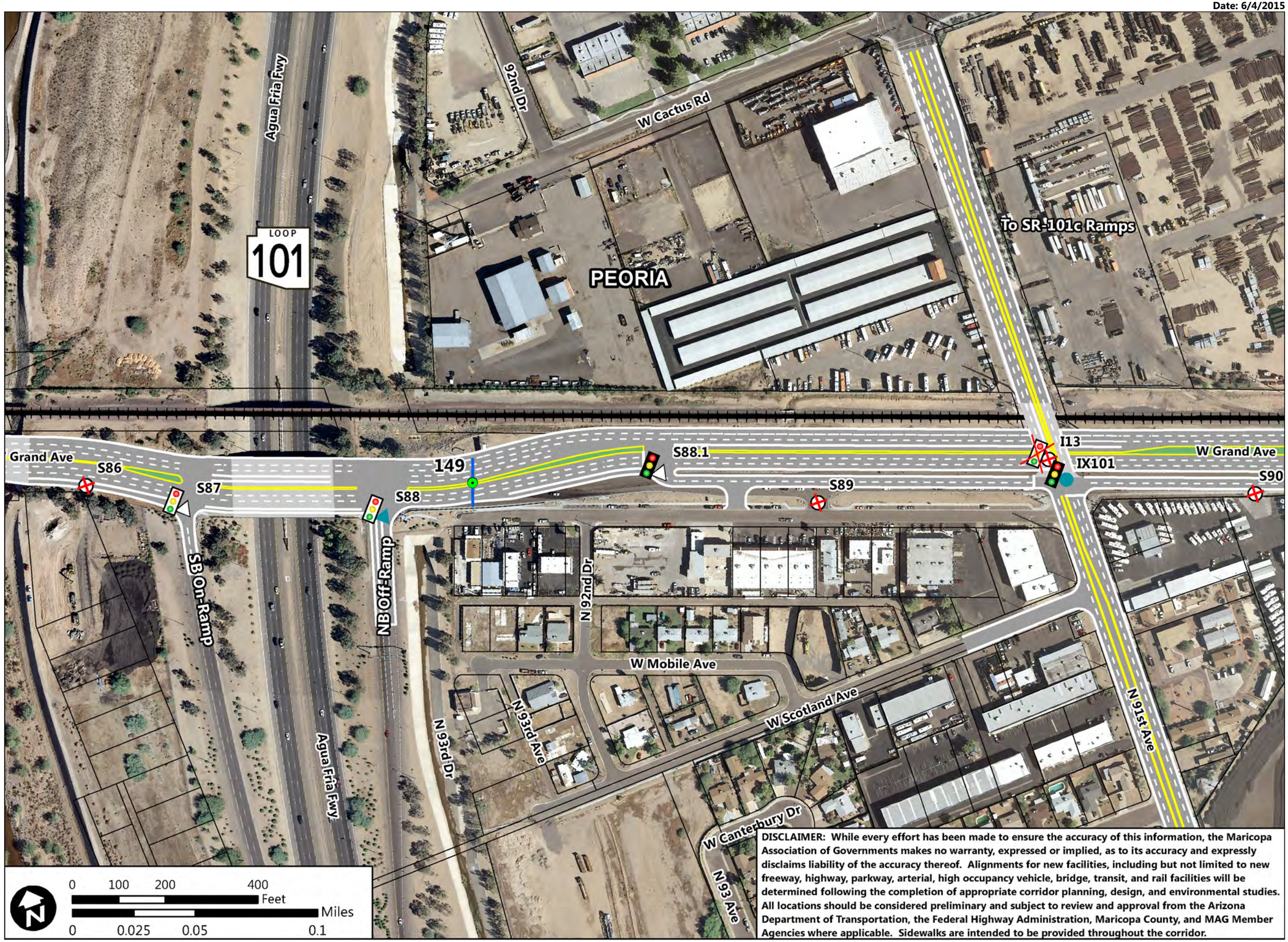
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S86	C	R
S87	OF	N
S88	ON	N
S88.1	OF	N
S89	C	R
I13	C	R
IX101	F	N
S90	C	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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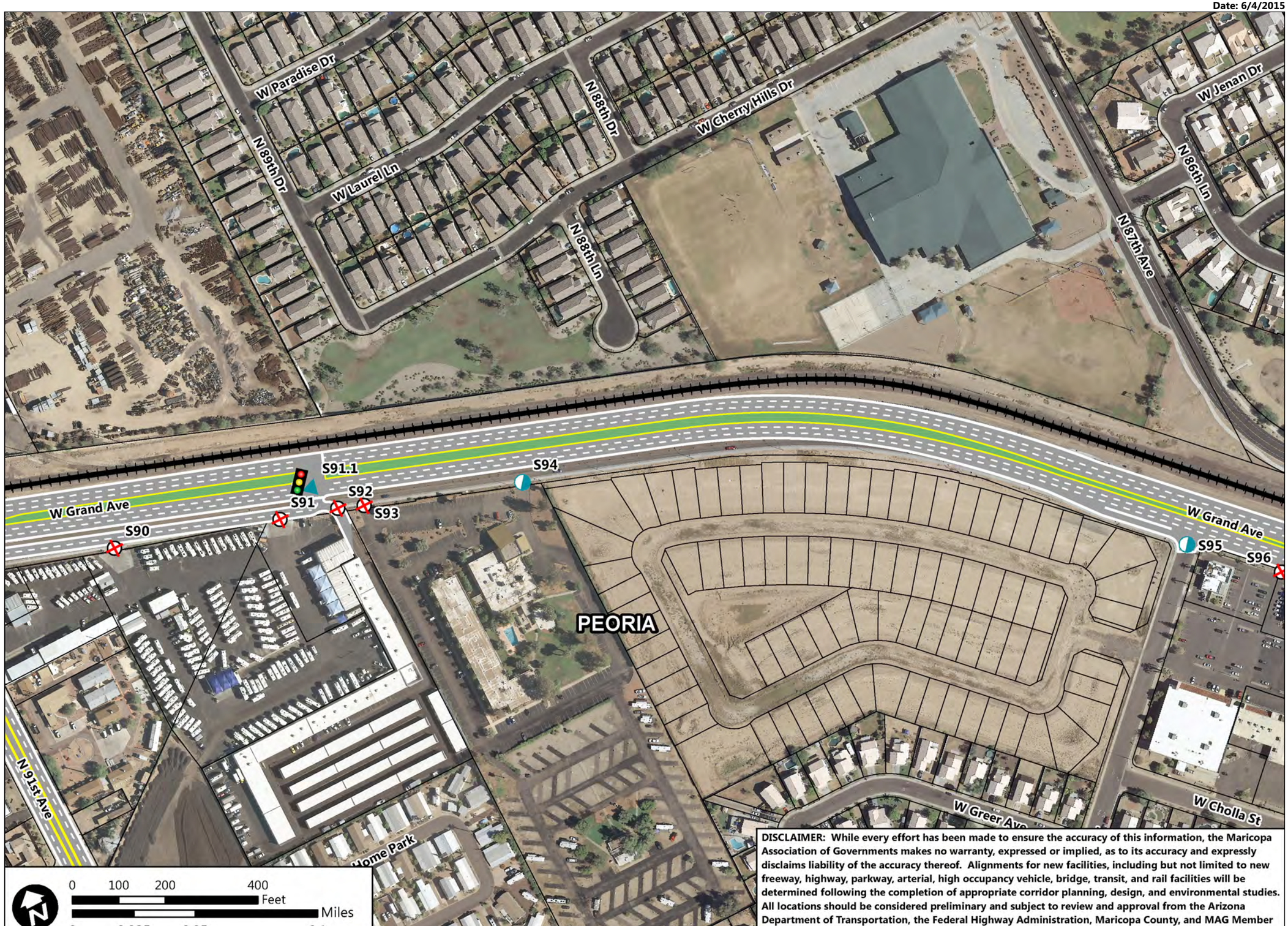
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S90	C	R
S91*	C	R
S91.1	ON	N
S92	C	R
S93	C	R
S94**	R	R
S95	R	R
S96	C	R

*S91 accesses frontage ramp in lieu of Grand
**S94 would require a driveway extension to access Grand



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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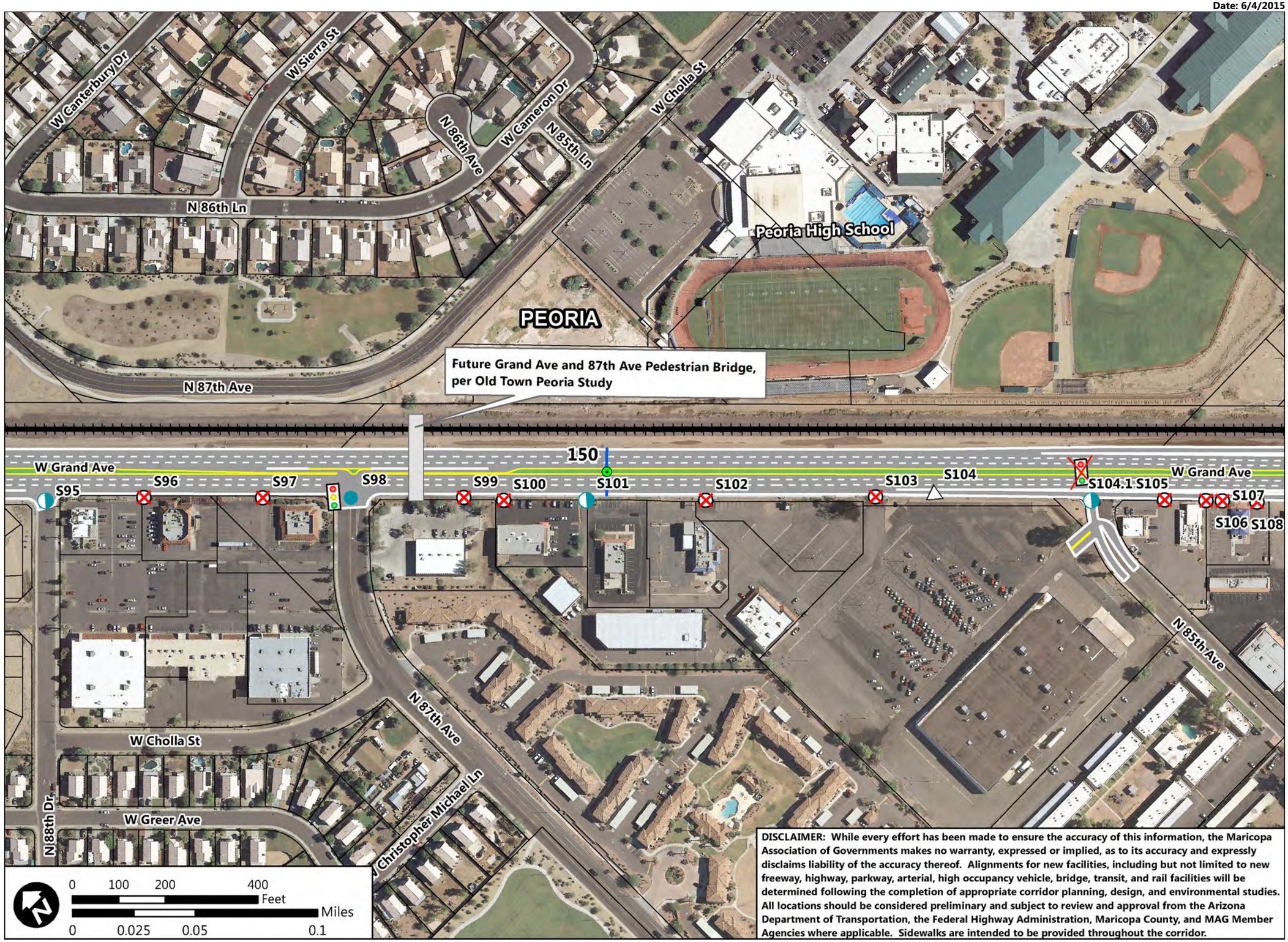
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S95	R	R
S96	C	R
S97	C	R
S98*	F	MB1
S99	C	R
S100	C	R
S101	R	R
S102	C	R
S103	C	R
S104	OF	R
S104.1	R	R
S105	C	R
S106	C	R
S107	C	R
S108**	C	R

*S98 is a Florida T

**S108 accesses frontage ramp in lieu of Grand



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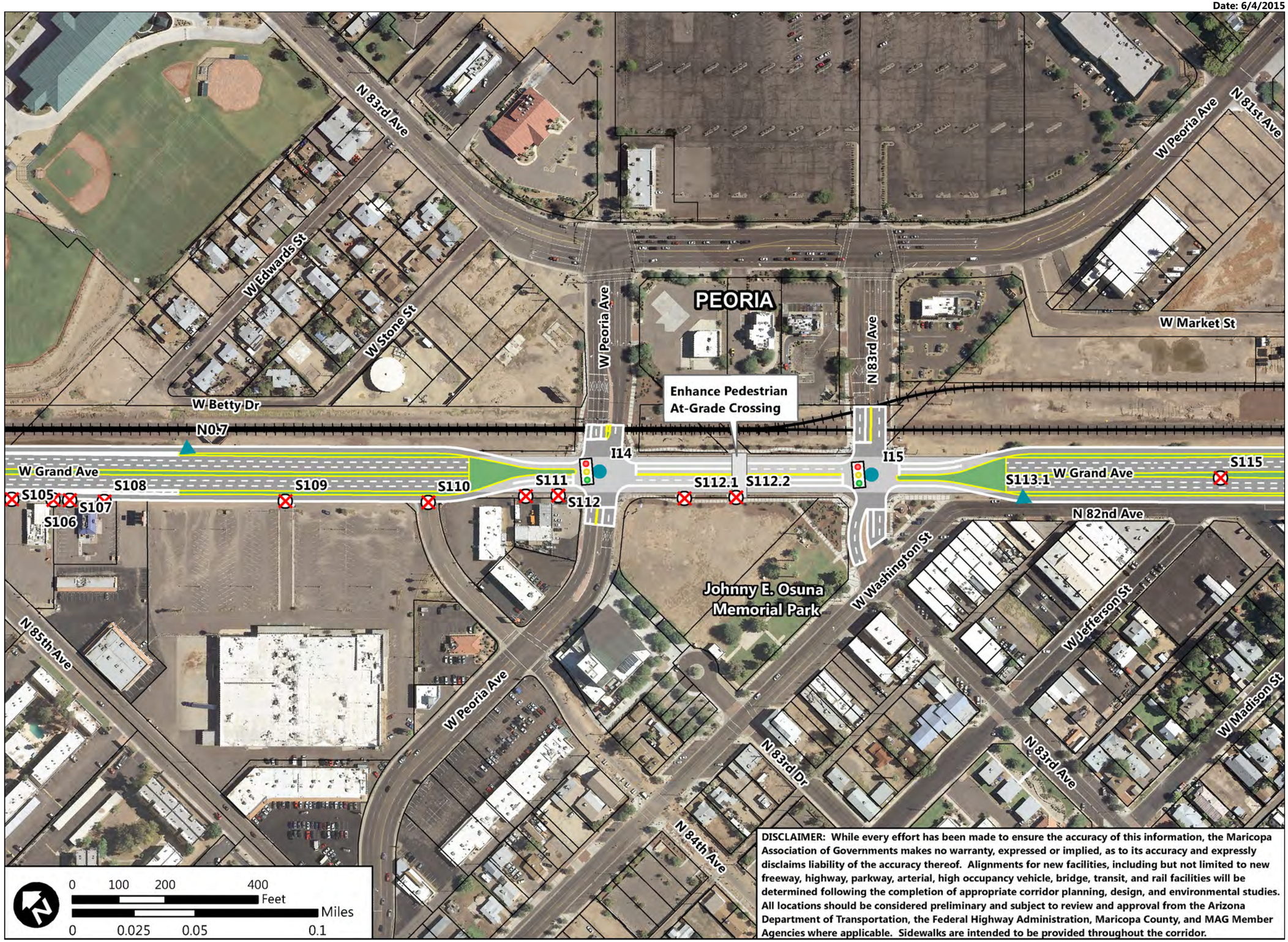
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S105	C	R
S106	C	R
S107	C	R
S108*	C	R
N0.7	ON	R
S109	C	R
S110	C	R
S111	C	R
S112	C	R
I14**	F	N
S112.1	C	R
S112.2	C	R
I15	F	N
S113.1	ON	R
S115	C	R

*S108 accesses frontage ramp in lieu of Grand

**I14 will be reconfigured with fewer lanes



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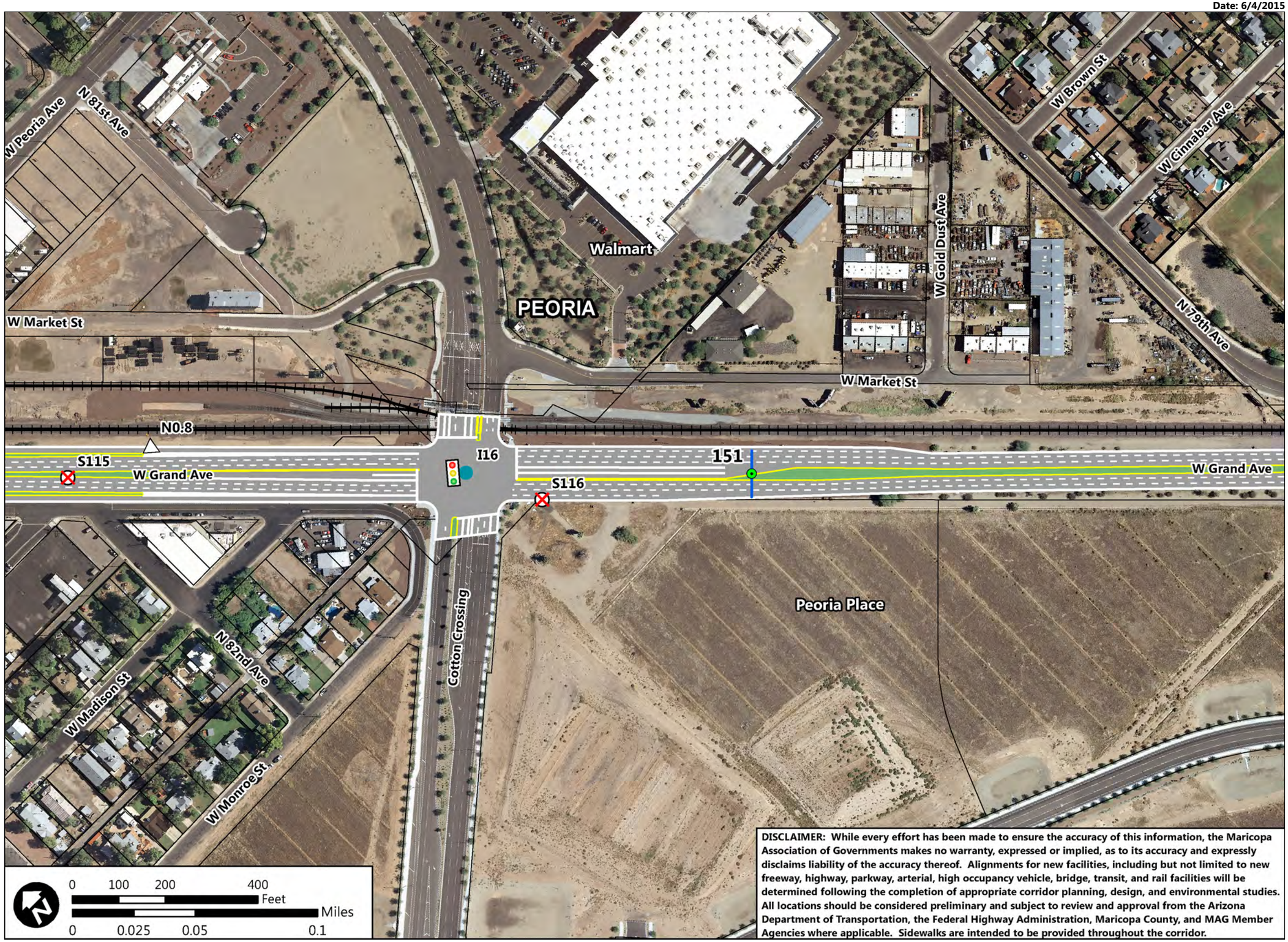
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S115	C	R
NO.8	OF	R
I16	F	N
S116	C	R



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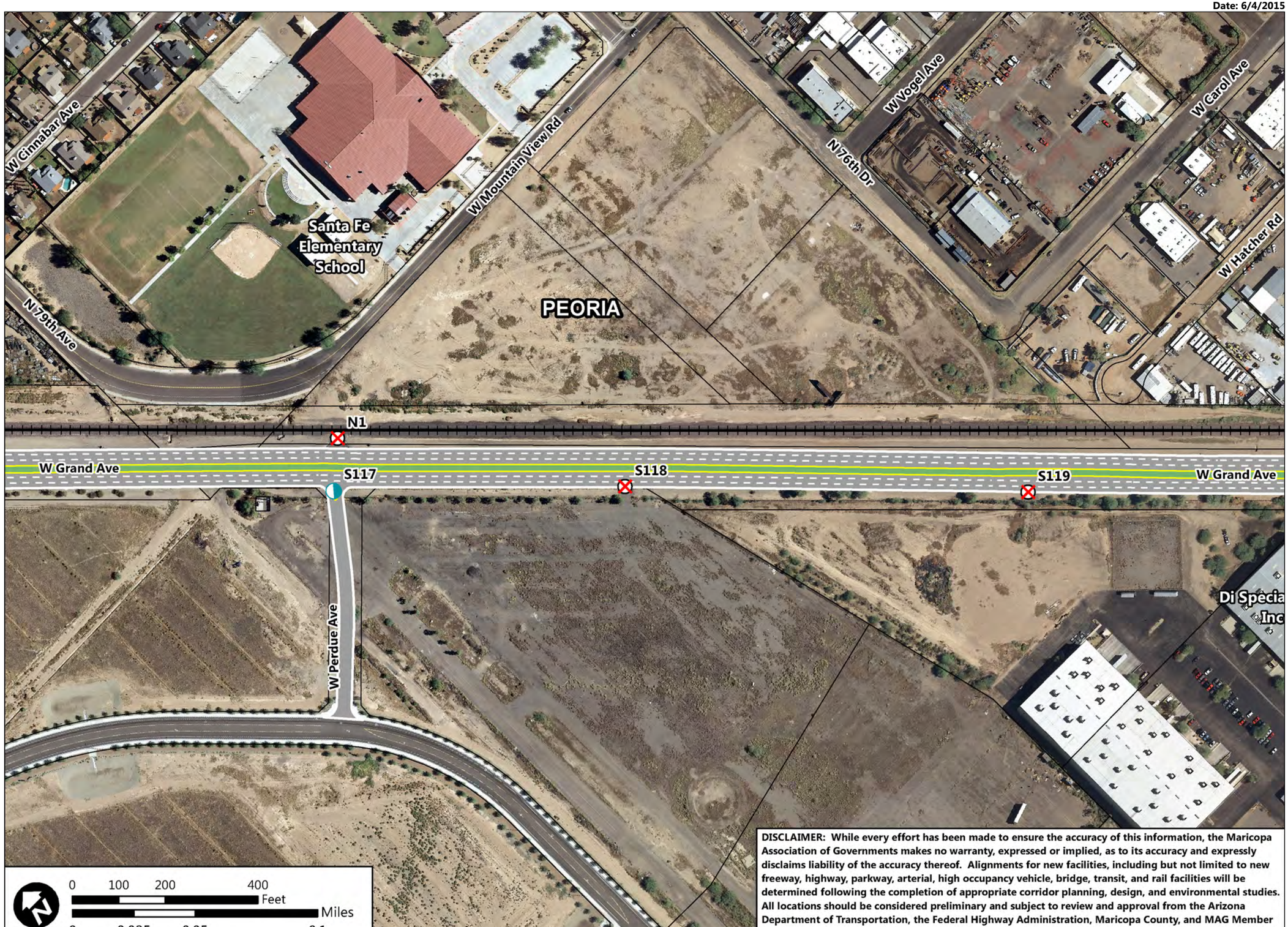
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S117	R	R
N1	C	R
S118	C	R
S119	C	R



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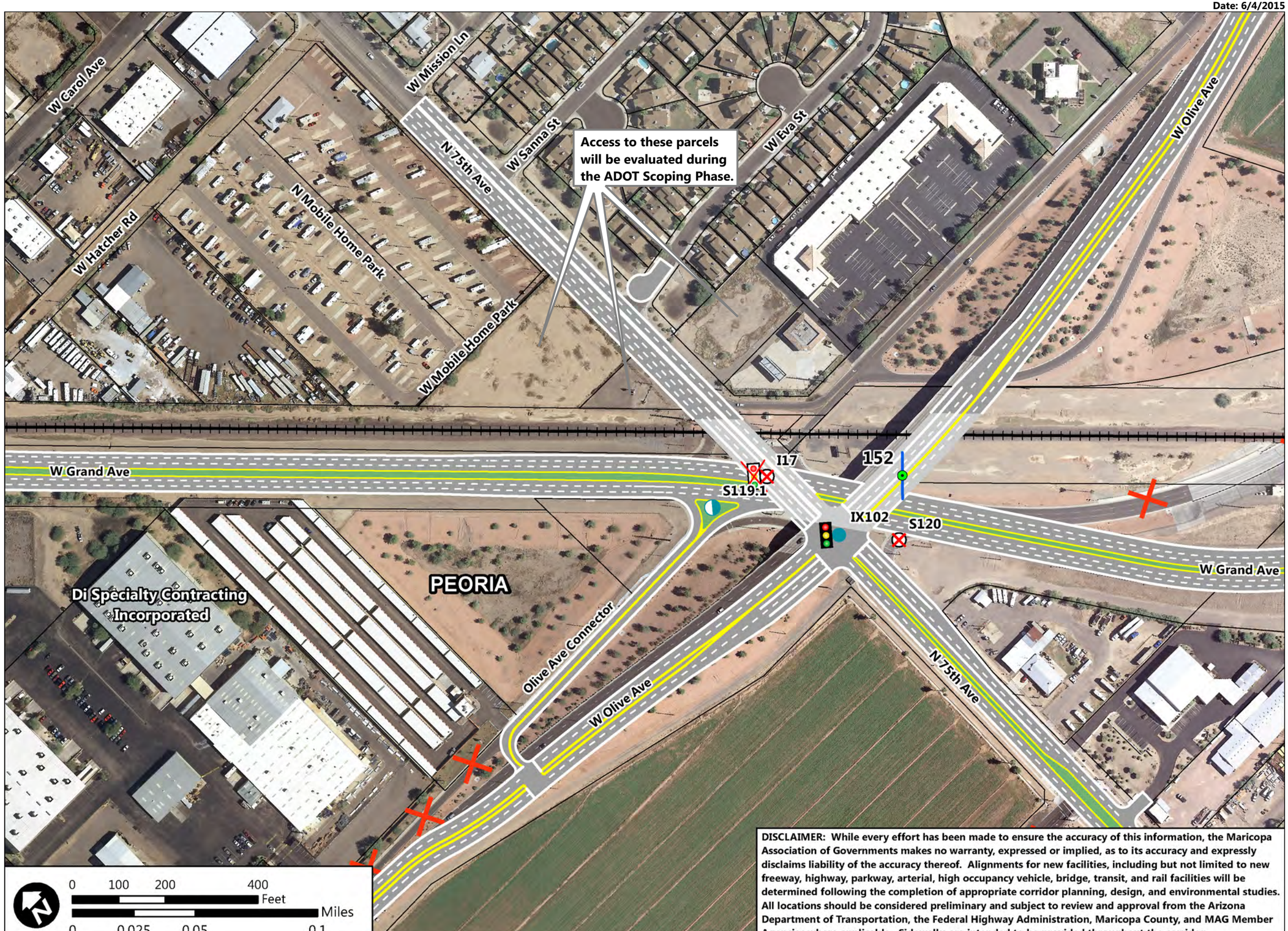
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I17	C	R
S119.1	R	R
S120	C	R
IX102*	F	N

*IX102 is Olive and 75th intersection above Grand



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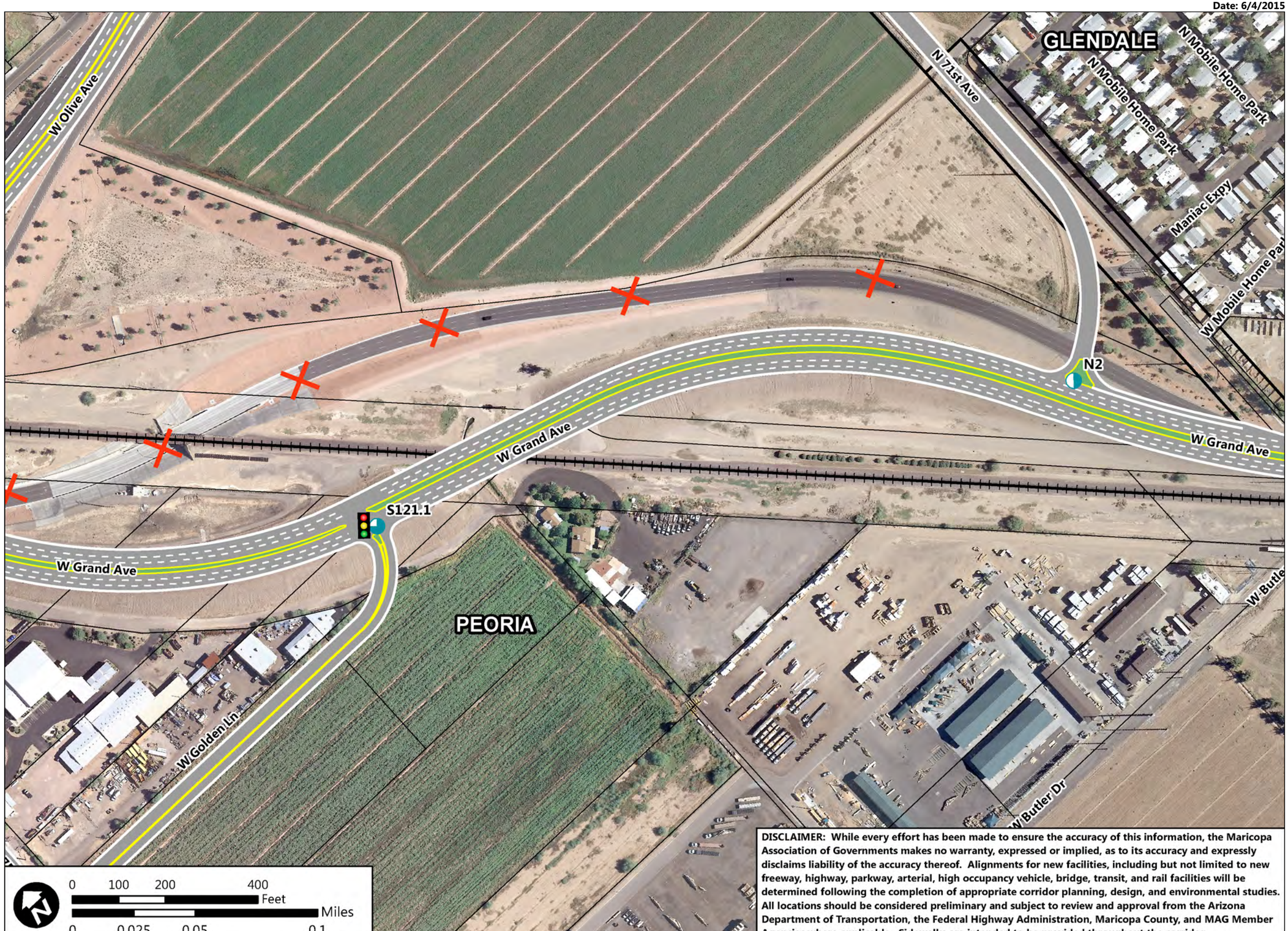
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S121.1	T	MB1
N2	R	R

I17.1 does not allow WB Grand to turn south



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- Close Access
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- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N3.5	C	R
N4	R	R
N5	C	R
N6	C	R
N8	C	R
N10	C	R
N13	C	R
N16	C	R
N17	C	R
N18	C	R
N19	C	R
N20	C	R
N21	C	R
N22	C	R
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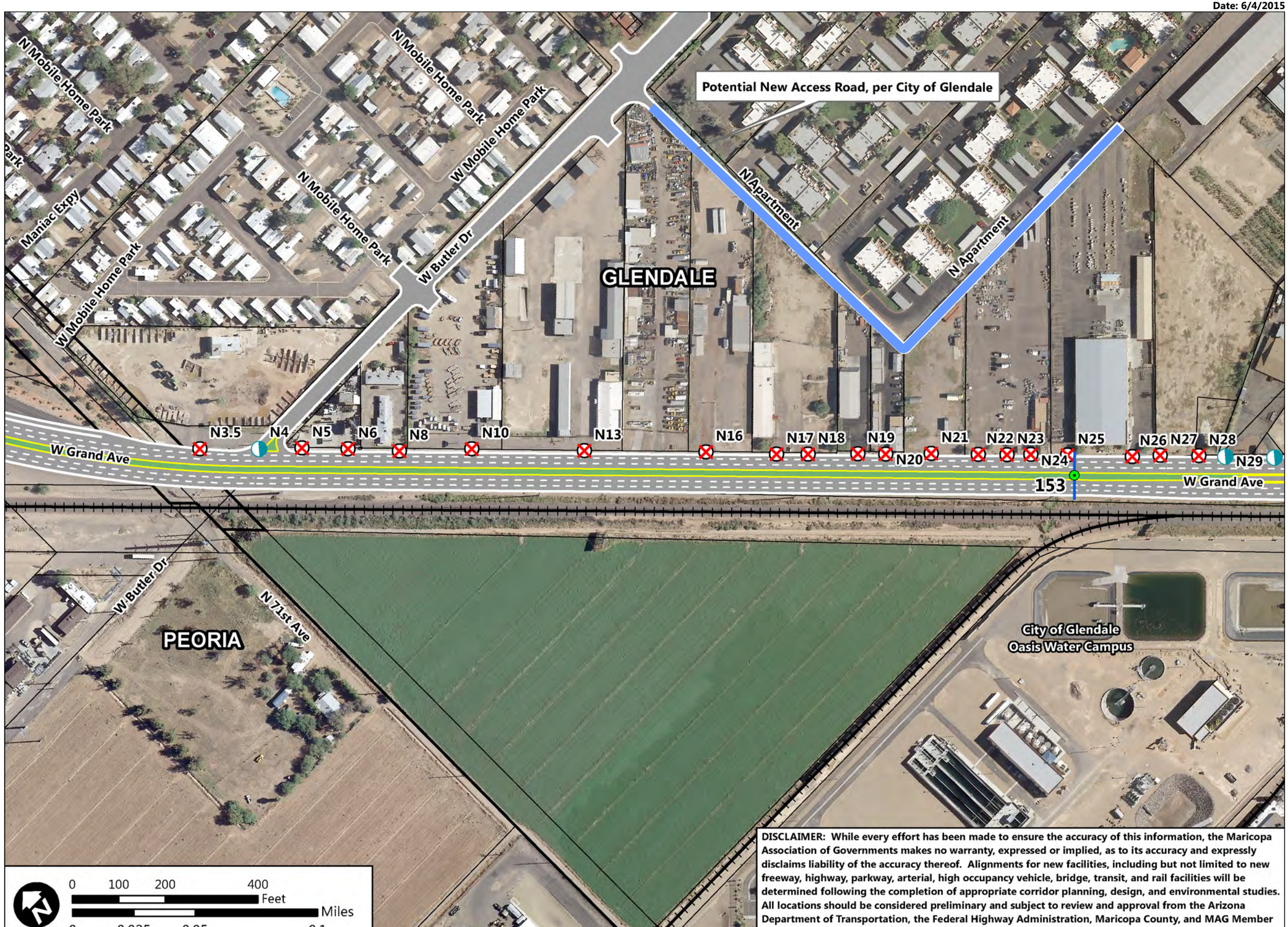
N26	C	R
N27	C	R
N28	C	R
N29	R	R



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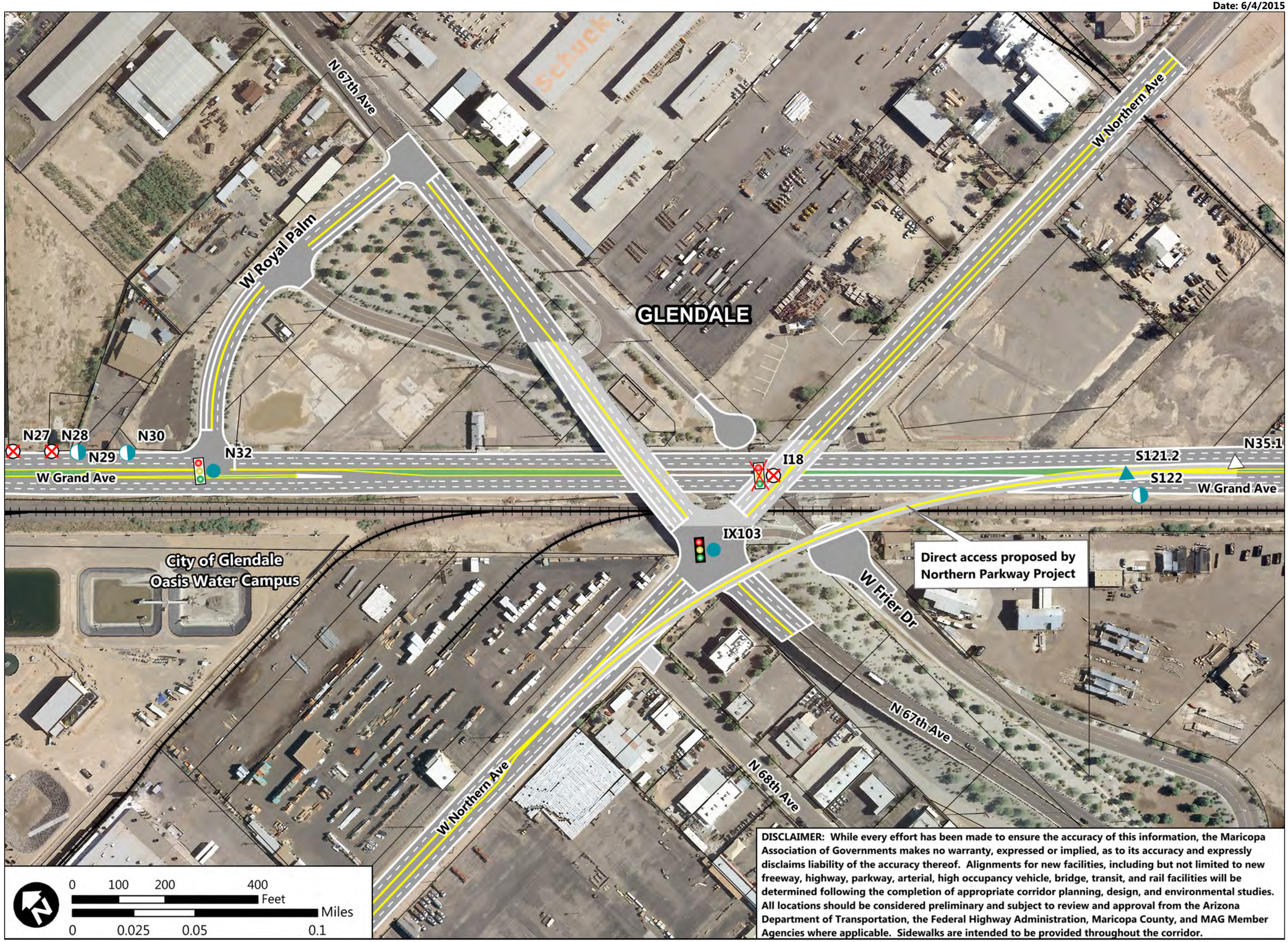
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N27	C	R
N28	C	R
N29	R	R
N30	R	R
N32	F	N
IX103*	F	N
I18	C	R
S122	R	R
N35.1	OF	R
S121.2	ON	R

*IX103 is signal at Northern and 67th



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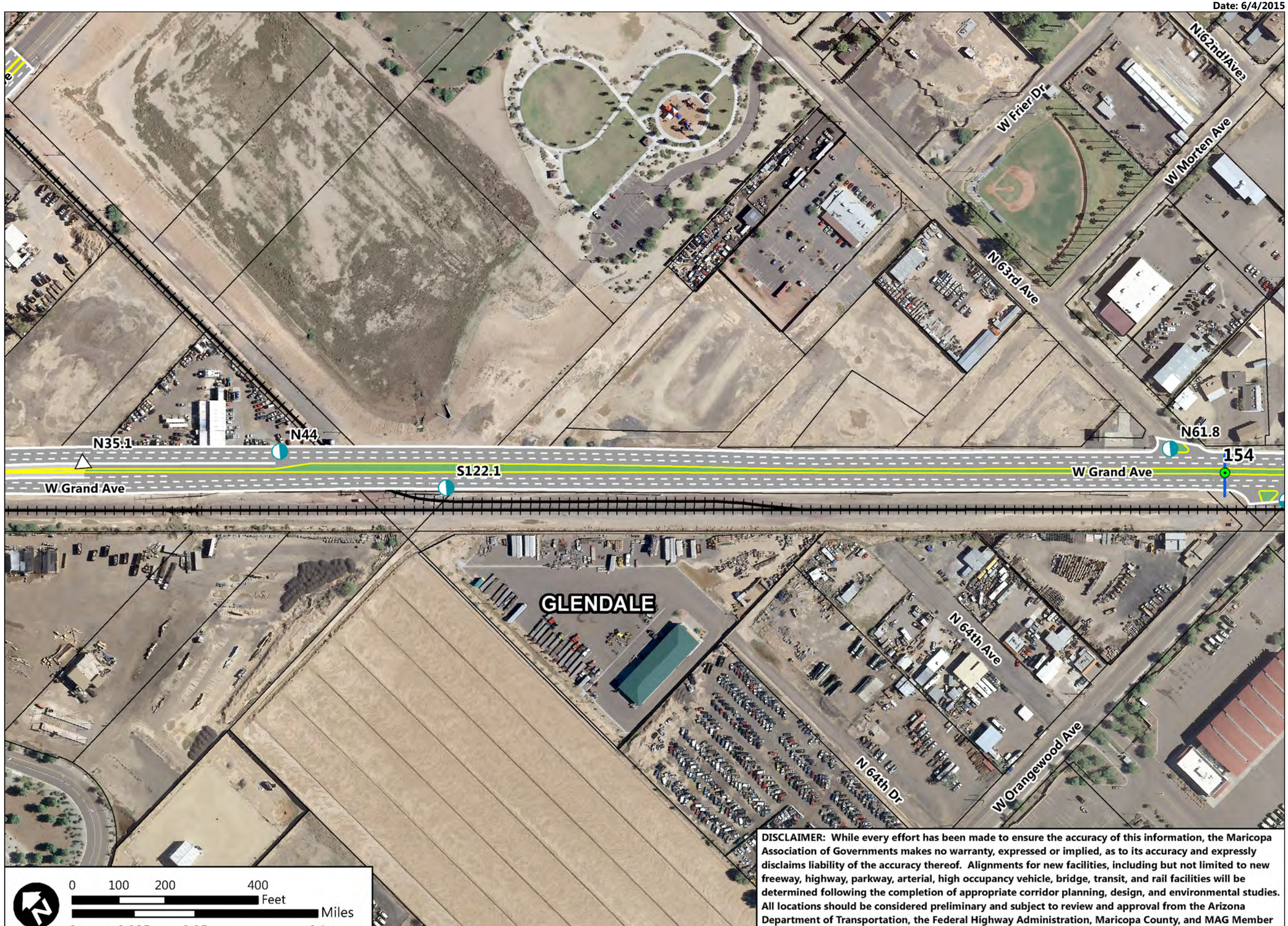
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N44	R	R
S122.1	R	R
N61.8	R	R



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

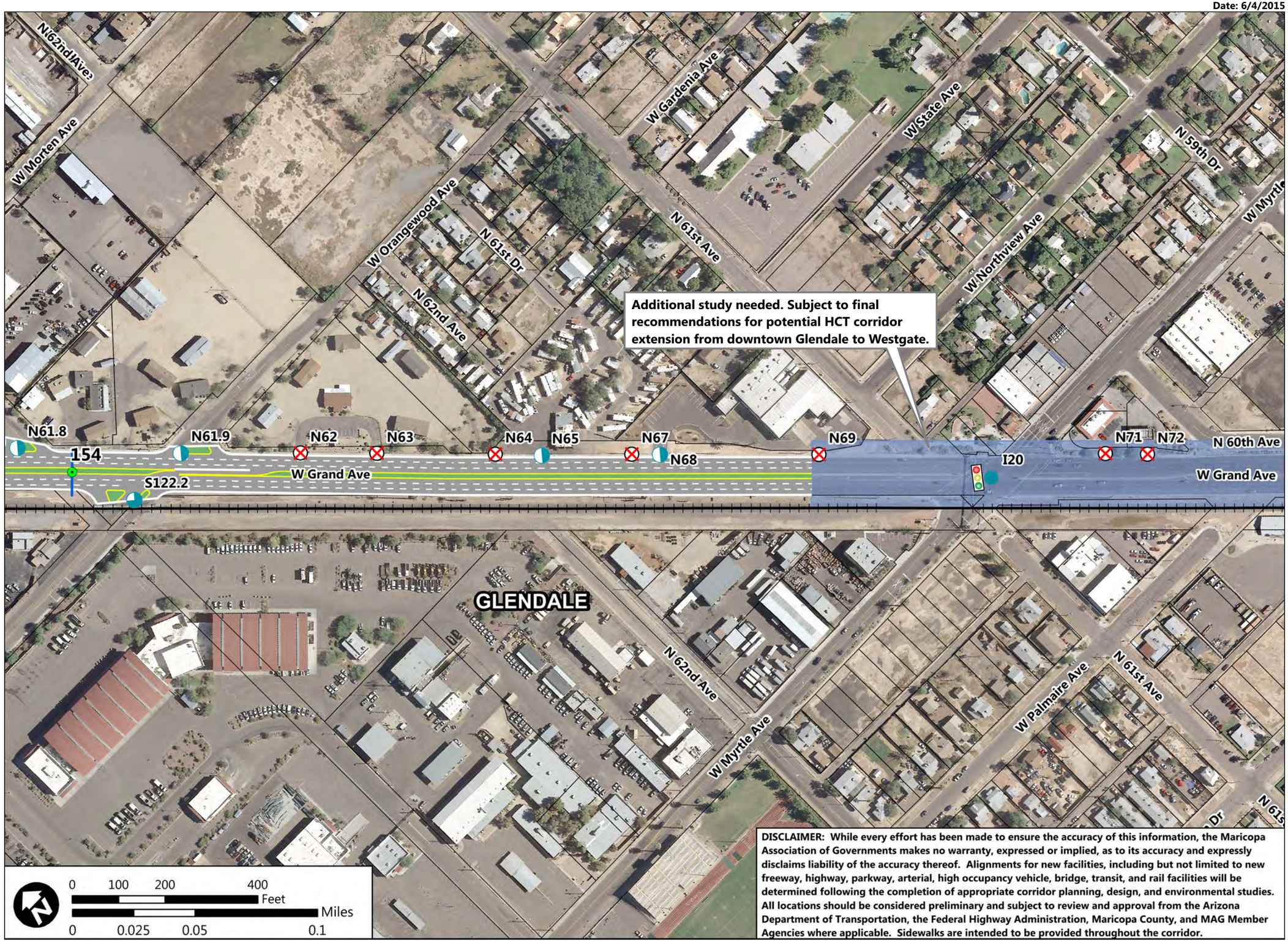
Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N61.8	R	R
S122.2	T	MB1
N61.9	R	R
N62	C	R
N63	C	R
N64	C	R
N65	R	R
N67	C	R
N68	R	R
N69	C	R
I20	F	N
N71	C	R
N72	C	R

I20 does not allow left turns



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COMPASS

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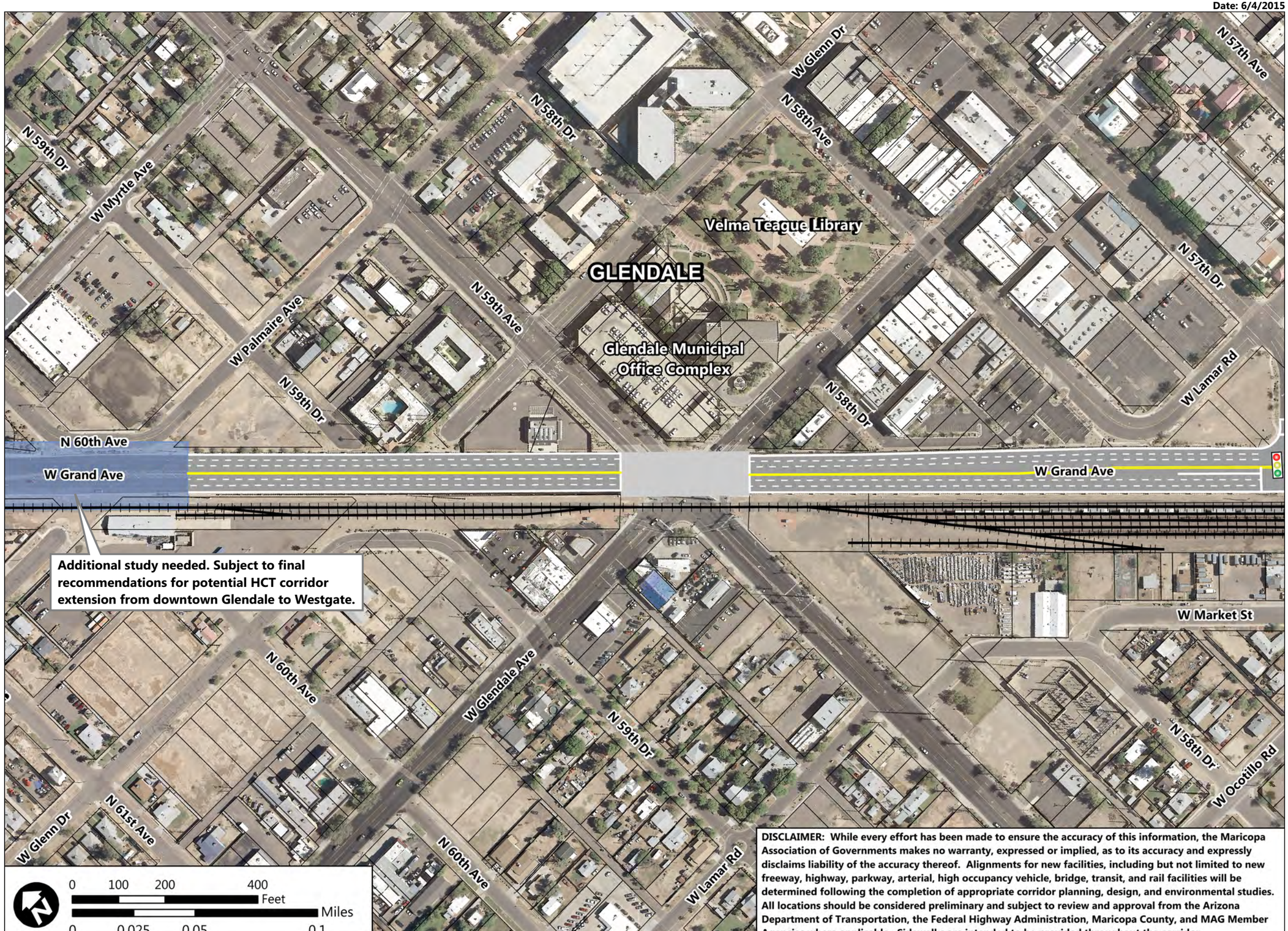
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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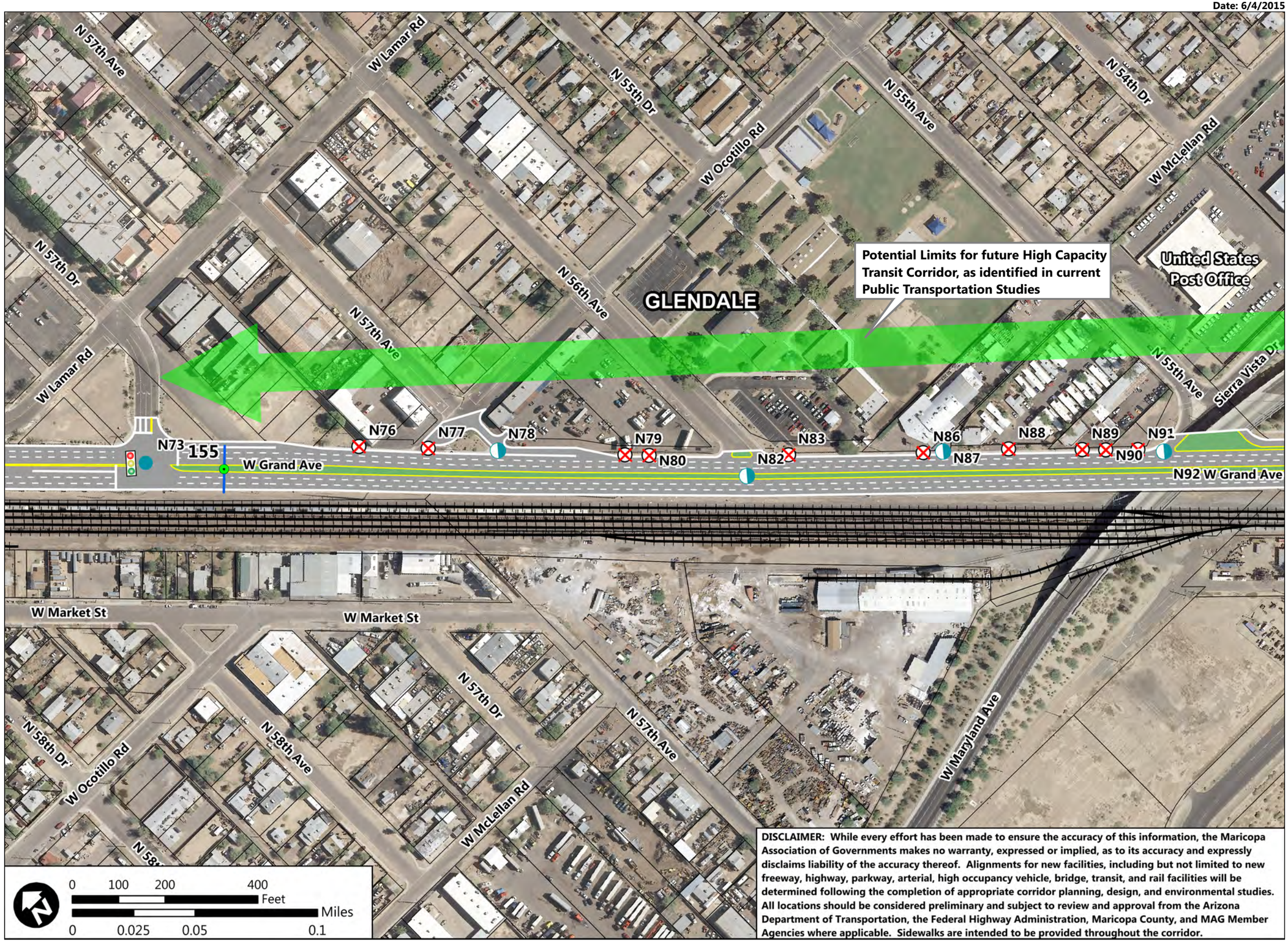
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N73	F	N
N76	C	R
N77	C	R
N78	R	R
N79	C	R
N80	C	R
N82	R	R
N83	C	R
N86	C	R
N87	R	R
N88	C	R
N89	C	R
N90	C	R
N91	C	R
N92*	R	R

*N92 only provides right turn onto Grand



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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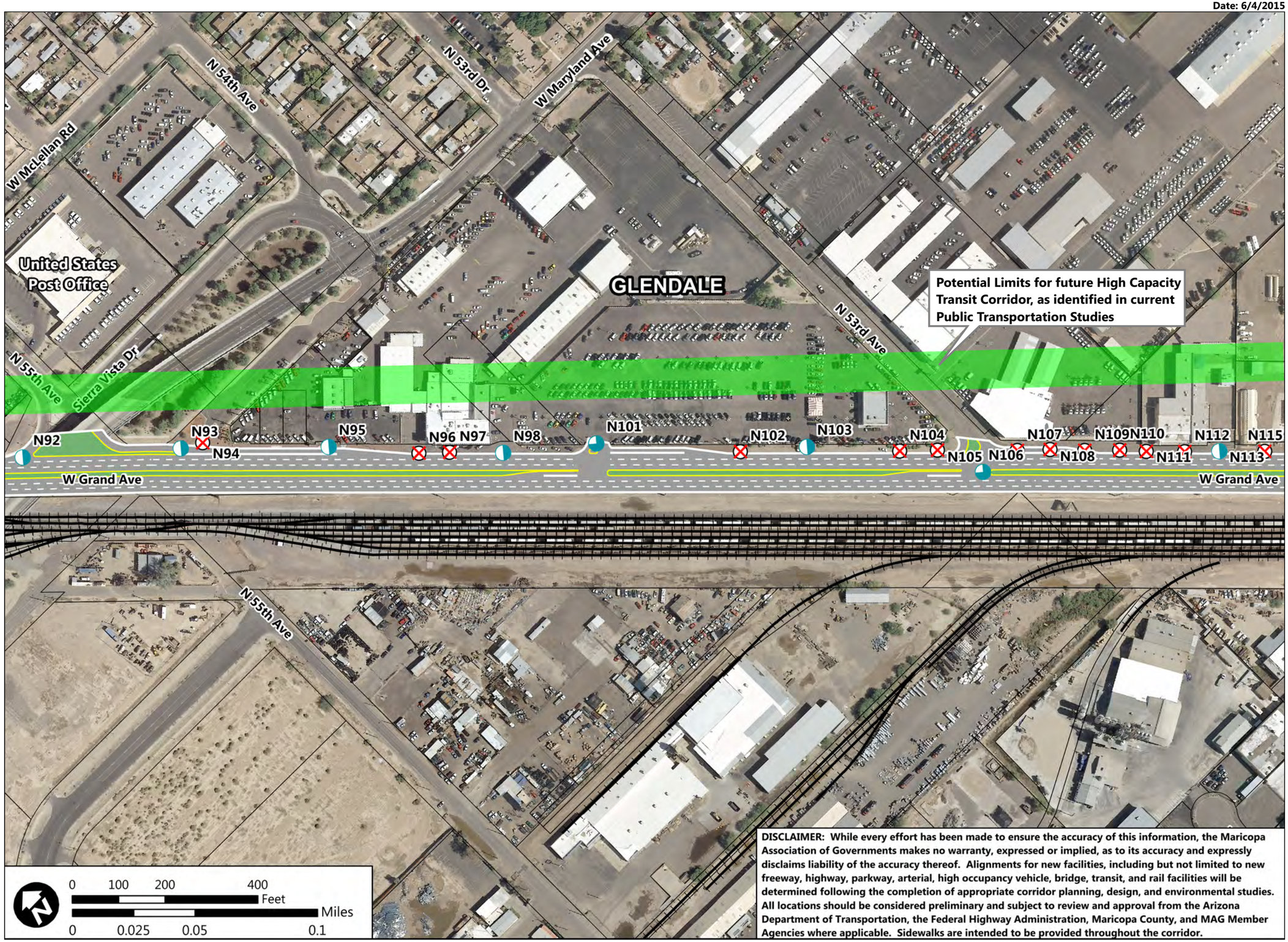
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N92*	R	R
N93**	R	R
N94	C	R
N95	R	R
N96	C	R
N97	C	R
N98	R	R
N101	T	MB1
N102	C	R
N103	R	R
N104	C	R
N105	C	R
N106	T	MB1
N107	C	R
N108	C	R
N109	C	R
N110	C	R
N111	C	R
N112	C	R
N113	R	R
N115	C	R

*N92 only provides right turn onto Grand
**N93 only provides right turn off of Grand



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
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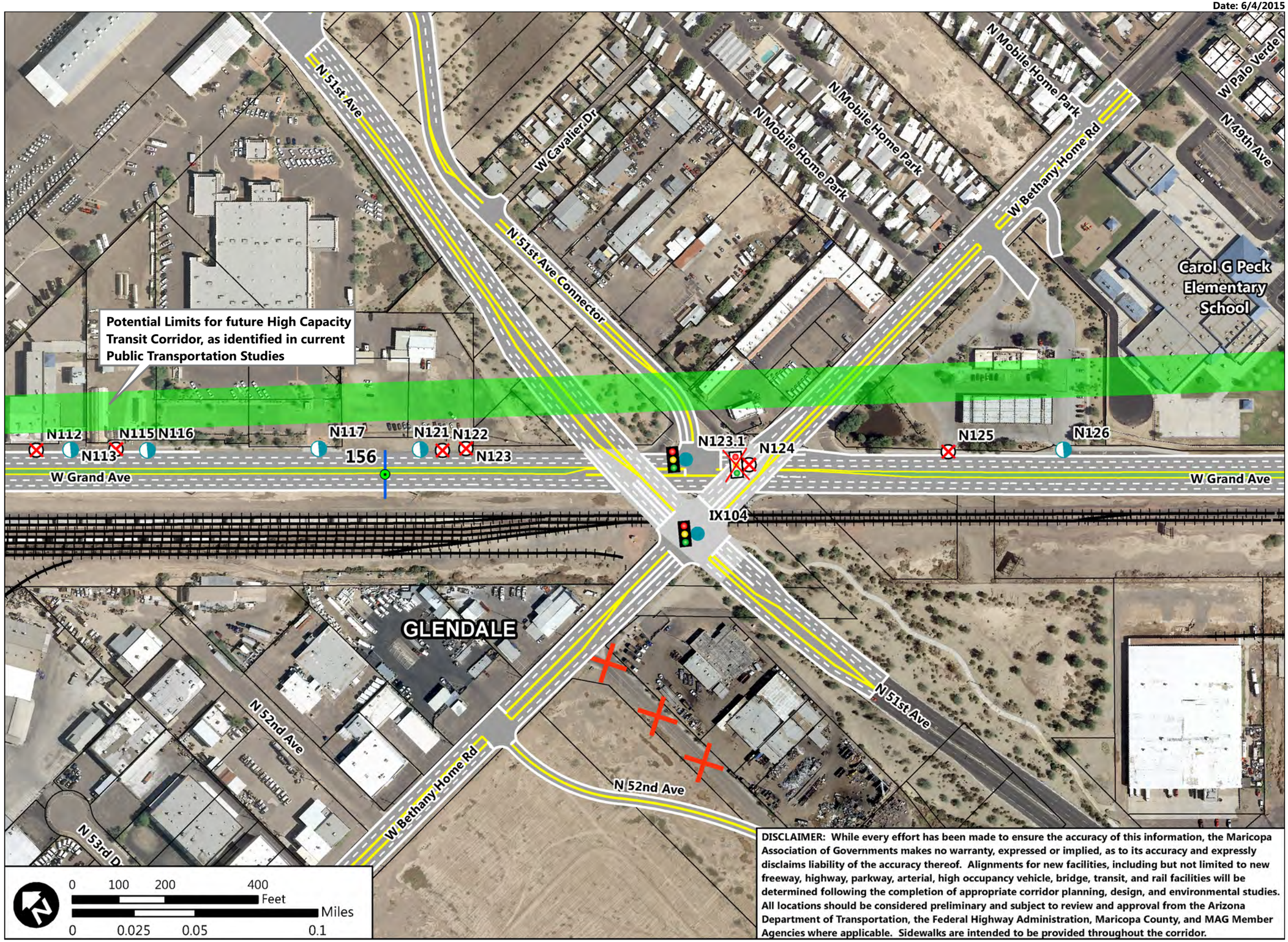
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N112	C	R
N113	R	R
N115	C	R
N116	R	R
N117	R	R
N121	R	R
N122	C	R
N123	C	R
N123.1	F	MB1
N124	C	R
IX104*	F	N
N125	C	R
N126	R	R

*IX104 is full intersection above Grand



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Recommended Disposition of Access		
Access ID	Access Type	Median Type

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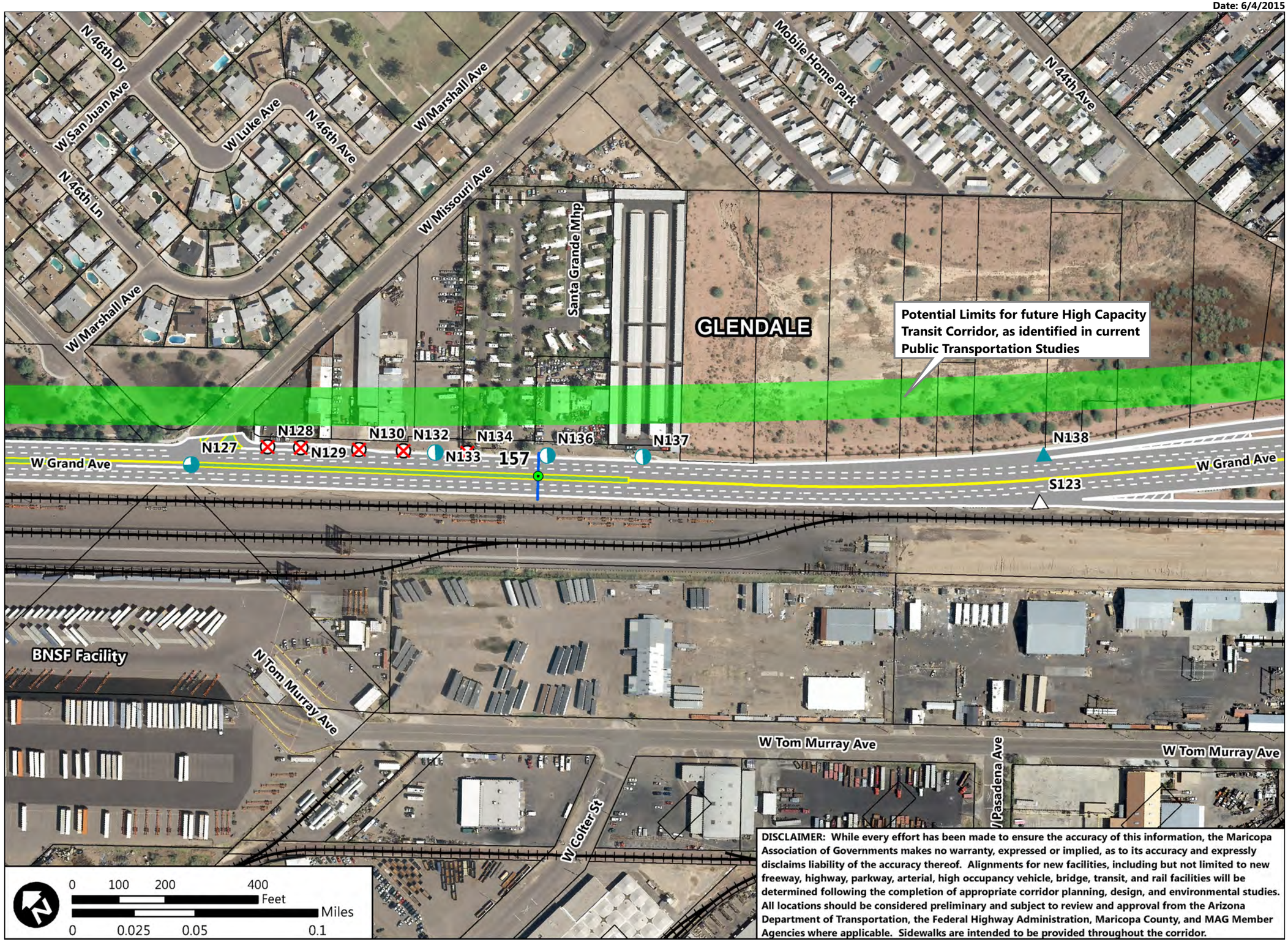
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N127	T	MB1
N128	C	R
N129	C	R
N130	C	R
N132	C	R
N133	R	R
N134	C	R
N136	R	R
N137	R	R
S123	OF	R
N138	ON	R



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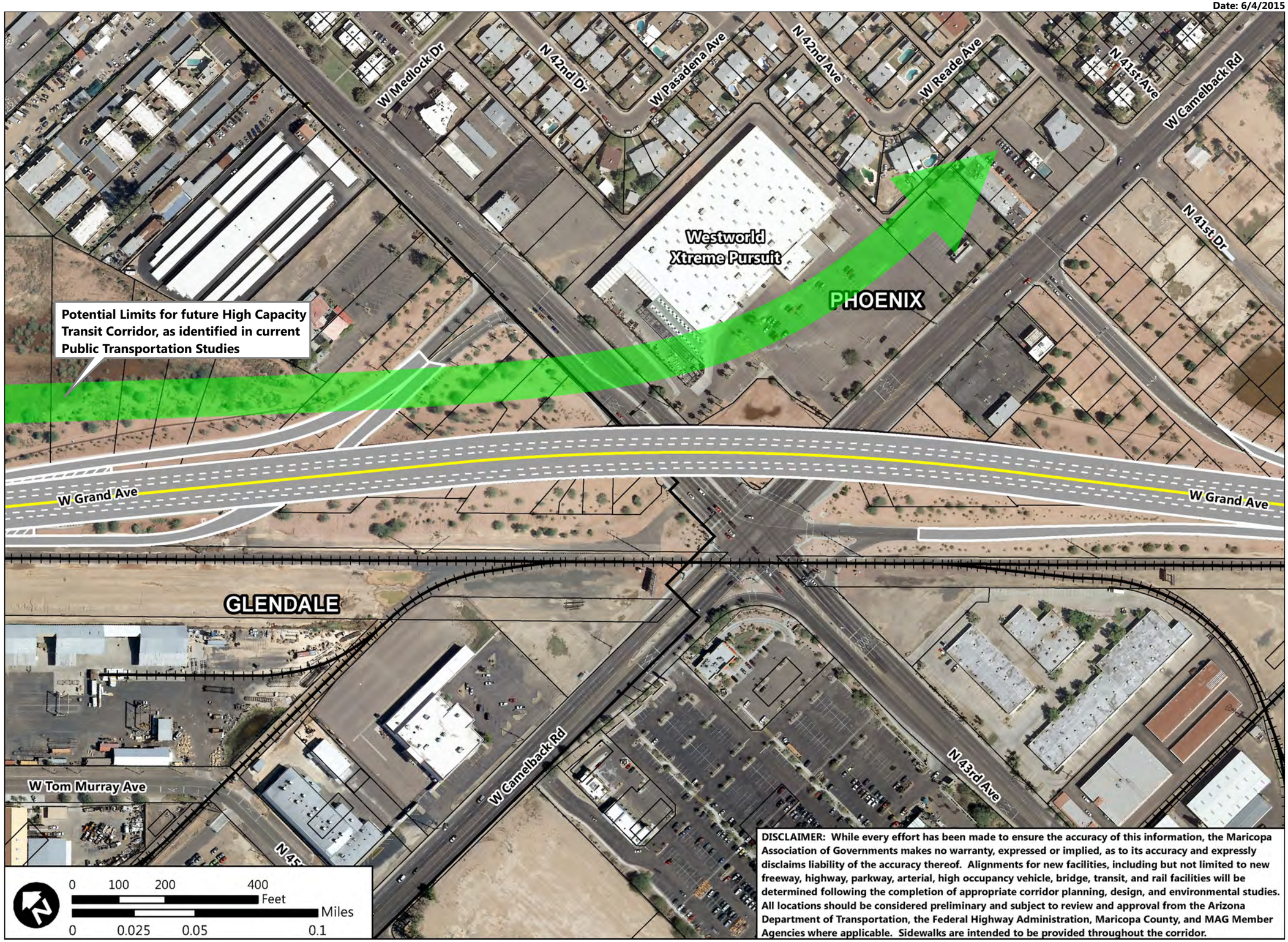
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access		
Access ID	Access Type	Median Type



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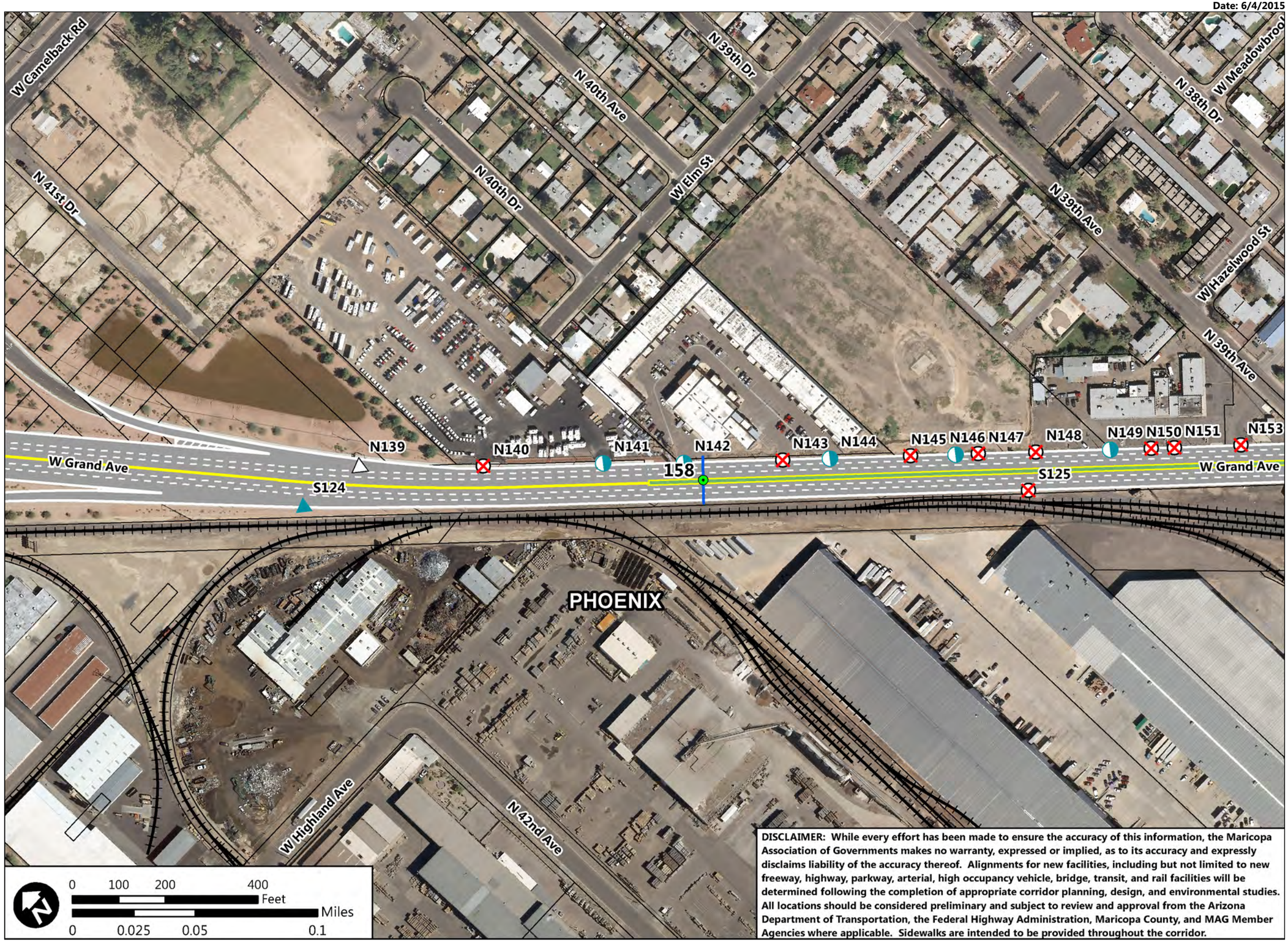
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S124	ON	R
N139	OF	R
N140	C	R
N141	R	R
N142	R	R
N143	C	R
N144	R	R
N145	C	R
N146	R	R
N147	C	R
S125	C	R
N148	C	R
N149	R	R
N150	C	R
N151	C	R
N153	C	R



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US-60/Grand Avenue: Loop 303 to Interstate 10

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- Right-In Right-Out Access
- Close Access
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- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N150	C	R
N151	C	R
N153	C	R
S126	C	R
N154	R	R
N155	C	R
S127	C	R
S128	C	R
S129	C	R
N157	R	R
S130	R	R
N158	R	R
N159	C	R
N160	R	R
N161	C	R
S131	C	R
N162	R	R
N163	C	R
N164	C	R
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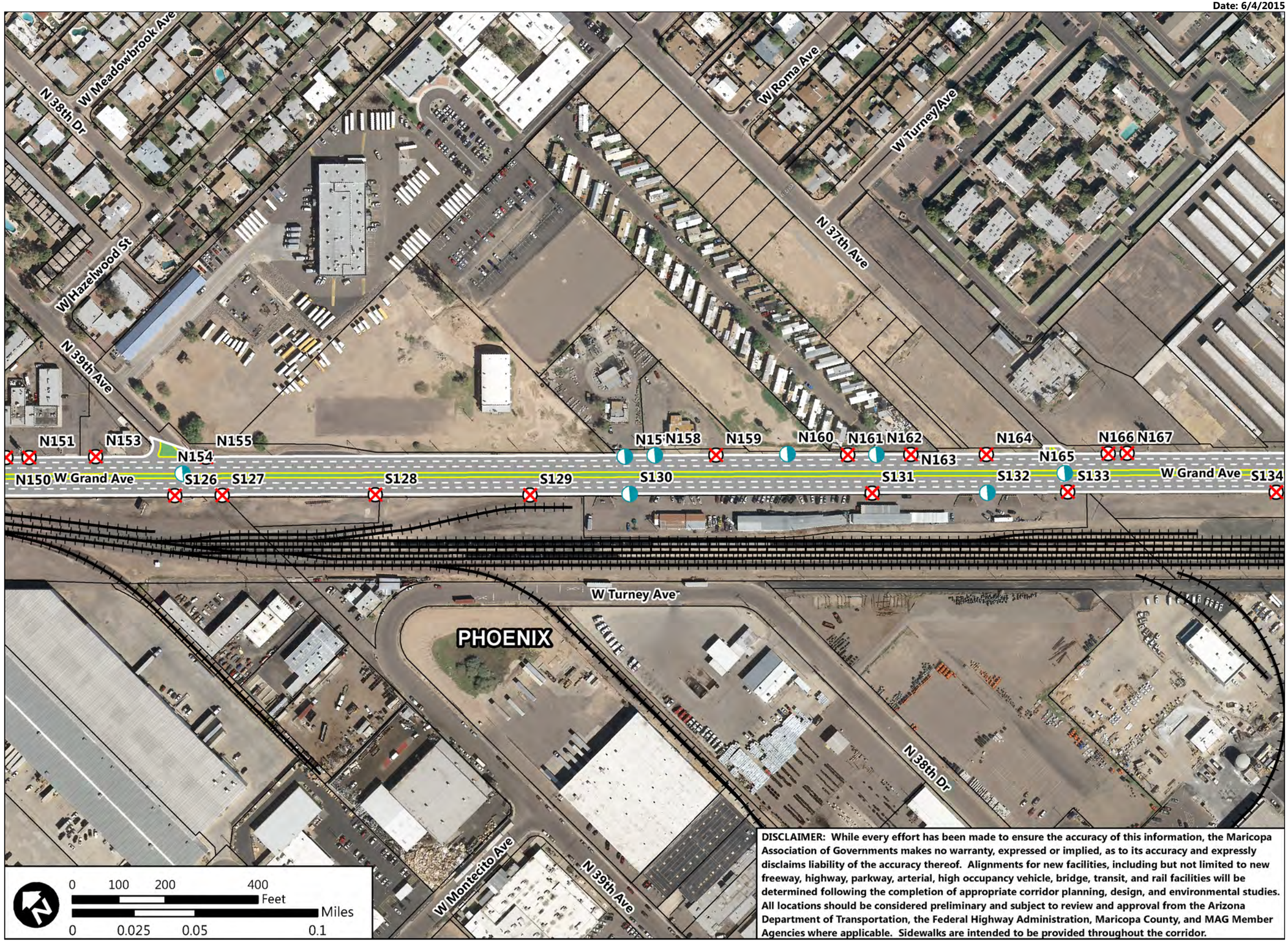
N165	R	R
S133	C	R
N166	C	R
N167	C	R
S134	C	R



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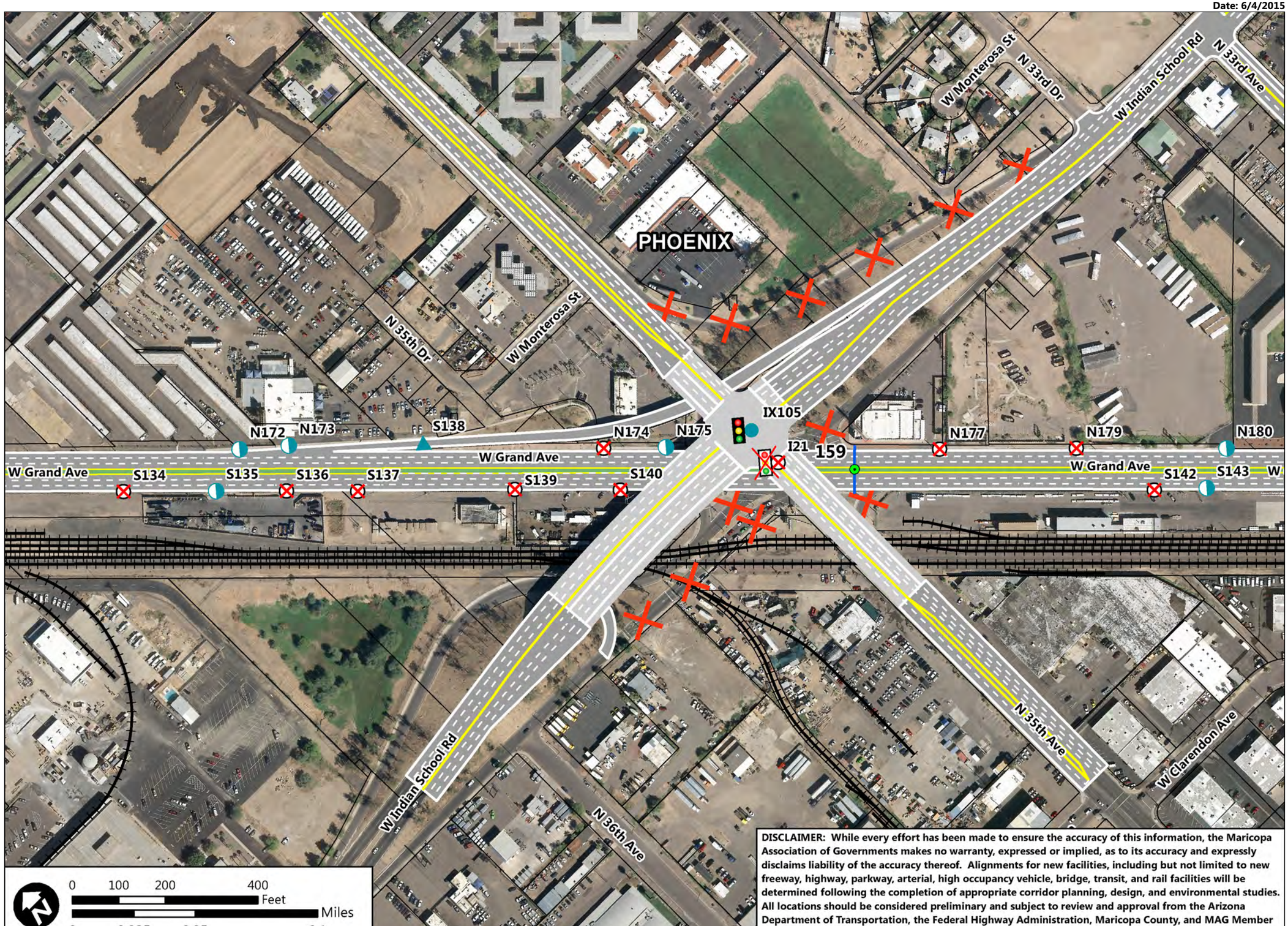
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S134	C	R
S135	R	R
N172	R	R
S136	C	R
N173	R	R
S137	C	R
S138	ON	R
S139	C	D
N174	C	R
S140	C	R
S140.1	OF	R
N175	R	R
IX105*	F	N
I21	C	R
N177	C	R
N179	C	R
S142	C	R
S143	R	R
N180	R	R

*IX105 is Indian School and 35th above Grand



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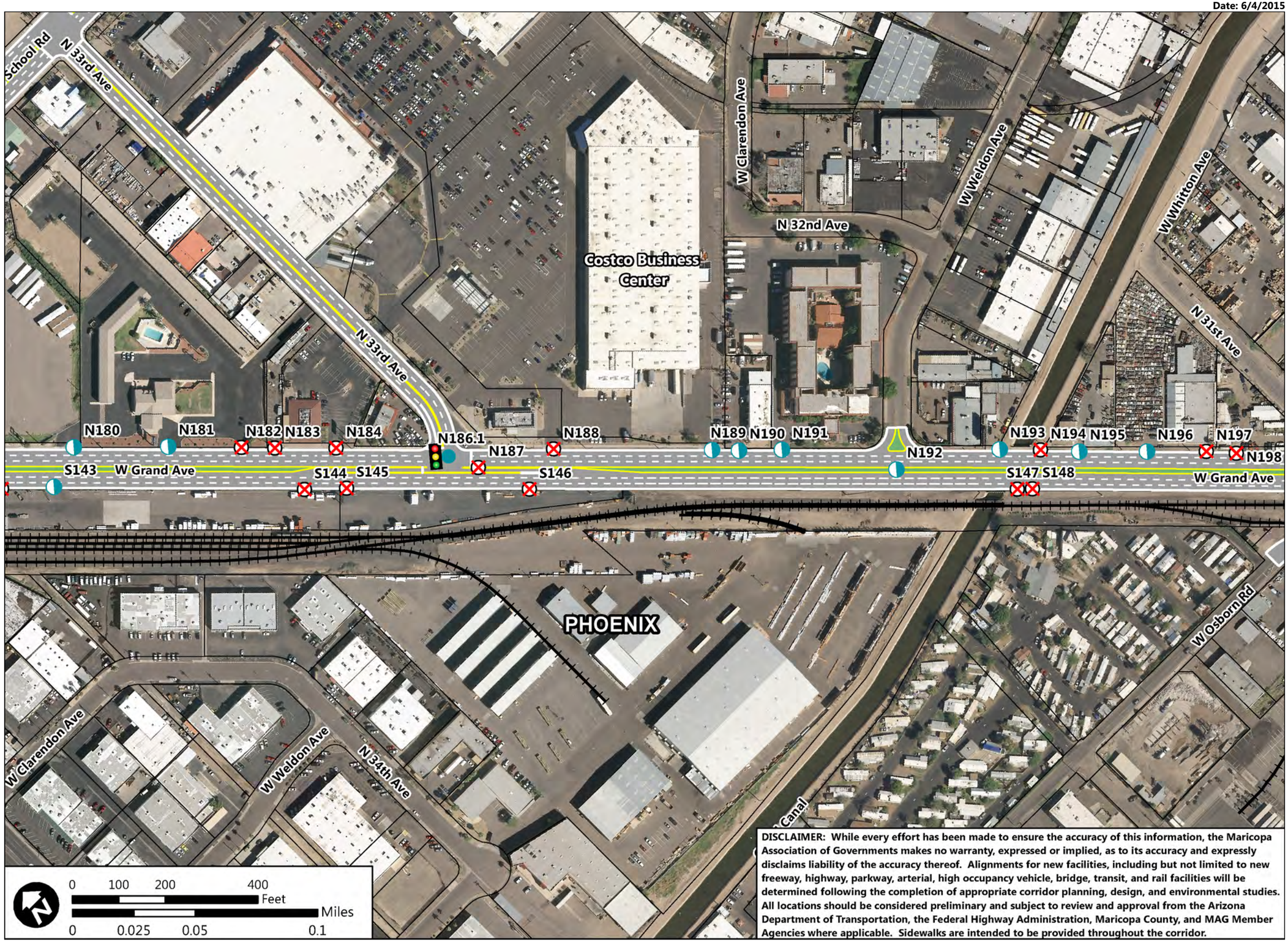
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S143	R	R
N180	R	R
N181	R	R
N182	C	R
N183	C	R
S144	C	R
N184	C	R
S145	C	R
N186.1	F	MB1
N187	C	R
S146	C	R
N188	C	R
N189	R	R
N190	R	R
N191	R	R
N192	R	R
N193	R	R
S147	C	R
S148	C	R
N194	C	R
N195	R	R
N196	R	R
N197	C	R
N198	C	R



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- Close Access
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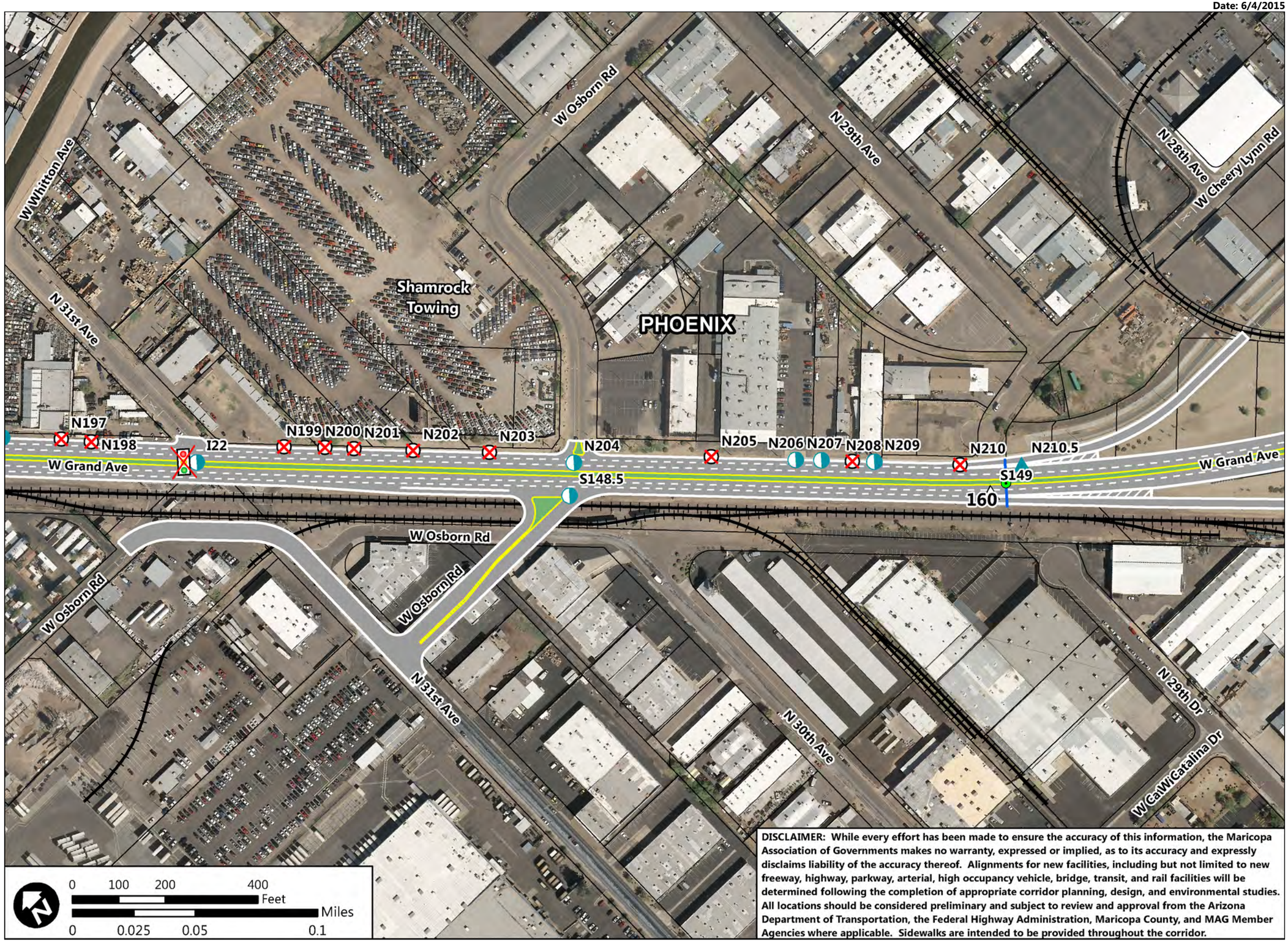
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N197	C	R
N198	C	R
I22	R	R
N199	C	R
N200	C	R
N201	C	R
N202	C	R
N203	C	R
S148.5	R	R
N204	R	R
N205	C	R
N206	R	R
N207	R	R
N208	C	R
N209	R	R
N210	C	R
S149	OF	R
N210.5	ON	R



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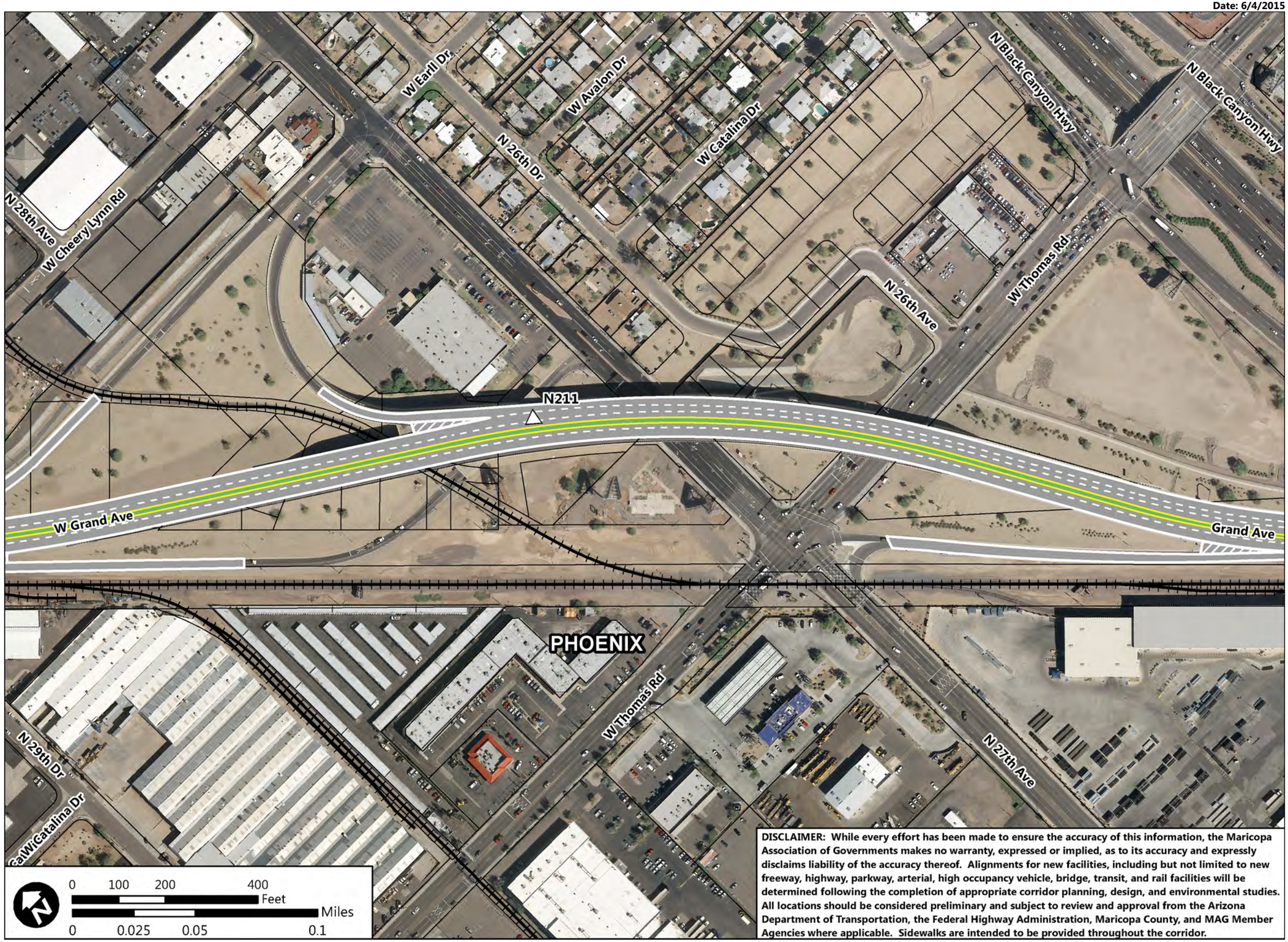
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N211	OF	R



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COMPASS

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US-60/Grand Avenue: Loop 303 to Interstate 10

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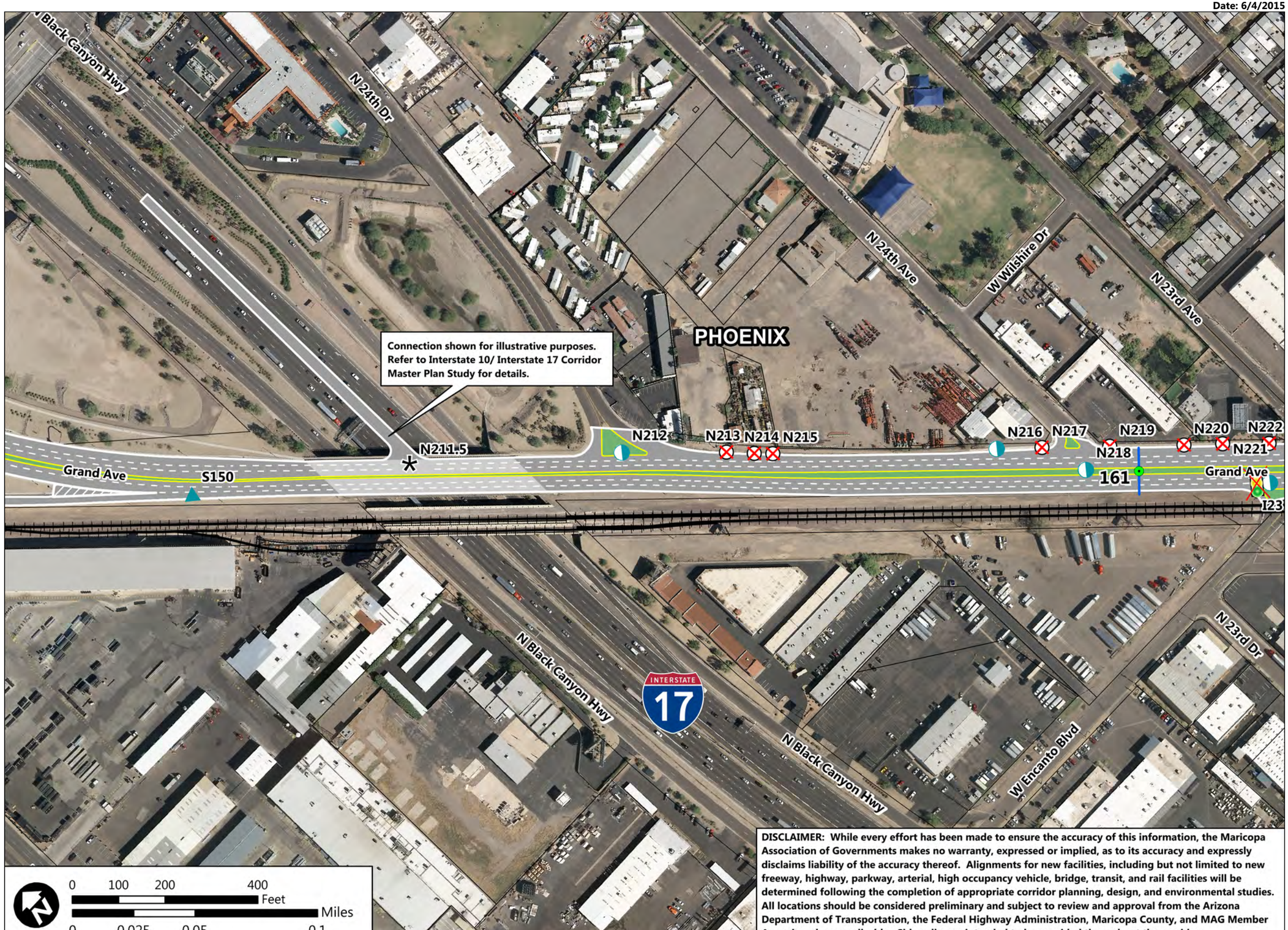
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S150	ON	R
N211.5*	*	*
N212	R	R
N213	C	R
N214	C	R
N215	C	R
N216	R	R
N217	C	R
N218	R	R
N219	C	R
N220	C	R
N221	C	R
N222	C	R

*N211.5 may provide access to I-17. See Interstate 10/Interstate 17 Corridor Master Plan Study



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

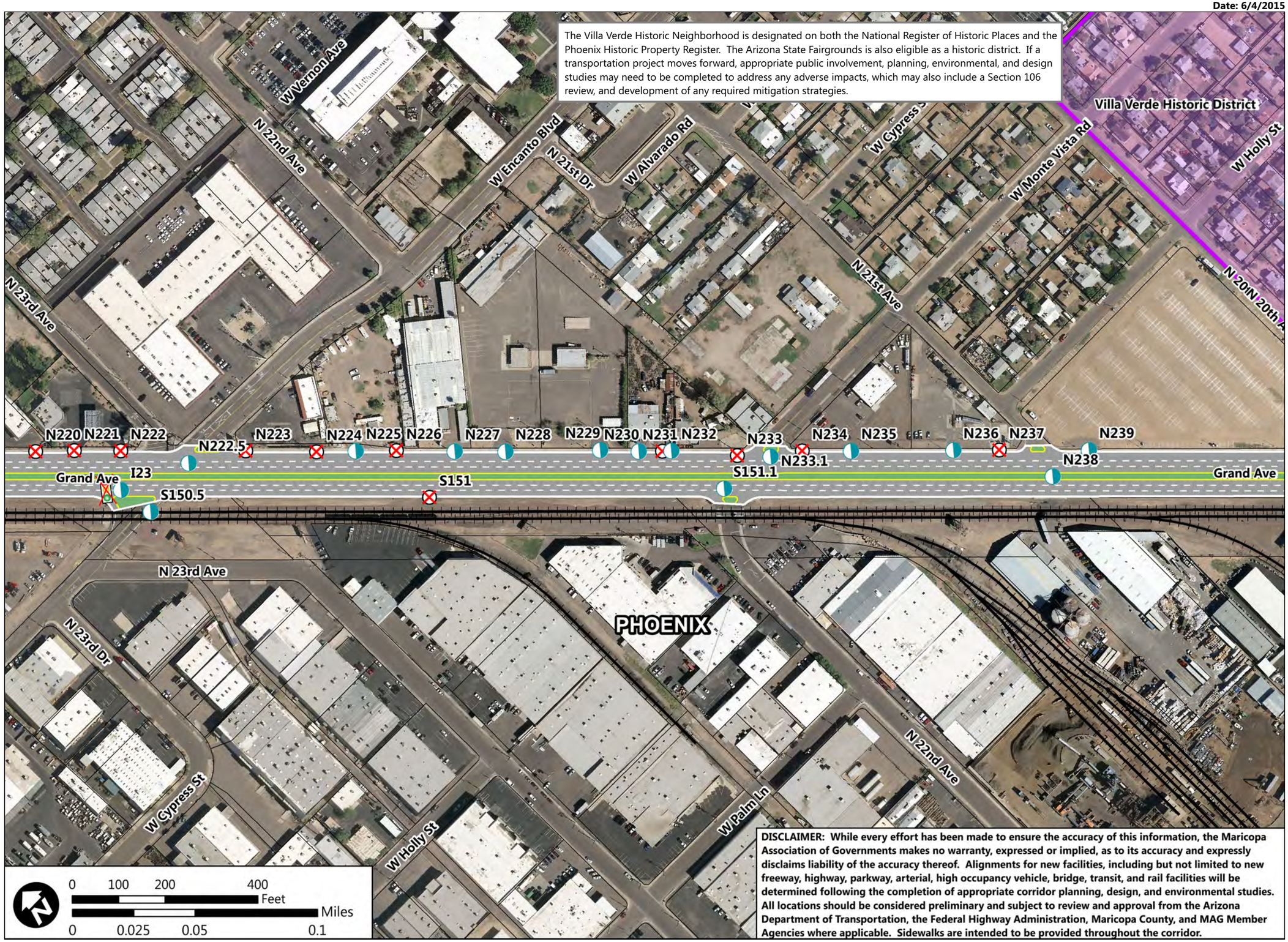
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N220	C	R
N221	C	R
N222	C	R
I23	R	R
S150.5	R	R
N222.5	R	R
N223	C	R
N224	C	R
N225	R	R
N226	C	R
S151	C	R
N227	R	R
N228	R	R
N229	R	R
N230	R	R
N231	C	R
N232	R	R
S151.1	R	R
N233	C	R
N233.1	R	R
N234	C	R
N235	R	R
N236	R	R
N237	C	R
N238	R	R
N239	R	R



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
- ADOT Mile Post
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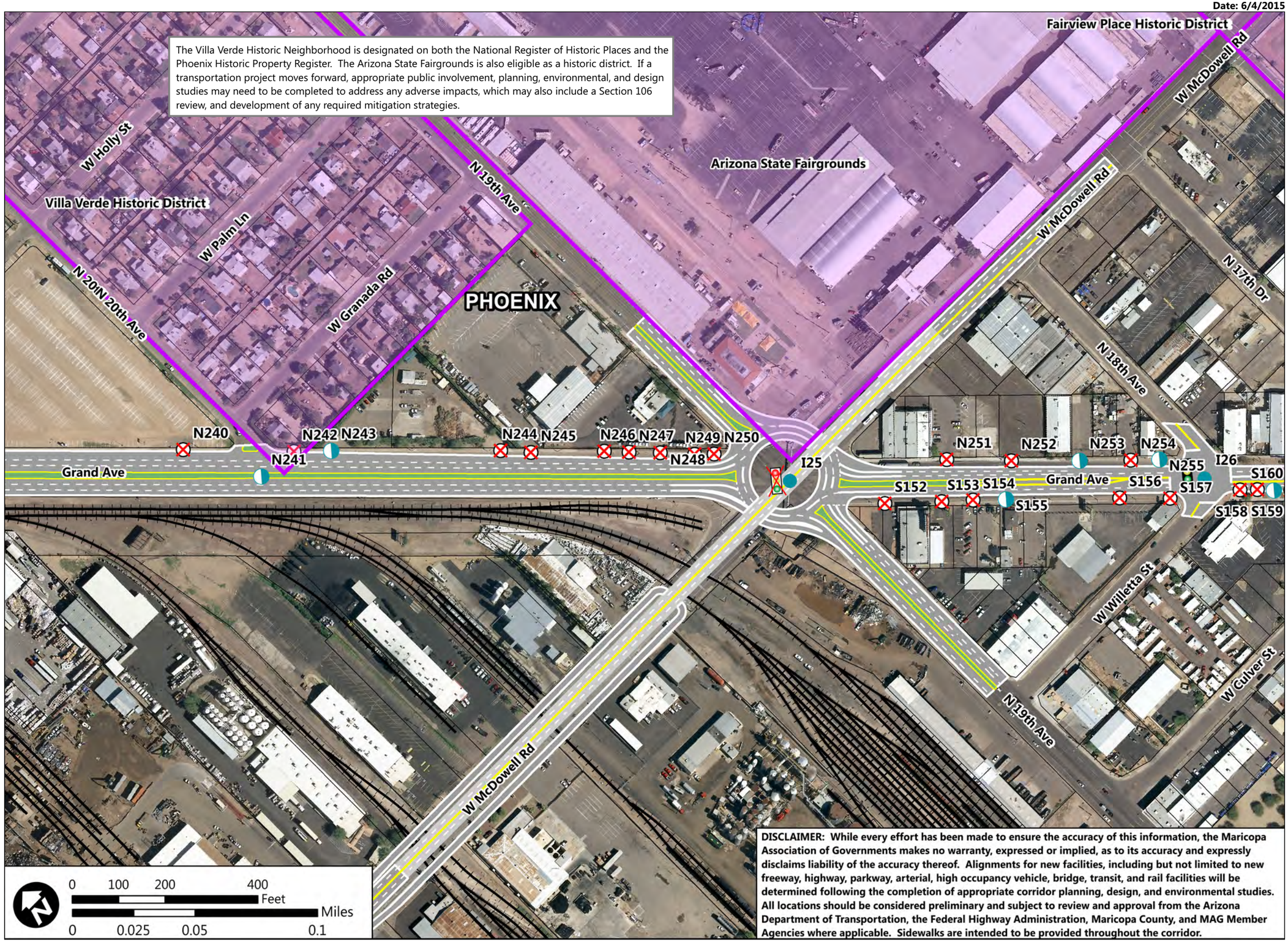
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N240	C	R
N241	R	R
N242	C	R
N243	R	R
N244	C	R
N245	C	R
N246	C	R
N247	C	R
N248	C	R
N249	C	R
N250	C	R
I25*	F	R
S152	C	R
S153	C	R
N251	C	R
S154	C	R
S155	R	N
N252	C	N
N253	R	N
S156	C	D
N254	C	D
N255	R	D
S157	C	D
I26	F	D
S158	C	D
S159	C	D
S160	R	D

*I25 is a roundabout. No access to McDowell



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Date: 6/4/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

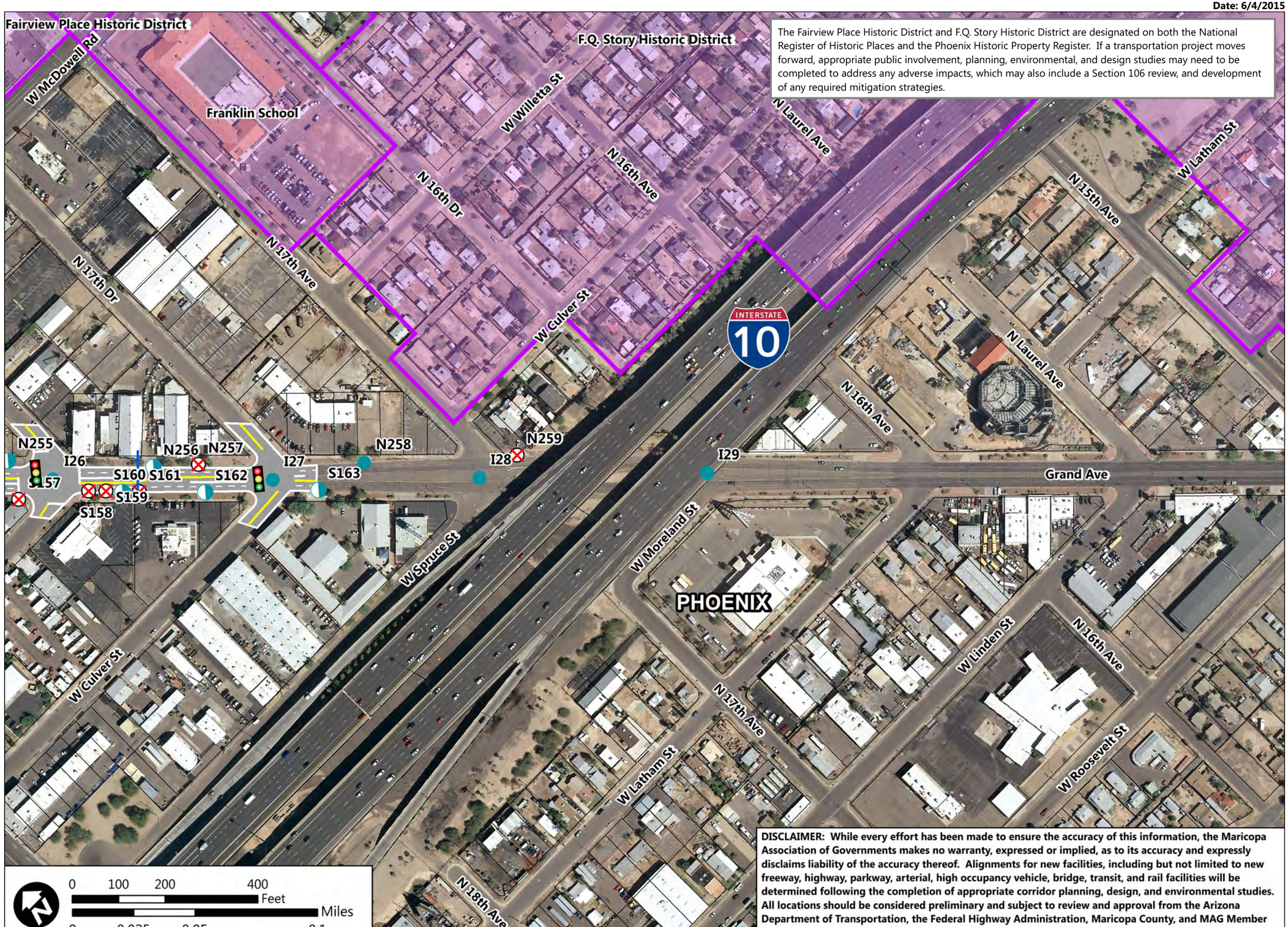
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N255	R	D
S157	C	D
I26	F	D
S158	C	D
S159	C	D
S160	R	D
S161	C	TW
N256	R	TW
N257	C	TW
S162	R	D
I27	F	N
S163	R	D
N258	F	TW
I28	F	N
N259	C	R
I29	F	R



The Fairview Place Historic District and F.Q. Story Historic District are designated on both the National Register of Historic Places and the Phoenix Historic Property Register. If a transportation project moves forward, appropriate public involvement, planning, environmental, and design studies may need to be completed to address any adverse impacts, which may also include a Section 106 review, and development of any required mitigation strategies.

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APPENDIX TM6-2

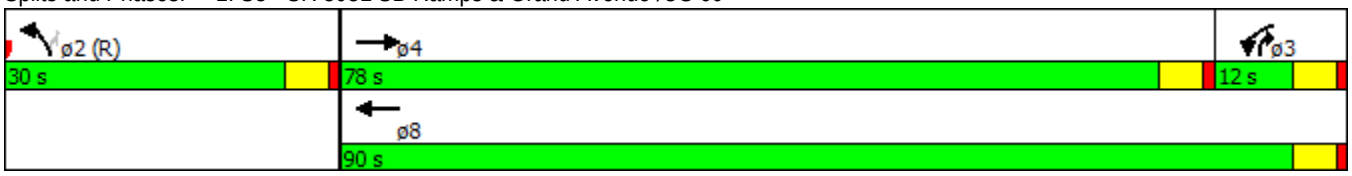
Traffic Operations

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2900	3000	180	1760	640	150
Turn Type	NA	Free	Prot	NA	Prot	pm+ov
Protected Phases	4		3	8	2	3
Permitted Phases		Free				2
Detector Phase	4		3	8	2	3
Switch Phase						
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		12.0	21.0	21.0	12.0
Total Split (s)	78.0		12.0	90.0	30.0	12.0
Total Split (%)	65.0%		10.0%	75.0%	25.0%	10.0%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag			Lag
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None		None	None	C-Max	None
Act Effct Green (s)	73.0	120.0	7.0	85.0	25.0	37.0
Actuated g/C Ratio	0.61	1.00	0.06	0.71	0.21	0.31
v/c Ratio	1.02	2.06	0.98	0.53	0.97	0.33
Control Delay	45.1	494.2	115.3	8.8	75.2	34.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.1	494.2	115.3	8.8	75.2	34.2
LOS	D	F	F	A	E	C
Approach Delay	273.5			18.7	67.4	
Approach LOS	F			B	E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 2.06
Intersection Signal Delay: 197.3 Intersection LOS: F
Intersection Capacity Utilization 91.9% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 1: S3 - SR 303L SB Ramps & Grand Avenue /US 60

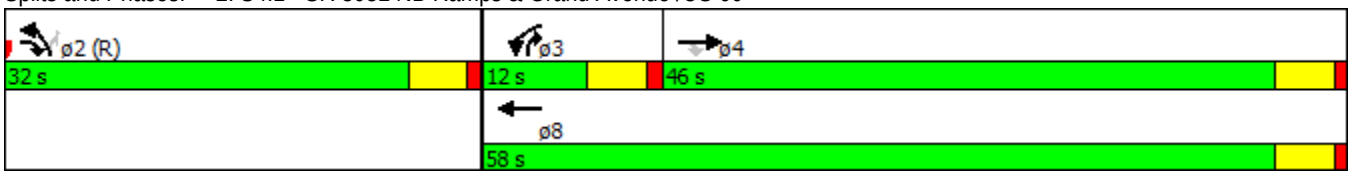


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2250	800	50	980	960	230
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	4	2	3	8	2	3
Permitted Phases		4				2
Detector Phase	4	2	3	8	2	3
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	12.0	21.0	21.0	12.0
Total Split (s)	46.0	32.0	12.0	58.0	32.0	12.0
Total Split (%)	51.1%	35.6%	13.3%	64.4%	35.6%	13.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None	C-Max	None	None	C-Max	None
Act Effct Green (s)	41.4	73.4	6.6	53.0	27.0	38.6
Actuated g/C Ratio	0.46	0.82	0.07	0.59	0.30	0.43
v/c Ratio	1.05	0.63	0.22	0.36	1.01	0.37
Control Delay	57.2	3.6	58.4	4.7	64.1	19.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.2	3.6	58.4	4.7	64.1	19.2
LOS	E	A	E	A	E	B
Approach Delay	43.1			7.3	55.4	
Approach LOS	D			A	E	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 36 (40%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 38.9 Intersection LOS: D
Intersection Capacity Utilization 79.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: S4.1 - SR 303L NB Ramps & Grand Avenue /US 60

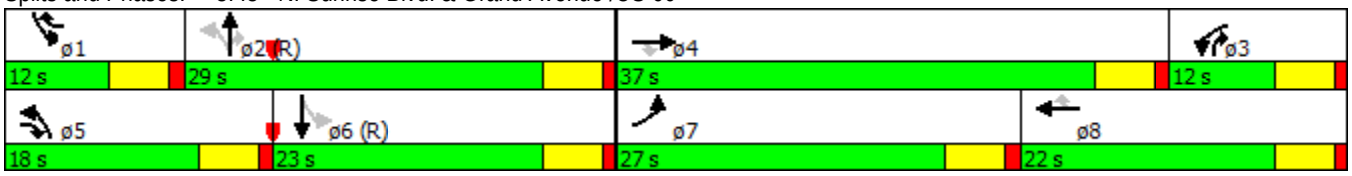


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	540	1710	50	200	510	30	340	490	140	30	540
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA
Protected Phases	7	4	5	3	8	1	5	2	3	1	6
Permitted Phases			4			8	2		2	6	
Detector Phase	7	4	5	3	8	1	5	2	3	1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0
Total Split (s)	27.0	37.0	18.0	12.0	22.0	12.0	18.0	29.0	12.0	12.0	23.0
Total Split (%)	30.0%	41.1%	20.0%	13.3%	24.4%	13.3%	20.0%	32.2%	13.3%	13.3%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max
Act Effct Green (s)	19.7	32.0	45.0	7.0	19.3	30.7	36.0	28.9	37.9	24.4	18.0
Actuated g/C Ratio	0.22	0.36	0.50	0.08	0.21	0.34	0.40	0.32	0.42	0.27	0.20
v/c Ratio	0.78	1.03	0.06	0.81	0.51	0.05	1.09	0.47	0.20	0.11	1.07
Control Delay	26.5	31.7	0.5	65.1	33.6	0.2	101.5	27.4	2.8	18.3	87.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.5	31.7	0.5	65.1	33.6	0.2	101.5	27.4	2.8	18.3	87.0
LOS	C	C	A	E	C	A	F	C	A	B	F
Approach Delay		29.8			40.7			49.8			84.2
Approach LOS		C			D			D			F

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 44.0 Intersection LOS: D
Intersection Capacity Utilization 94.3% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: I3 - N. Sunrise Blvd. & Grand Avenue /US 60

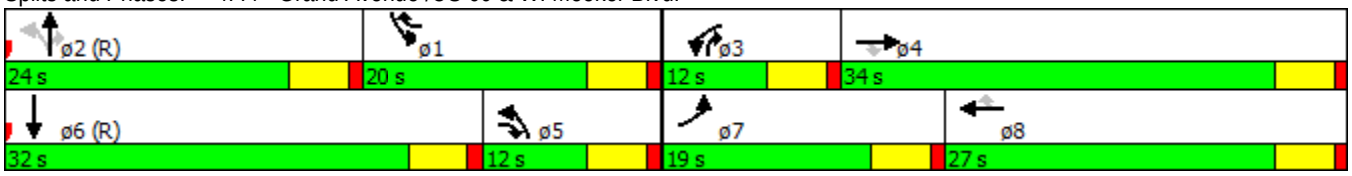


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	320	1410	140	140	480	460	130	500	150	330	280
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA
Protected Phases	7	4	5	3	8	1	5	2	3	1	6
Permitted Phases			4			8	2		2		
Detector Phase	7	4	5	3	8	1	5	2	3	1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0
Total Split (s)	19.0	34.0	12.0	12.0	27.0	20.0	12.0	24.0	12.0	20.0	32.0
Total Split (%)	21.1%	37.8%	13.3%	13.3%	30.0%	22.2%	13.3%	26.7%	13.3%	22.2%	35.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max
Act Effct Green (s)	13.0	29.3	35.9	7.1	23.4	38.0	25.6	19.0	26.1	14.6	27.0
Actuated g/C Ratio	0.14	0.33	0.40	0.08	0.26	0.42	0.28	0.21	0.29	0.16	0.30
v/c Ratio	0.70	0.93	0.21	0.56	0.40	0.67	0.45	0.73	0.27	0.64	0.34
Control Delay	44.6	40.6	2.5	48.4	28.9	12.7	23.8	39.6	2.0	41.2	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.6	40.6	2.5	48.4	28.9	12.7	23.8	39.6	2.0	41.2	24.0
LOS	D	D	A	D	C	B	C	D	A	D	C
Approach Delay		38.4			24.5			29.7			32.6
Approach LOS		D			C			C			C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 32.6 Intersection LOS: C
Intersection Capacity Utilization 71.1% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: I4 - Grand Avenue /US 60 & W. Meeker Blvd.

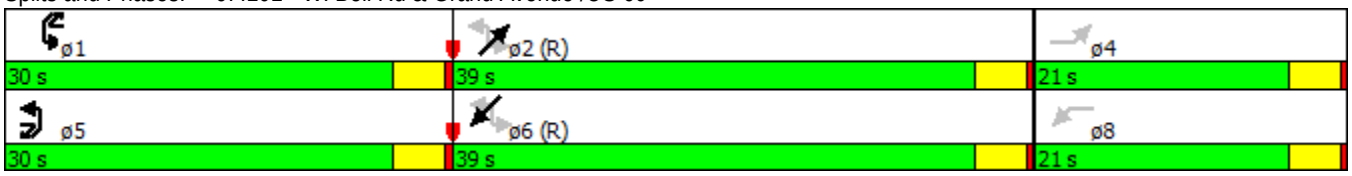


Lane Group	EBL	EBR	WBL	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations										
Volume (vph)	60	260	100	280	270	710	20	310	940	50
Turn Type	Perm	Over	Perm	Over	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		5		1	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	5	8	1	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	12.0	20.0	12.0	12.0	20.0	20.0	12.0	20.0	20.0
Total Split (s)	21.0	30.0	21.0	30.0	30.0	39.0	39.0	30.0	39.0	39.0
Total Split (%)	23.3%	33.3%	23.3%	33.3%	33.3%	43.3%	43.3%	33.3%	43.3%	43.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag		Lead		Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	8.1	12.1	8.2	12.7	71.2	59.1	59.1	72.4	59.7	59.7
Actuated g/C Ratio	0.09	0.13	0.09	0.14	0.79	0.66	0.66	0.80	0.66	0.66
v/c Ratio	0.21	0.75	0.35	0.65	0.54	0.23	0.02	0.51	0.30	0.05
Control Delay	38.8	25.0	41.0	12.5	6.1	7.9	0.1	4.9	8.2	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.8	25.0	41.0	12.5	6.1	7.9	0.1	4.9	8.2	2.6
LOS	D	C	D	B	A	A	A	A	A	A
Approach Delay						7.3			7.2	
Approach LOS						A			A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NETL and 6:SWTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 11.0 Intersection LOS: B
Intersection Capacity Utilization 47.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 9: I101 - W. Bell Rd & Grand Avenue /US 60

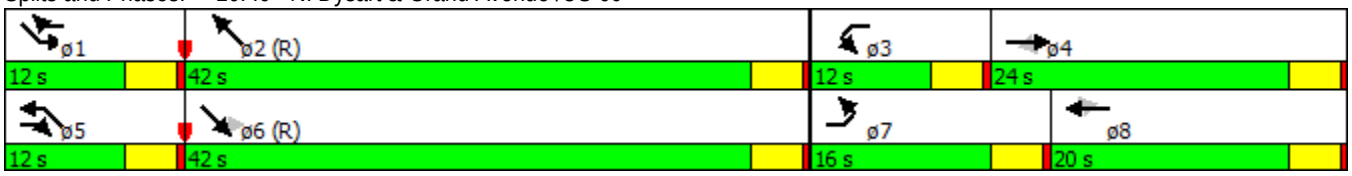


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	400	670	190	10	530	260	180	1000	350	110	1230	10
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	Free	Prot	NA	Free
Protected Phases	7	4	5	3	8	1	1	6		5	2	
Permitted Phases			4			8	6		Free			Free
Detector Phase	7	4	5	3	8	1	1	6		5	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	12.0	20.0	12.0	12.0	20.0	12.0	12.0	20.0		12.0	20.0	
Total Split (s)	16.0	24.0	12.0	12.0	20.0	12.0	12.0	42.0		12.0	42.0	
Total Split (%)	17.8%	26.7%	13.3%	13.3%	22.2%	13.3%	13.3%	46.7%		13.3%	46.7%	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)	12.0	28.9	40.5	5.8	15.0	27.3	47.8	39.5	90.0	7.6	38.7	90.0
Actuated g/C Ratio	0.13	0.32	0.45	0.06	0.17	0.30	0.53	0.44	1.00	0.08	0.43	1.00
v/c Ratio	0.95	0.45	0.25	0.05	0.68	0.54	0.77	0.70	0.24	0.42	0.88	0.01
Control Delay	72.0	25.7	4.2	52.7	27.3	10.2	38.3	23.9	0.4	43.6	32.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.0	25.7	4.2	52.7	27.3	10.2	38.3	23.9	0.4	43.6	32.0	0.0
LOS	E	C	A	D	C	B	D	C	A	D	C	A
Approach Delay		37.2			22.0			20.2			32.7	
Approach LOS		D			C			C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 12 (13%), Referenced to phase 2:NWT and 6:SETL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 28.3 Intersection LOS: C
Intersection Capacity Utilization 79.0% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 10: I6 - N. Dysart & Grand Avenue /US 60

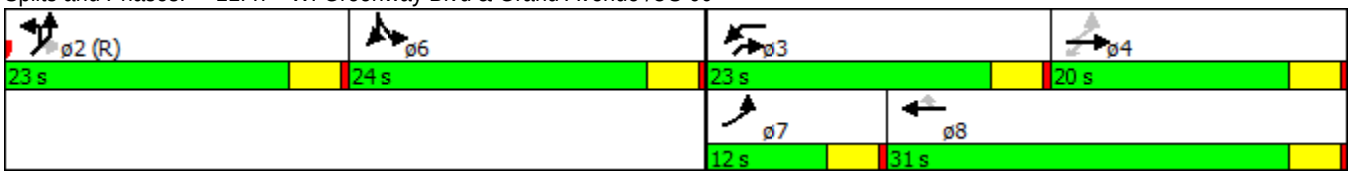


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL	NER
Lane Configurations										
Volume (vph)	70	640	130	220	610	70	130	280	410	550
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Prot	Prot	Prot	pm+ov
Protected Phases	7	4		3	8		6	6	2	3
Permitted Phases	4		4			8				2
Detector Phase	7	4	4	3	8	8	6	6	2	3
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	20.0	20.0	12.0	20.0	20.0	20.0	20.0	20.0	12.0
Total Split (s)	12.0	20.0	20.0	23.0	31.0	31.0	24.0	24.0	23.0	23.0
Total Split (%)	13.3%	22.2%	22.2%	25.6%	34.4%	34.4%	26.7%	26.7%	25.6%	25.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	None
Act Effct Green (s)	23.9	16.7	16.7	14.6	26.0	26.0	17.3	17.3	25.4	40.0
Actuated g/C Ratio	0.27	0.19	0.19	0.16	0.29	0.29	0.19	0.19	0.28	0.44
v/c Ratio	0.28	0.74	0.33	0.43	0.45	0.14	0.41	0.88	0.55	0.70
Control Delay	24.5	42.4	12.7	35.3	27.3	2.8	34.9	42.8	32.2	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	42.4	12.7	35.3	27.3	2.8	34.9	42.8	32.2	10.6
LOS	C	D	B	D	C	A	C	D	C	B
Approach Delay		36.3			27.3		40.6		20.8	
Approach LOS		D			C		D		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NEL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 29.5 Intersection LOS: C
Intersection Capacity Utilization 53.2% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 11: I7 - W. Greenway Blvd & Grand Avenue /US 60

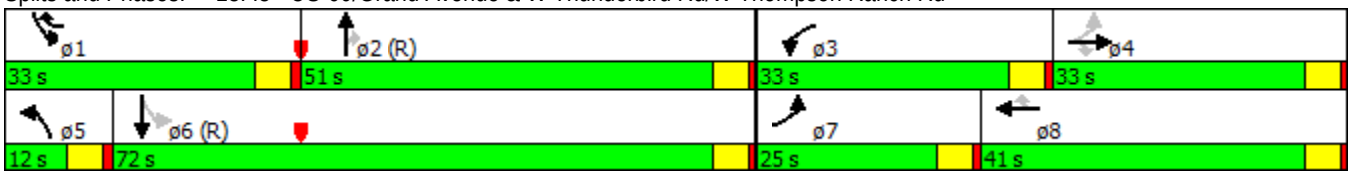


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	190	1020	20	690	840	420	40	800	1340	840	710
Turn Type	pm+pt	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	pm+pt	NA
Protected Phases	7	4		3	8	1	5	2		1	6
Permitted Phases	4		4			8			2	6	
Detector Phase	7	4	4	3	8	1	5	2	2	1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	12.0	21.0	12.0	12.0	21.0	21.0	12.0	21.0
Total Split (s)	25.0	33.0	33.0	33.0	41.0	33.0	12.0	51.0	51.0	33.0	72.0
Total Split (%)	16.7%	22.0%	22.0%	22.0%	27.3%	22.0%	8.0%	34.0%	34.0%	22.0%	48.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	45.0	28.0	28.0	28.0	39.0	72.0	6.6	46.0	46.0	79.0	69.5
Actuated g/C Ratio	0.30	0.19	0.19	0.19	0.26	0.48	0.04	0.31	0.31	0.53	0.46
v/c Ratio	0.77	1.17	0.05	1.17	0.69	0.57	0.28	0.80	1.15	1.20	0.54
Control Delay	52.2	139.2	0.2	145.0	53.8	26.0	74.1	54.5	103.8	140.1	30.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.2	139.2	0.2	145.0	53.8	26.0	74.1	54.5	103.8	140.1	30.4
LOS	D	F	A	F	D	C	E	D	F	F	C
Approach Delay		123.5			80.0			85.1			86.6
Approach LOS		F			F			F			F

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.20
Intersection Signal Delay: 90.8 Intersection LOS: F
Intersection Capacity Utilization 103.0% ICU Level of Service G
Analysis Period (min) 15

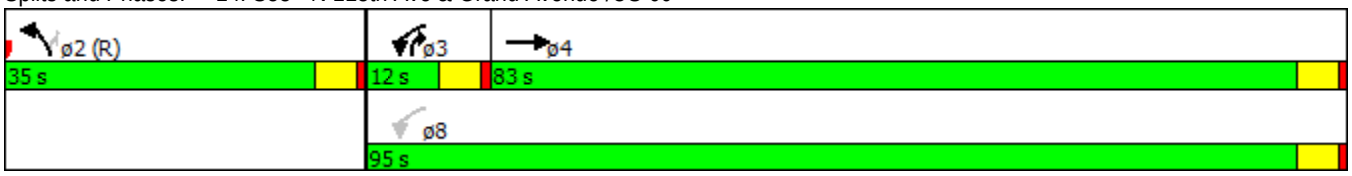
Splits and Phases: 13: I8 - US-60/Grand Avenue & W Thunderbird Rd/W Thompson Ranch Rd



Lane Group	EBT	WBL	NBL	NBR	ø8
Lane Configurations					
Volume (vph)	2160	100	350	70	
Turn Type	NA	pm+pt	Prot	pm+ov	
Protected Phases	4	3	2	3	8
Permitted Phases		8		2	
Detector Phase	4	3	2	3	
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	12.0	21.0	12.0	21.0
Total Split (s)	83.0	12.0	35.0	12.0	95.0
Total Split (%)	63.8%	9.2%	26.9%	9.2%	73%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lead		Lead	
Lead-Lag Optimize?	Yes	Yes		Yes	
Recall Mode	None	None	C-Max	None	None
Act Effct Green (s)	78.0	90.0	30.0	42.0	
Actuated g/C Ratio	0.60	0.69	0.23	0.32	
v/c Ratio	1.03	0.72	0.93	0.15	
Control Delay	50.3	47.9	79.5	30.2	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	50.3	47.9	79.5	30.2	
LOS	D	D	E	C	
Approach Delay	50.3		71.3		
Approach LOS	D		E		

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 130	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 52.9	Intersection LOS: D
Intersection Capacity Utilization 93.3%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 14: S58 - N 113th Ave & Grand Avenue /US 60

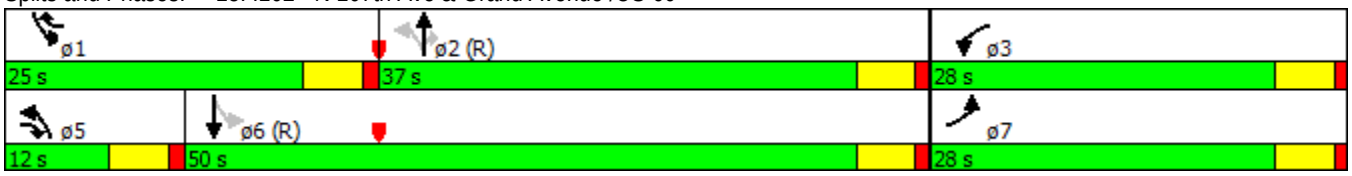


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	650	50	40	230	20	450	20	330	840
Turn Type	Prot	Over	Prot	Over	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	7	5	3	1	5	2		1	6
Permitted Phases					2		2	6	
Detector Phase	7	5	3	1	5	2	2	1	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	21.0	21.0	12.0	21.0
Total Split (s)	28.0	12.0	28.0	25.0	12.0	37.0	37.0	25.0	50.0
Total Split (%)	31.1%	13.3%	31.1%	27.8%	13.3%	41.1%	41.1%	27.8%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	21.8	6.0	16.1	14.5	44.7	38.8	38.8	58.2	49.4
Actuated g/C Ratio	0.24	0.07	0.18	0.16	0.50	0.43	0.43	0.65	0.55
v/c Ratio	0.85	0.23	0.07	0.71	0.11	0.32	0.03	0.57	0.77
Control Delay	43.6	2.2	27.0	30.1	9.3	18.9	0.1	11.2	17.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.6	2.2	27.0	30.1	9.3	18.9	0.1	11.2	17.7
LOS	D	A	C	C	A	B	A	B	B
Approach Delay						17.7			16.5
Approach LOS						B			B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 23.2 Intersection LOS: C
Intersection Capacity Utilization 74.3% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 15: I102 - N 107th Ave & Grand Avenue /US 60

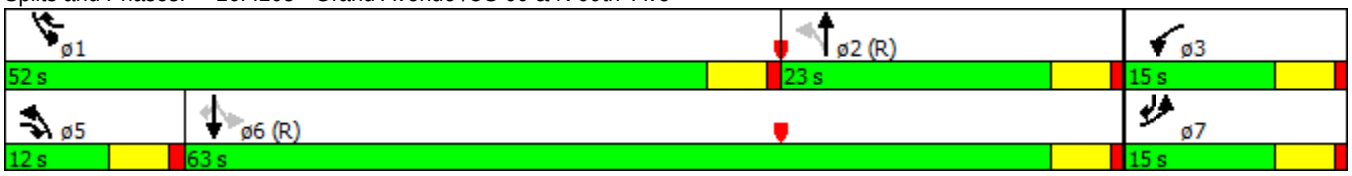


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	190	20	30	470	20	270	730	360	20
Turn Type	Prot	Over	Prot	Over	pm+pt	NA	pm+pt	NA	pm+ov
Protected Phases	7	5	3	1	5	2	1	6	7
Permitted Phases					2		6		6
Detector Phase	7	5	3	1	5	2	1	6	7
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	15.0	12.0	15.0	52.0	12.0	23.0	52.0	63.0	15.0
Total Split (%)	16.7%	13.3%	16.7%	57.8%	13.3%	25.6%	57.8%	70.0%	16.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lead	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?		Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)	9.4	5.8	8.3	31.9	39.4	33.6	70.6	64.0	80.4
Actuated g/C Ratio	0.10	0.06	0.09	0.35	0.44	0.37	0.78	0.71	0.89
v/c Ratio	0.57	0.09	0.10	0.79	0.05	0.23	0.78	0.16	0.02
Control Delay	45.0	0.8	38.0	23.5	11.7	22.7	10.5	5.1	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	0.8	38.0	23.5	11.7	22.7	10.5	5.1	0.6
LOS	D	A	D	C	B	C	B	A	A
Approach Delay						22.0		8.6	
Approach LOS						C		A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 57 (63%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 17.4 Intersection LOS: B
Intersection Capacity Utilization 66.1% ICU Level of Service C
Analysis Period (min) 15

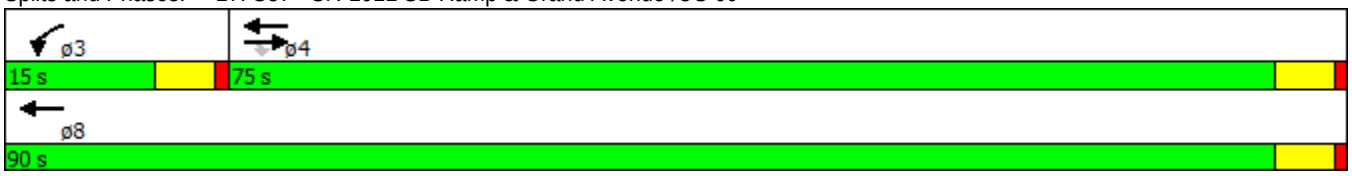
Splits and Phases: 16: I103 - Grand Avenue /US 60 & N 99th Ave



Lane Group	EBT	EBR	WBL	WBT	ø8
Lane Configurations					
Volume (vph)	1470	740	210	1560	
Turn Type	NA	Perm	Prot	NA	
Protected Phases	4		3	8 4	8
Permitted Phases		4			
Detector Phase	4	4	3	8 4	
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0		4.0
Minimum Split (s)	21.0	21.0	12.0		21.0
Total Split (s)	75.0	75.0	15.0		90.0
Total Split (%)	83.3%	83.3%	16.7%		100%
Yellow Time (s)	4.0	4.0	4.0		4.0
All-Red Time (s)	1.0	1.0	1.0		1.0
Lost Time Adjust (s)	0.0	0.0	0.0		
Total Lost Time (s)	5.0	5.0	5.0		
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	None	None	None		None
Act Effct Green (s)	70.4	70.4	9.6	90.0	
Actuated g/C Ratio	0.78	0.78	0.11	1.00	
v/c Ratio	0.40	0.64	0.62	0.33	
Control Delay	3.4	6.1	42.7	1.1	
Queue Delay	0.1	0.0	0.0	0.0	
Total Delay	3.5	6.1	42.7	1.1	
LOS	A	A	D	A	
Approach Delay	4.4			6.1	
Approach LOS	A			A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 19 (21%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 5.1	Intersection LOS: A
Intersection Capacity Utilization 98.4%	ICU Level of Service F
Analysis Period (min) 15	

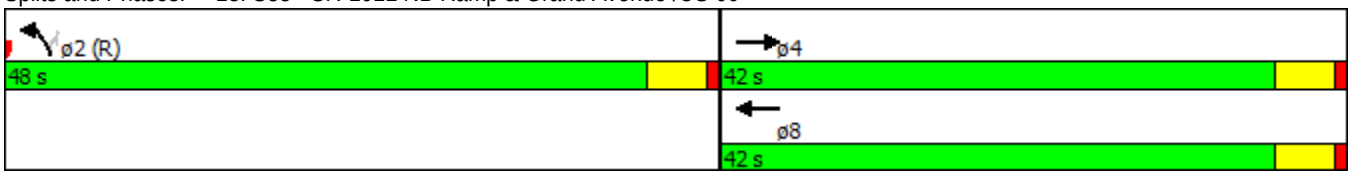
Splits and Phases: 17: S87 - SR-101L SB Ramp & Grand Avenue /US 60



Lane Group	EBT	WBT	NBL	NBR
Lane Configurations				
Volume (vph)	1480	1110	660	440
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Detector Phase	4	8	2	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	42.0	42.0	48.0	48.0
Total Split (%)	46.7%	46.7%	53.3%	53.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	35.7	35.7	44.3	44.3
Actuated g/C Ratio	0.40	0.40	0.49	0.49
v/c Ratio	0.80	0.40	0.42	0.61
Control Delay	22.6	11.9	16.0	21.1
Queue Delay	1.0	0.0	0.0	0.0
Total Delay	23.6	11.9	16.0	21.1
LOS	C	B	B	C
Approach Delay	23.6	11.9	18.0	
Approach LOS	C	B	B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 8 (9%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 18.4	Intersection LOS: B
Intersection Capacity Utilization 98.4%	ICU Level of Service F
Analysis Period (min) 15	

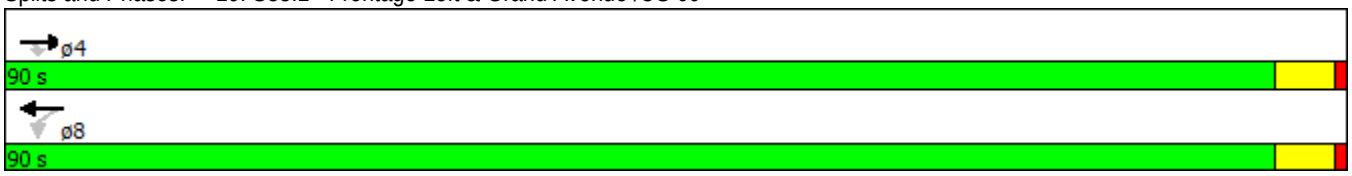
Splits and Phases: 18: S88 - SR-101L NB Ramp & Grand Avenue /US 60



Lane Group	EBT	EBR	WBL	WBT
Lane Configurations				
Volume (vph)	920	620	220	1110
Turn Type	NA	Perm	Perm	NA
Protected Phases	4			8
Permitted Phases		4	8	
Detector Phase	4	4	8	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	90.0	90.0	90.0	90.0
Total Split (%)	100.0%	100.0%	100.0%	100.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	None	None
Act Effct Green (s)	90.0	90.0	90.0	90.0
Actuated g/C Ratio	1.00	1.00	1.00	1.00
v/c Ratio	0.20	0.43	0.47	0.24
Control Delay	0.1	1.3	7.3	0.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	0.1	1.3	7.3	0.1
LOS	A	A	A	A
Approach Delay	0.5			1.3
Approach LOS	A			A

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.47	
Intersection Signal Delay: 0.9	Intersection LOS: A
Intersection Capacity Utilization 58.9%	ICU Level of Service B
Analysis Period (min) 15	

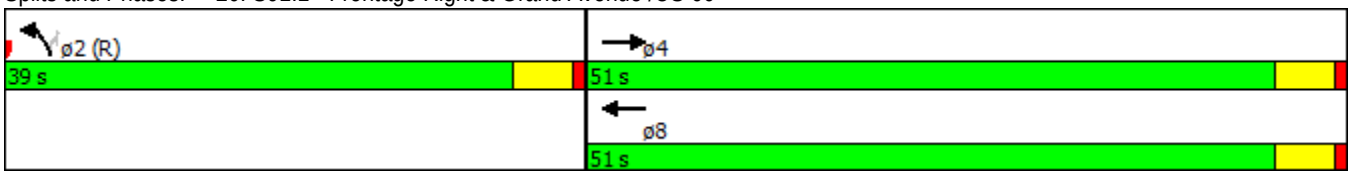
Splits and Phases: 19: S88.1 - Frontage Left & Grand Avenue /US 60



Lane Group	EBT	WBT	NBL	NBR
Lane Configurations				
Volume (vph)	920	920	410	350
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Detector Phase	4	8	2	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	51.0	51.0	39.0	39.0
Total Split (%)	56.7%	56.7%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	27.7	27.7	52.3	52.3
Actuated g/C Ratio	0.31	0.31	0.58	0.58
v/c Ratio	0.64	0.64	0.43	0.40
Control Delay	22.8	28.4	13.3	10.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	22.8	28.4	13.3	10.3
LOS	C	C	B	B
Approach Delay	22.8	28.4	11.9	
Approach LOS	C	C	B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 72 (80%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 58.9%	ICU Level of Service B
Analysis Period (min) 15	

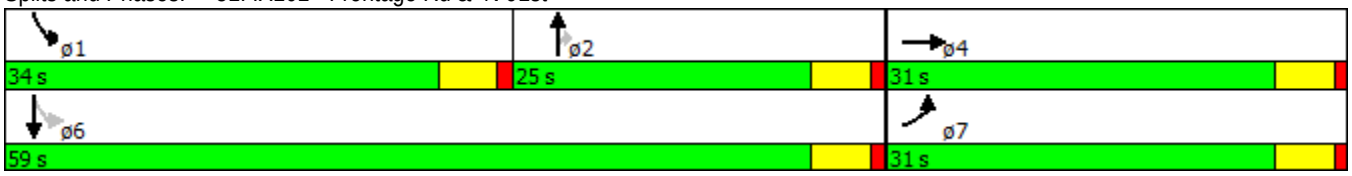
Splits and Phases: 20: S91.1 - Frontage Right & Grand Avenue /US 60



Lane Group	EBL	EBT	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	390	40	480	260	500	670
Turn Type	Prot	NA	NA	Perm	pm+pt	NA
Protected Phases	7	4	2		1	6
Permitted Phases				2	6	
Detector Phase	7	4	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	12.0	21.0
Total Split (s)	31.0	31.0	25.0	25.0	34.0	59.0
Total Split (%)	34.4%	34.4%	27.8%	27.8%	37.8%	65.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	Max	Max	None	Max
Act Effct Green (s)	26.0	26.0	25.2	25.2	54.0	54.0
Actuated g/C Ratio	0.29	0.29	0.28	0.28	0.60	0.60
v/c Ratio	0.77	0.62	0.53	0.44	0.84	0.34
Control Delay	41.6	20.6	31.0	6.2	26.2	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.6	20.6	31.0	6.2	26.2	9.6
LOS	D	C	C	A	C	A
Approach Delay		31.5	22.3			16.7
Approach LOS		C	C			B

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 22.1	Intersection LOS: C
Intersection Capacity Utilization 75.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 51: IX101 - Frontage Rd & N 91st

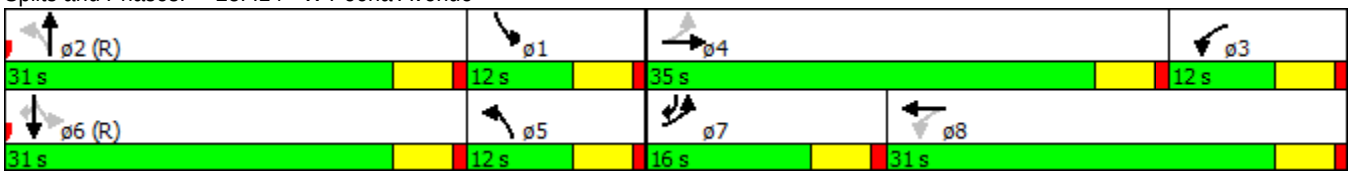


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	200	540	110	220	70	710	150	670	240
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+ov
Protected Phases	7	4	3	8	5	2	1	6	7
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	7
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	16.0	35.0	12.0	31.0	12.0	31.0	12.0	31.0	16.0
Total Split (%)	17.8%	38.9%	13.3%	34.4%	13.3%	34.4%	13.3%	34.4%	17.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lead	Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)	29.9	29.9	25.6	25.6	33.5	26.8	34.7	29.1	40.8
Actuated g/C Ratio	0.33	0.33	0.28	0.28	0.37	0.30	0.39	0.32	0.45
v/c Ratio	0.74	0.97	0.56	0.86	0.31	0.88	0.75	0.64	0.30
Control Delay	40.0	60.4	26.4	27.7	24.7	41.1	54.0	30.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.0	60.4	26.4	27.7	24.7	41.1	54.0	30.1	2.3
LOS	D	E	C	C	C	D	D	C	A
Approach Delay		55.0		27.4		39.8		27.2	
Approach LOS		D		C		D		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 81 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 37.2 Intersection LOS: D
Intersection Capacity Utilization 84.2% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 23: I14 - W Peoria Avenue

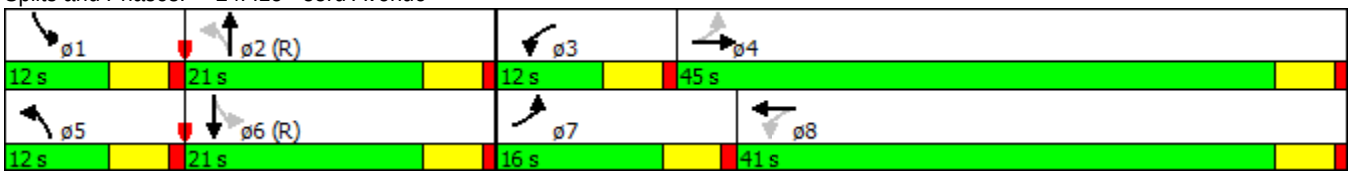


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	170	550	20	430	70	110	150	210
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	12.0	21.0	12.0	21.0
Total Split (s)	16.0	45.0	12.0	41.0	12.0	21.0	12.0	21.0
Total Split (%)	17.8%	50.0%	13.3%	45.6%	13.3%	23.3%	13.3%	23.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
Act Effct Green (s)	44.9	40.5	36.0	30.0	28.5	21.6	31.9	25.1
Actuated g/C Ratio	0.50	0.45	0.40	0.33	0.32	0.24	0.35	0.28
v/c Ratio	0.55	0.87	0.10	0.83	0.19	0.19	0.37	0.27
Control Delay	12.8	16.7	4.2	19.2	22.2	22.9	24.6	28.0
Queue Delay	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	17.4	4.2	19.2	22.2	22.9	24.6	28.0
LOS	B	B	A	B	C	C	C	C
Approach Delay		16.5		18.6		22.7		26.7
Approach LOS		B		B		C		C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 19.8 Intersection LOS: B
Intersection Capacity Utilization 68.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 24: I15 - 83rd Avenue

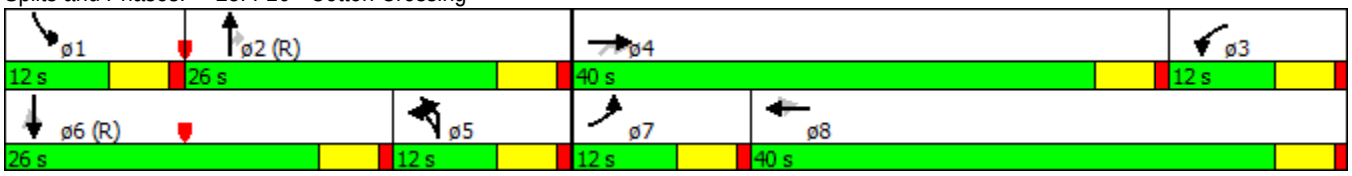


Lane Group	EBL	EBT	WBL2	WBT	WBR	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	580	70	370	490	60	0	500	120	40	840	50
Turn Type	Prot	NA	Prot	NA	Perm	Prot	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	3	8		5	5	2		1	6	
Permitted Phases					8				2			6
Detector Phase	7	4	3	8	8	5	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	21.0	12.0	12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	12.0	40.0	12.0	40.0	40.0	12.0	12.0	26.0	26.0	12.0	26.0	26.0
Total Split (%)	13.3%	44.4%	13.3%	44.4%	44.4%	13.3%	13.3%	28.9%	28.9%	13.3%	28.9%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	6.9	35.0	6.6	32.6	32.6	6.5	6.5	28.4	28.4	6.4	28.3	28.3
Actuated g/C Ratio	0.08	0.39	0.07	0.36	0.36	0.07	0.07	0.32	0.32	0.07	0.31	0.31
v/c Ratio	0.53	0.32	0.30	0.22	0.88	0.29	0.27	0.34	0.20	0.18	0.82	0.11
Control Delay	47.9	19.7	42.6	19.7	32.9	46.3	45.1	26.5	1.4	40.8	39.7	27.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.9	19.7	42.6	19.7	32.9	46.3	45.1	26.5	1.4	40.8	39.7	27.4
LOS	D	B	D	B	C	D	D	C	A	D	D	C
Approach Delay		24.9		28.7				23.8			39.1	
Approach LOS		C		C				C			D	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 62 (69%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.28
Intersection Signal Delay: 53.9 Intersection LOS: D
Intersection Capacity Utilization 102.0% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 25: I-16 - Cotton Crossing



Lane Group	NER
Lane Configurations	
Volume (vph)	740
Turn Type	Perm
Protected Phases	
Permitted Phases	4
Detector Phase	4
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	21.0
Total Split (s)	40.0
Total Split (%)	44.4%
Yellow Time (s)	4.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	5.0
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	35.0
Actuated g/C Ratio	0.39
v/c Ratio	1.28
Control Delay	162.6
Queue Delay	0.0
Total Delay	162.6
LOS	F
Approach Delay	
Approach LOS	

Intersection Summary

Timings
44: IX 102 - 75th Avenue/75th Avenue & W. Olive Avenue

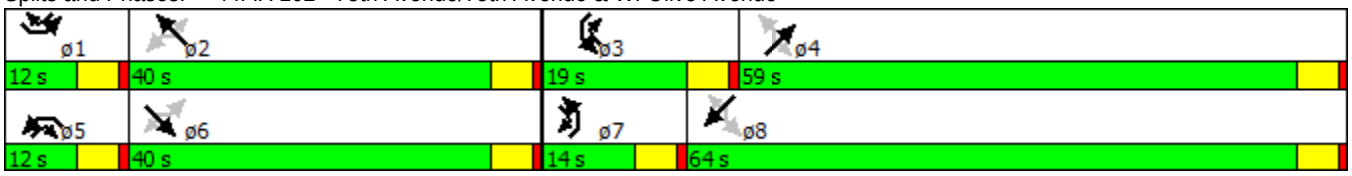
4/29/2015

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	110	850	100	100	700	100	100	1400	350	250	980	210
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	12.0	40.0	14.0	12.0	40.0	19.0	14.0	59.0	12.0	19.0	64.0	12.0
Total Split (%)	9.2%	30.8%	10.8%	9.2%	30.8%	14.6%	10.8%	45.4%	9.2%	14.6%	49.2%	9.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	42.0	35.0	48.4	42.0	35.0	54.0	62.4	54.0	66.0	73.0	59.6	71.6
Actuated g/C Ratio	0.32	0.27	0.37	0.32	0.27	0.42	0.48	0.42	0.51	0.56	0.46	0.55
v/c Ratio	0.74	0.97	0.17	0.72	0.80	0.16	0.46	1.04	0.46	1.10	0.66	0.25
Control Delay	57.4	69.9	12.7	55.8	51.6	12.2	20.4	70.5	19.1	120.3	29.8	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.4	69.9	12.7	55.8	51.6	12.2	20.4	70.5	19.1	120.3	29.8	9.1
LOS	E	E	B	E	D	B	C	E	B	F	C	A
Approach Delay		63.2			47.7			58.1			42.5	
Approach LOS		E			D			E			D	

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.10
Intersection Signal Delay: 53.1 — Intersection LOS: D
Intersection Capacity Utilization 98.3% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 44: IX 102 - 75th Avenue/75th Avenue & W. Olive Avenue



Lane Group	SEL	SET	NWT	SWL
Lane Configurations				
Volume (vph)	150	1360	660	70
Turn Type	Perm	NA	NA	Prot
Protected Phases		6	2	8
Permitted Phases	6			
Detector Phase	6	6	2	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	69.0	69.0	69.0	21.0
Total Split (%)	76.7%	76.7%	76.7%	23.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	C-Max	None
Act Effct Green (s)		66.2	66.2	13.8
Actuated g/C Ratio		0.74	0.74	0.15
v/c Ratio		0.88	0.33	0.87
Control Delay		17.2	4.5	41.2
Queue Delay		0.0	0.0	0.0
Total Delay		17.2	4.5	41.2
LOS		B	A	D
Approach Delay		17.2	4.5	41.2
Approach LOS		B	A	D

Intersection Summary

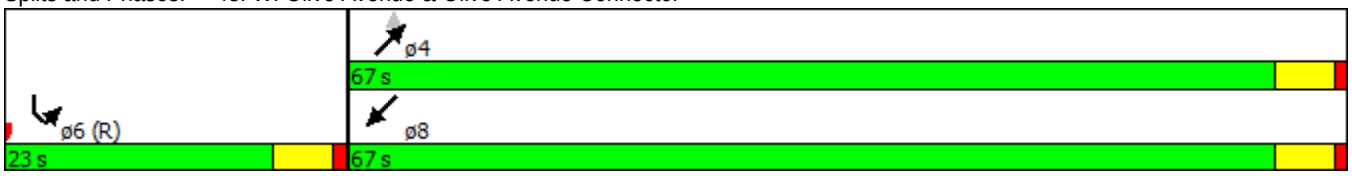
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NWT and 6:SETL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 16.4 Intersection LOS: B
Intersection Capacity Utilization 95.8% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 46: 75th Avenue & W Golden Ln

Lane Group	SBL	NEL	NET	SWT
Lane Configurations				
Volume (vph)	330	100	1480	1090
Turn Type	Prot	Perm	NA	NA
Protected Phases	6		4	8
Permitted Phases		4		
Detector Phase	6	4	4	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	23.0	67.0	67.0	67.0
Total Split (%)	25.6%	74.4%	74.4%	74.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	None	None	None
Act Effct Green (s)	18.0		62.0	62.0
Actuated g/C Ratio	0.20		0.69	0.69
v/c Ratio	0.57		1.05	0.56
Control Delay	35.3		53.7	7.9
Queue Delay	0.0		0.0	0.0
Total Delay	35.3		53.7	7.9
LOS	D		D	A
Approach Delay	35.3		53.7	7.9
Approach LOS	D		D	A

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.05	
Intersection Signal Delay: 33.8	Intersection LOS: C
Intersection Capacity Utilization 101.6%	ICU Level of Service G
Analysis Period (min) 15	

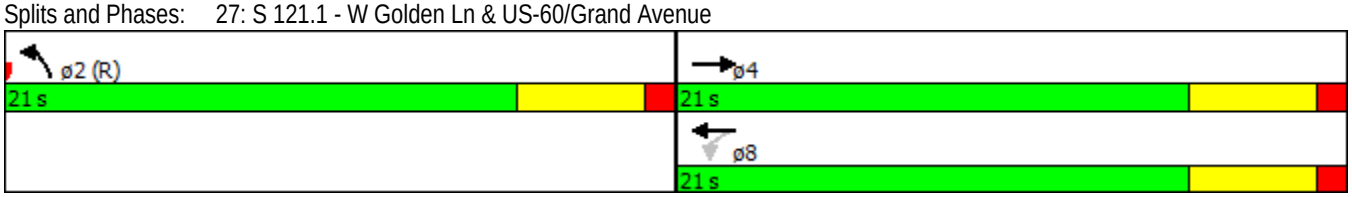
Splits and Phases: 48: W. Olive Avenue & Olive Avenue Connector



Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1710	320	810	70
Turn Type	NA	Perm	NA	Prot
Protected Phases	4		8	2
Permitted Phases		8		
Detector Phase	4	8	8	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	21.0	21.0	21.0	21.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	None	C-Max
Act Effct Green (s)	16.0		16.0	16.0
Actuated g/C Ratio	0.38		0.38	0.38
v/c Ratio	0.96		1.97dl	0.46
Control Delay	28.2		20.5	12.8
Queue Delay	0.0		0.0	0.0
Total Delay	28.2		20.5	12.8
LOS	C		C	B
Approach Delay	28.2		20.5	12.8
Approach LOS	C		C	B

Intersection Summary	
Cycle Length: 42	
Actuated Cycle Length: 42	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 24.1	Intersection LOS: C
Intersection Capacity Utilization 83.9%	ICU Level of Service E
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

Splits and Phases: 27: S 121.1 - W Golden Ln & US-60/Grand Avenue



HCM Unsignalized Intersection Capacity Analysis
28: N2 - US-60/Grand Avenue & 71st Avenue

4/29/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1670	1240	110	0	170
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1815	1348	120	0	185
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1348				1953	449
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1348				1953	449
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	67
cM capacity (veh/h)	507				56	557

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	SB 1
Volume Total	605	605	605	449	449	449	120	185
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	120	185
cSH	1700	1700	1700	1700	1700	1700	1700	557
Volume to Capacity	0.36	0.36	0.36	0.26	0.26	0.26	0.07	0.33
Queue Length 95th (ft)	0	0	0	0	0	0	0	36
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6
Lane LOS								B
Approach Delay (s)	0.0			0.0				14.6
Approach LOS								B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
29: N4 - US-60/Grand Avenue & W. Butler Drive

4/29/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1770	1120	100	0	120
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1924	1217	109	0	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1217				1913	460
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1217				1913	460
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	76
cM capacity (veh/h)	569				60	548

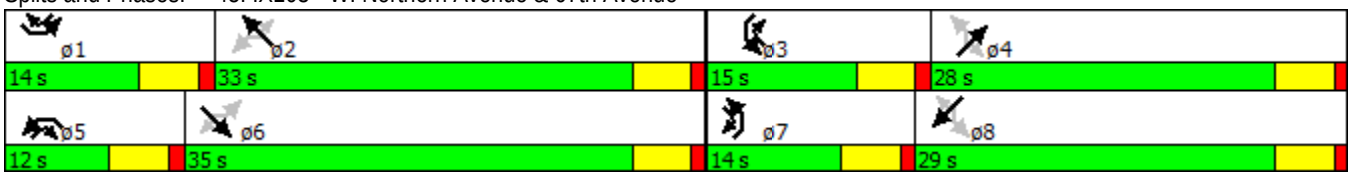
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	641	641	641	487	487	352	130
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	109	130
cSH	1700	1700	1700	1700	1700	1700	548
Volume to Capacity	0.38	0.38	0.38	0.29	0.29	0.21	0.24
Queue Length 95th (ft)	0	0	0	0	0	0	23
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	13.6
Lane LOS							B
Approach Delay (s)	0.0			0.0			13.6
Approach LOS							B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	250	1060	290	100	870	290	250	800	70	270	830	160
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.123			0.138			0.174			0.167		
Satd. Flow (perm)	229	3539	1583	257	3539	1583	324	3539	1583	311	3539	1583
Satd. Flow (RTOR)			88			85			85			85
Lane Group Flow (vph)	272	1152	315	109	946	315	272	870	76	293	902	174
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	14.0	35.0	14.0	12.0	33.0	15.0	14.0	28.0	12.0	15.0	29.0	14.0
Total Split (%)	15.6%	38.9%	15.6%	13.3%	36.7%	16.7%	15.6%	31.1%	13.3%	16.7%	32.2%	15.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	39.6	32.4	46.4	34.8	28.0	43.0	32.0	23.0	34.8	34.0	24.0	38.0
Actuated g/C Ratio	0.44	0.36	0.52	0.39	0.31	0.48	0.36	0.26	0.39	0.38	0.27	0.42
v/c Ratio	1.07	0.90	0.37	0.51	0.86	0.39	1.05	0.96	0.11	1.05	0.96	0.24
Control Delay	100.3	40.1	11.3	23.1	38.6	12.5	93.8	56.4	4.1	91.9	54.2	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	100.3	40.1	11.3	23.1	38.6	12.5	93.8	56.4	4.1	91.9	54.2	9.6
LOS	F	D	B	C	D	B	F	E	A	F	D	A
Approach Delay		44.3			31.4			61.5			56.6	
Approach LOS		D			C			E			E	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.07	
Intersection Signal Delay: 47.8	Intersection LOS: D
Intersection Capacity Utilization 91.6%	ICU Level of Service F
Analysis Period (min) 15	

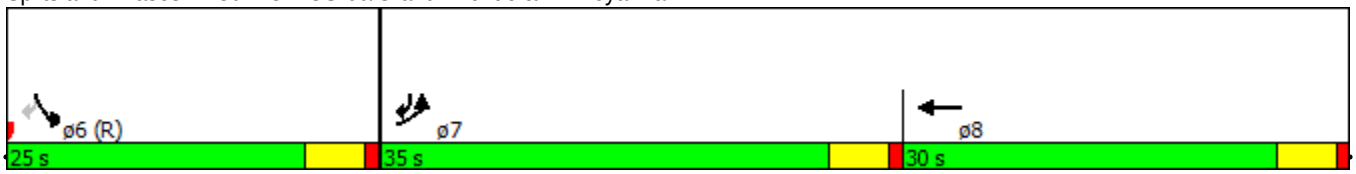
Splits and Phases: 45: IX103 - W. Northern Avenue & 67th Avenue



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	360	0	910	10	120	210
Satd. Flow (prot)	1770	0	5075	0	1770	1583
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	0	5075	0	1770	1583
Satd. Flow (RTOR)			2			8
Lane Group Flow (vph)	391	0	1000	0	130	228
Turn Type	Prot		NA		Prot	pm+ov
Protected Phases	7		8		6	7
Permitted Phases						6
Detector Phase	7		8		6	7
Switch Phase						
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	12.0		21.0		21.0	12.0
Total Split (s)	35.0		30.0		25.0	35.0
Total Split (%)	38.9%		33.3%		27.8%	38.9%
Yellow Time (s)	4.0		4.0		4.0	4.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0		5.0	5.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None		None		C-Max	None
Act Effct Green (s)	24.6		23.6		26.8	56.4
Actuated g/C Ratio	0.27		0.26		0.30	0.63
v/c Ratio	0.81		0.75		0.25	0.23
Control Delay	43.7		34.3		15.1	6.0
Queue Delay	0.0		0.0		0.0	0.0
Total Delay	43.7		34.3		15.1	6.0
LOS	D		C		B	A
Approach Delay			34.3		9.3	
Approach LOS			C		A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 31.3	Intersection LOS: C
Intersection Capacity Utilization 56.1%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 30: N32 -US-60/Grand Avenue & W. Royal Palm



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (vph)	40	330	1270	10	320	960
Satd. Flow (prot)	1770	1583	3536	0	1770	3539
Flt Permitted	0.950				0.095	
Satd. Flow (perm)	1770	1583	3536	0	177	3539
Satd. Flow (RTOR)		17	1			
Lane Group Flow (vph)	43	359	1391	0	348	1043
Turn Type	Prot	pm+ov	NA		pm+pt	NA
Protected Phases	4	5	6		5	2
Permitted Phases		4			2	
Detector Phase	4	5	6		5	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	21.0	12.0	21.0		12.0	21.0
Total Split (s)	21.0	23.0	46.0		23.0	69.0
Total Split (%)	23.3%	25.6%	51.1%		25.6%	76.7%
Yellow Time (s)	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0		5.0	5.0
Lead/Lag		Lead	Lag		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Recall Mode	None	None	C-Max		None	C-Max
Act Effct Green (s)	7.7	28.5	51.5		76.7	78.7
Actuated g/C Ratio	0.09	0.32	0.57		0.85	0.87
v/c Ratio	0.28	0.70	0.69		0.69	0.34
Control Delay	40.5	9.5	18.2		23.8	2.3
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	40.5	9.5	18.2		23.8	2.3
LOS	D	A	B		C	A
Approach Delay	12.8		18.2			7.7
Approach LOS	B		B			A

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 2 (2%), Referenced to phase 2:NWTL and 6:SET, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 12.9	Intersection LOS: B
Intersection Capacity Utilization 69.0%	ICU Level of Service C
Analysis Period (min) 15	

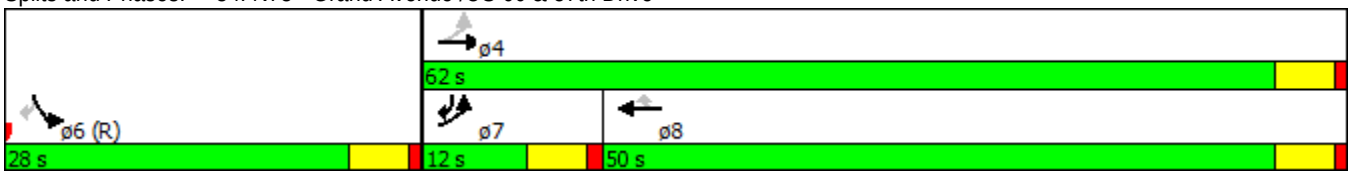
Splits and Phases: 36: W Royal Palm & 67th Ave

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	60	1710	980	200	340	60
Turn Type	pm+pt	NA	NA	Perm	Prot	pm+ov
Protected Phases	7	4	8		6	7
Permitted Phases	4			8		6
Detector Phase	7	4	8	8	6	7
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	21.0	12.0
Total Split (s)	12.0	62.0	50.0	50.0	28.0	12.0
Total Split (%)	13.3%	68.9%	55.6%	55.6%	31.1%	13.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		Lead
Lead-Lag Optimize?	Yes		Yes	Yes		Yes
Recall Mode	None	None	None	None	C-Max	None
Act Effct Green (s)	49.0	49.0	39.5	39.5	31.0	42.6
Actuated g/C Ratio	0.54	0.54	0.44	0.44	0.34	0.47
v/c Ratio	0.23	0.67	0.48	0.27	0.31	0.08
Control Delay	2.2	2.9	18.6	2.8	24.1	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.2	2.9	18.6	2.8	24.1	5.1
LOS	A	A	B	A	C	A
Approach Delay		2.9	15.9		21.2	
Approach LOS		A	B		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 54 (60%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 9.7 Intersection LOS: A
Intersection Capacity Utilization 51.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 34: N73 - Grand Avenue /US 60 & 57th Drive



Timings
46: IX 104 - W. Bethany Home Rd & 51st Avenue

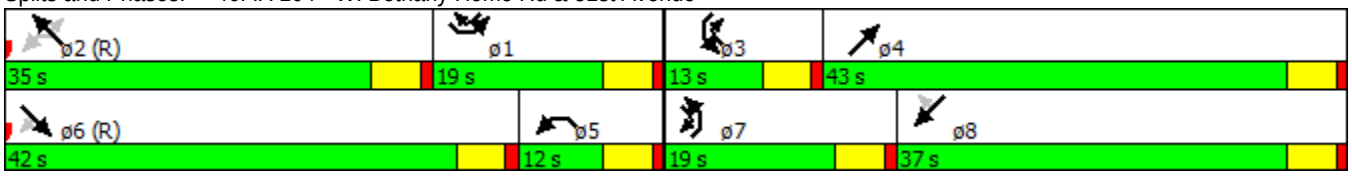
4/29/2015

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	SWL	SWT	SWR
Lane Configurations											
Volume (vph)	250	1050	270	10	880	300	340	1180	230	740	310
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA	Prot	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	3	8	1
Permitted Phases			6	2		2					8
Detector Phase	1	6	7	5	2	3	7	4	3	8	1
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	19.0	42.0	19.0	12.0	35.0	13.0	19.0	43.0	13.0	37.0	19.0
Total Split (%)	17.3%	38.2%	17.3%	10.9%	31.8%	11.8%	17.3%	39.1%	11.8%	33.6%	17.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None
Act Effct Green (s)	12.9	45.5	63.7	35.8	30.0	39.1	14.2	38.0	9.1	32.9	45.8
Actuated g/C Ratio	0.12	0.41	0.58	0.33	0.27	0.36	0.13	0.35	0.08	0.30	0.42
v/c Ratio	0.68	0.78	0.29	0.06	0.69	0.49	0.84	1.06	0.88	0.76	0.46
Control Delay	55.4	33.1	4.3	20.4	38.9	9.9	64.2	78.4	81.5	40.8	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.4	33.1	4.3	20.4	38.9	9.9	64.2	78.4	81.5	40.8	9.9
LOS	E	C	A	C	D	A	E	E	F	D	A
Approach Delay		31.7			31.5			75.2		40.6	
Approach LOS		C			C			E		D	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SET, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 45.7 — Intersection LOS: D
Intersection Capacity Utilization 88.5% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 46: IX 104 - W. Bethany Home Rd & 51st Avenue

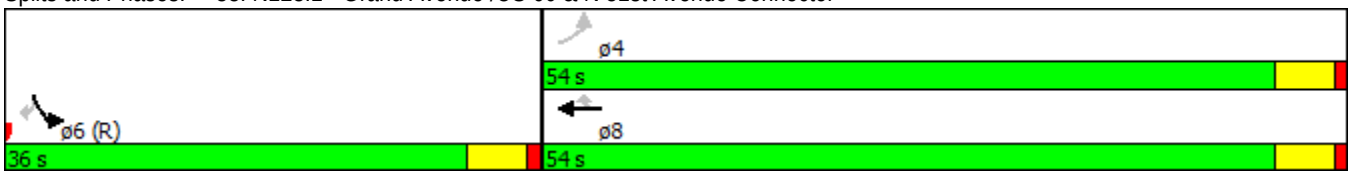


Lane Group	EBL	WBT	WBR	SBL	SBR
Lane Configurations					
Volume (vph)	140	860	340	380	350
Turn Type	Perm	NA	Perm	Prot	Perm
Protected Phases		8		6	
Permitted Phases	4		8		6
Detector Phase	4	8	8	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0
Total Split (s)	54.0	54.0	54.0	36.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	C-Max	C-Max
Act Effct Green (s)	35.1	35.1	35.1	44.9	44.9
Actuated g/C Ratio	0.39	0.39	0.39	0.50	0.50
v/c Ratio	0.92	0.47	0.44	0.47	0.45
Control Delay	77.6	20.5	3.0	15.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	77.6	20.5	3.0	15.6	10.3
LOS	E	C	A	B	B
Approach Delay		15.6		13.1	
Approach LOS		B		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 18.9 Intersection LOS: B
Intersection Capacity Utilization 57.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 38: N123.1 - Grand Avenue /US 60 & N 51st Avenue Connector

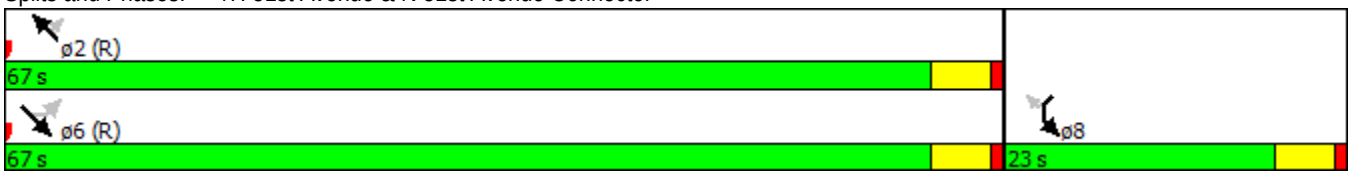


Lane Group	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	250	1230	1040	480	340	140
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		6	2		8	
Permitted Phases	6			2		8
Detector Phase	6	6	2	2	8	8
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	67.0	67.0	67.0	67.0	23.0	23.0
Total Split (%)	74.4%	74.4%	74.4%	74.4%	25.6%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Act Effct Green (s)	62.0	62.0	62.0	62.0	18.0	18.0
Actuated g/C Ratio	0.69	0.69	0.69	0.69	0.20	0.20
v/c Ratio	0.93	0.55	0.32	0.42	1.05	0.37
Control Delay	55.5	8.0	5.9	1.5	90.3	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.5	8.0	5.9	1.5	90.3	7.3
LOS	E	A	A	A	F	A
Approach Delay		16.1	4.5		66.1	
Approach LOS		B	A		E	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 24 (27%), Referenced to phase 2:NWT and 6:SETL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 17.9 Intersection LOS: B
Intersection Capacity Utilization 65.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 47: 51st Avenue & N 51st Avenue Connector

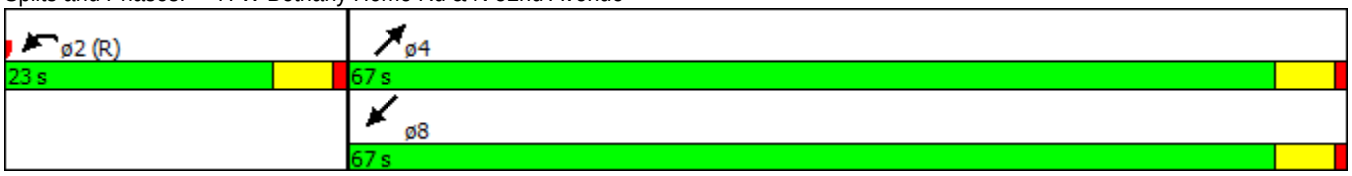


Lane Group	NWL	NET	SWT
Lane Configurations			
Volume (vph)	100	1520	1020
Turn Type	Prot	NA	NA
Protected Phases	2	4	8
Permitted Phases			
Detector Phase	2	4	8
Switch Phase			
Minimum Initial (s)	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0
Total Split (s)	23.0	67.0	67.0
Total Split (%)	25.6%	74.4%	74.4%
Yellow Time (s)	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0
Lead/Lag			
Lead-Lag Optimize?			
Recall Mode	C-Max	None	None
Act Effct Green (s)	20.2	59.8	59.8
Actuated g/C Ratio	0.22	0.66	0.66
v/c Ratio	0.30	0.75	0.47
Control Delay	31.5	12.3	7.9
Queue Delay	0.0	0.0	0.0
Total Delay	31.5	12.3	7.9
LOS	C	B	A
Approach Delay	31.5	12.3	7.9
Approach LOS	C	B	A

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NWL and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 7: W Bethany Home Rd & N 52nd Avenue



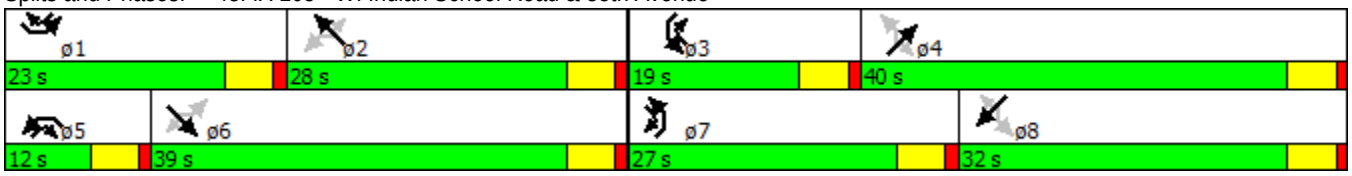
Timings
48: IX 105 - W. Indian School Road & 35th Avenue

4/29/2015

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	300	980	500	40	770	450	90	1590	240	270	660	230
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	23.0	39.0	27.0	12.0	28.0	19.0	27.0	40.0	12.0	19.0	32.0	23.0
Total Split (%)	20.9%	35.5%	24.5%	10.9%	25.5%	17.3%	24.5%	36.4%	10.9%	17.3%	29.1%	20.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	45.7	34.2	48.8	29.6	23.0	42.0	44.6	35.0	46.6	52.5	39.4	62.1
Actuated g/C Ratio	0.42	0.31	0.44	0.27	0.21	0.38	0.41	0.32	0.42	0.48	0.36	0.57
v/c Ratio	0.92	0.97	0.69	0.25	0.79	0.69	0.27	1.07	0.35	1.00	0.39	0.25
Control Delay	61.1	58.2	22.2	24.2	47.2	24.0	17.6	78.8	12.6	84.2	27.7	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.1	58.2	22.2	24.2	47.2	24.0	17.6	78.8	12.6	84.2	27.7	2.3
LOS	E	E	C	C	D	C	B	E	B	F	C	A
Approach Delay		48.6			38.2			67.7			35.8	
Approach LOS		D			D			E			D	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 109.7	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.07	
Intersection Signal Delay: 50.0	Intersection LOS: D
Intersection Capacity Utilization 93.8%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 48: IX 105 - W. Indian School Road & 35th Avenue

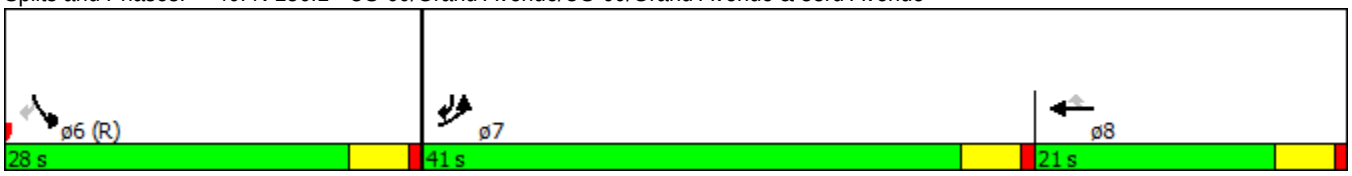


Lane Group	EBL	WBT	WBR	SBL	SBR
Lane Configurations					
Volume (vph)	490	580	180	280	450
Turn Type	Prot	NA	Perm	Prot	pm+ov
Protected Phases	7	8		6	7
Permitted Phases			8		6
Detector Phase	7	8	8	6	7
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	12.0
Total Split (s)	41.0	21.0	21.0	28.0	41.0
Total Split (%)	45.6%	23.3%	23.3%	31.1%	45.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag		Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes
Recall Mode	None	None	None	C-Max	None
Act Effct Green (s)	31.7	15.7	15.7	27.6	64.3
Actuated g/C Ratio	0.35	0.17	0.17	0.31	0.71
v/c Ratio	0.85	0.71	0.45	0.56	0.43
Control Delay	40.7	39.9	8.6	9.2	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.7	39.9	8.6	9.2	6.3
LOS	D	D	A	A	A
Approach Delay		32.5		7.4	
Approach LOS		C		A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 25.3 Intersection LOS: C
Intersection Capacity Utilization 65.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 40: N 186.1 - US-60/Grand Avenue/US-60/Grand Avenue & 33rd Avenue



Lane Group	NWL	NET	NER	SWL	SWT
Lane Configurations					
Volume (vph)	180	2210	130	600	750
Turn Type	Prot	NA	pm+ov	Prot	NA
Protected Phases	2	4	2	3	8
Permitted Phases			4		
Detector Phase	2	4	2	3	8
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	12.0	21.0
Total Split (s)	21.0	47.0	21.0	22.0	69.0
Total Split (%)	23.3%	52.2%	23.3%	24.4%	76.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lag	
Lead-Lag Optimize?		Yes		Yes	
Recall Mode	C-Max	None	C-Max	None	None
Act Effct Green (s)	16.0	42.0	63.0	17.0	64.0
Actuated g/C Ratio	0.18	0.47	0.70	0.19	0.71
v/c Ratio	0.98dr	1.01	0.13	1.01	0.23
Control Delay	21.6	46.5	4.5	74.8	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.6	46.5	4.5	74.8	4.6
LOS	C	D	A	E	A
Approach Delay	21.6	44.2			35.8
Approach LOS	C	D			D

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 79 (88%), Referenced to phase 2:NWL and 6:, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 38.1 Intersection LOS: D
Intersection Capacity Utilization 93.0% ICU Level of Service F
Analysis Period (min) 15
dr Defacto Right Lane. Recode with 1 though lane as a right lane.

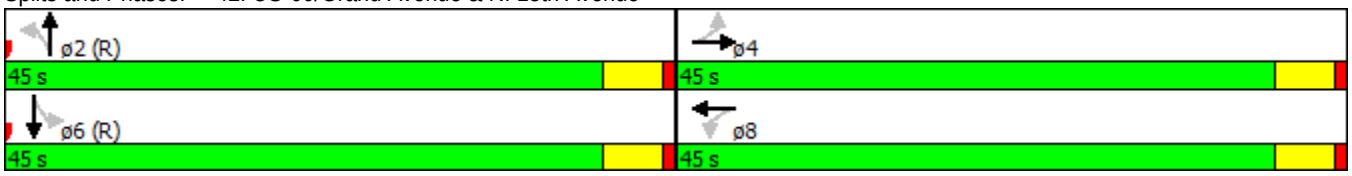
Splits and Phases: 49: N 33rd Ave & Indian School Rd

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	1020	10	320	40	130	190	80
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	36.2	36.2	36.2	36.2		43.8		43.8
Actuated g/C Ratio	0.40	0.40	0.40	0.40		0.49		0.49
v/c Ratio	0.18	0.79	0.13	0.28		0.28		0.54
Control Delay	17.4	27.7	12.3	7.7		14.9		20.9
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	17.4	27.7	12.3	7.7		14.9		20.9
LOS	B	C	B	A		B		C
Approach Delay		27.1		7.8		14.9		20.9
Approach LOS		C		A		B		C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 76.6% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 42: US-60/Grand Avenue & N. 18th Avenue

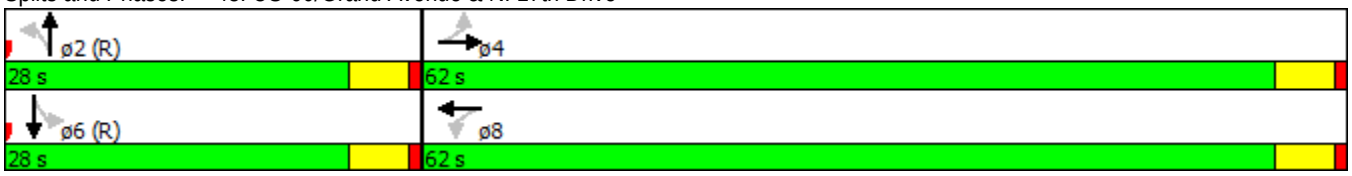


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	150	1090	10	360	10	90	10	50
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	62.0	62.0	62.0	62.0	28.0	28.0	28.0	28.0
Total Split (%)	68.9%	68.9%	68.9%	68.9%	31.1%	31.1%	31.1%	31.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	44.2	44.2	44.2	44.2		35.8		35.8
Actuated g/C Ratio	0.49	0.49	0.49	0.49		0.40		0.40
v/c Ratio	0.36	0.69	0.09	0.23		0.17		0.11
Control Delay	7.1	8.0	11.3	12.5		20.1		18.7
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	7.1	8.1	11.3	12.5		20.1		18.7
LOS	A	A	B	B		C		B
Approach Delay		8.0		12.4		20.1		18.7
Approach LOS		A		B		C		B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 13 (14%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 10.1 Intersection LOS: B
Intersection Capacity Utilization 53.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 43: US-60/Grand Avenue & N. 17th Drive

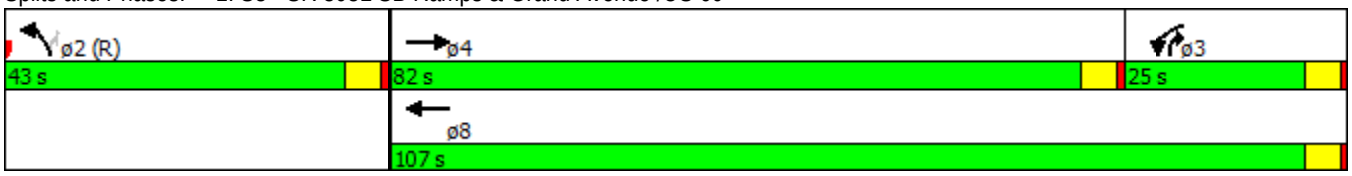


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1690	1230	280	4420	950	190
Turn Type	NA	Free	Prot	NA	Prot	pm+ov
Protected Phases	4		3	8	2	3
Permitted Phases		Free				2
Detector Phase	4		3	8	2	3
Switch Phase						
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		12.0	21.0	21.0	12.0
Total Split (s)	82.0		25.0	107.0	43.0	25.0
Total Split (%)	54.7%		16.7%	71.3%	28.7%	16.7%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag			Lag
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None		None	None	C-Max	None
Act Effct Green (s)	72.2	150.0	24.8	102.0	38.0	67.8
Actuated g/C Ratio	0.48	1.00	0.17	0.68	0.25	0.45
v/c Ratio	0.75	0.84	0.54	1.39	1.19	0.29
Control Delay	33.5	5.7	51.7	195.9	143.9	27.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	5.7	51.7	195.9	143.9	27.3
LOS	C	A	D	F	F	C
Approach Delay	21.8			187.4	124.5	
Approach LOS	C			F	F	

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 28 (19%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.39
Intersection Signal Delay: 124.0 Intersection LOS: F
Intersection Capacity Utilization 120.8% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 1: S3 - SR 303L SB Ramps & Grand Avenue /US 60

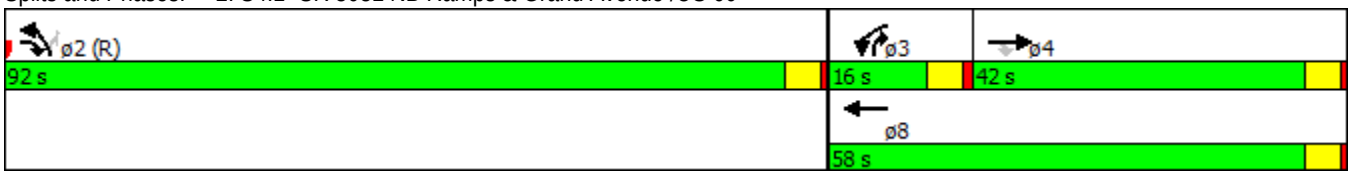


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	970	720	170	2160	2540	230
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	4	2	3	8	2	3
Permitted Phases		4				2
Detector Phase	4	2	3	8	2	3
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	12.0	21.0	21.0	12.0
Total Split (s)	42.0	92.0	16.0	58.0	92.0	16.0
Total Split (%)	28.0%	61.3%	10.7%	38.7%	61.3%	10.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None	C-Max	None	None	C-Max	None
Act Effct Green (s)	37.2	129.2	10.8	53.0	87.0	102.8
Actuated g/C Ratio	0.25	0.86	0.07	0.35	0.58	0.69
v/c Ratio	0.84	0.57	0.75	1.31	1.39	0.23
Control Delay	37.8	10.2	87.2	181.6	205.7	9.3
Queue Delay	0.0	0.0	0.0	4.5	0.0	0.0
Total Delay	37.8	10.2	87.2	186.1	205.7	9.3
LOS	D	B	F	F	F	A
Approach Delay	26.0			178.8	189.3	
Approach LOS	C			F	F	

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 148 (99%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.39
Intersection Signal Delay: 145.1 Intersection LOS: F
Intersection Capacity Utilization 122.5% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: S4.1- SR 303L NB Ramps & Grand Avenue /US 60

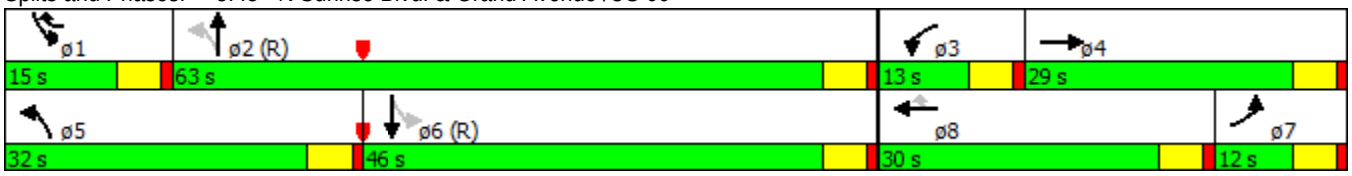


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	150	650	490	120	1010	100	460	450	200	190	560
Turn Type	Prot	NA	Free	Prot	NA	pm+ov	pm+pt	NA	Free	pm+pt	NA
Protected Phases	7	4		3	8	1	5	2		1	6
Permitted Phases			Free			8	2		Free	6	
Detector Phase	7	4		3	8	1	5	2		1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	12.0	21.0		12.0	21.0	12.0	12.0	21.0		12.0	21.0
Total Split (s)	12.0	29.0		13.0	30.0	15.0	32.0	63.0		15.0	46.0
Total Split (%)	10.0%	24.2%		10.8%	25.0%	12.5%	26.7%	52.5%		12.5%	38.3%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lead	Lag		Lead	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes
Recall Mode	None	None		None	None	None	None	C-Max		None	C-Max
Act Effct Green (s)	7.0	24.2	120.0	7.8	25.0	34.7	73.0	58.3	120.0	50.7	41.0
Actuated g/C Ratio	0.06	0.20	1.00	0.06	0.21	0.29	0.61	0.49	1.00	0.42	0.34
v/c Ratio	0.81	0.69	0.34	0.58	1.04	0.20	1.09	0.28	0.14	0.47	1.02
Control Delay	85.5	48.6	0.6	65.4	84.0	4.9	101.9	19.0	0.2	16.9	65.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.5	48.6	0.6	65.4	84.0	4.9	101.9	19.0	0.2	16.9	65.2
LOS	F	D	A	E	F	A	F	B	A	B	E
Approach Delay		34.6			75.7			50.0			58.4
Approach LOS		C			E			D			E

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 54.7 Intersection LOS: D
Intersection Capacity Utilization 101.0% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: I3 - N Sunrise Blvd. & Grand Avenue /US 60

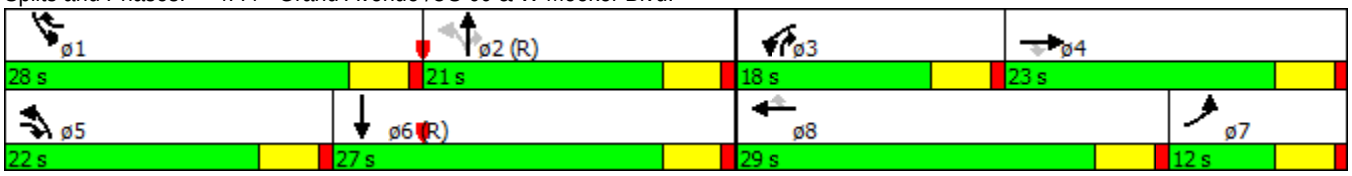


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	100	860	90	390	1000	650	260	370	160	470	450
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA
Protected Phases	7	4	5	3	8	1	5	2	3	1	6
Permitted Phases			4			8	2		2		
Detector Phase	7	4	5	3	8	1	5	2	3	1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0
Total Split (s)	12.0	23.0	22.0	18.0	29.0	28.0	22.0	21.0	18.0	28.0	27.0
Total Split (%)	13.3%	25.6%	24.4%	20.0%	32.2%	31.1%	24.4%	23.3%	20.0%	31.1%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lag	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max
Act Effct Green (s)	6.8	18.0	36.9	13.0	26.4	47.6	32.7	18.8	36.8	20.2	25.1
Actuated g/C Ratio	0.08	0.20	0.41	0.14	0.29	0.53	0.36	0.21	0.41	0.22	0.28
v/c Ratio	0.42	0.92	0.13	0.86	0.73	0.80	0.65	0.54	0.23	0.66	0.55
Control Delay	44.8	50.3	1.3	56.1	32.8	17.8	22.9	35.8	2.5	36.0	30.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	50.3	1.3	56.1	32.8	17.8	22.9	35.8	2.5	36.0	30.2
LOS	D	D	A	E	C	B	C	D	A	D	C
Approach Delay		45.6			32.5			24.8			33.0
Approach LOS		D			C			C			C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 34.2 Intersection LOS: C
Intersection Capacity Utilization 72.8% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: I4 - Grand Avenue /US 60 & W Meeker Blvd.

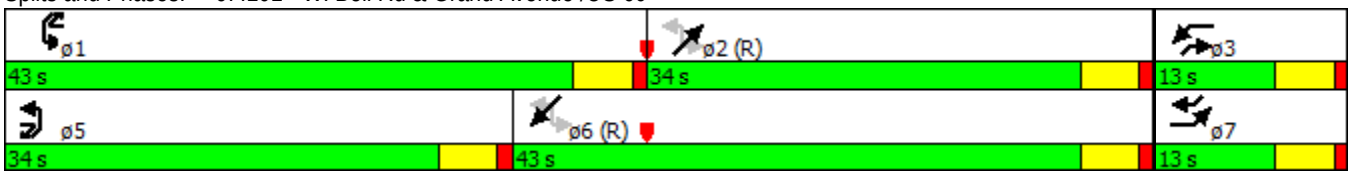


Lane Group	EBL	EBR	WBL	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations										
Volume (vph)	110	210	80	380	390	890	20	330	890	50
Turn Type	Prot	Over	Prot	Over	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	7	5	3	1	5	2	3	1	6	7
Permitted Phases					2		2	6		6
Detector Phase	7	5	3	1	5	2	3	1	6	7
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	13.0	34.0	13.0	43.0	34.0	34.0	13.0	43.0	43.0	13.0
Total Split (%)	14.4%	37.8%	14.4%	47.8%	37.8%	37.8%	14.4%	47.8%	47.8%	14.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes		Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	None	None	C-Max	None
Act Effct Green (s)	7.6	15.6	7.5	25.9	57.2	41.6	54.0	72.4	51.8	64.4
Actuated g/C Ratio	0.08	0.17	0.08	0.29	0.64	0.46	0.60	0.80	0.58	0.72
v/c Ratio	0.42	0.58	0.31	0.80	0.77	0.41	0.02	0.50	0.33	0.05
Control Delay	43.6	17.9	41.5	34.6	21.3	18.3	0.1	6.3	11.6	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.6	17.9	41.5	34.6	21.3	18.3	0.1	6.3	11.6	2.1
LOS	D	B	D	C	C	B	A	A	B	A
Approach Delay						18.9			9.8	
Approach LOS						B			A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NETL and 6:SWTL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 18.6 Intersection LOS: B
Intersection Capacity Utilization 55.7% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 9: I101 - W. Bell Rd & Grand Avenue /US 60

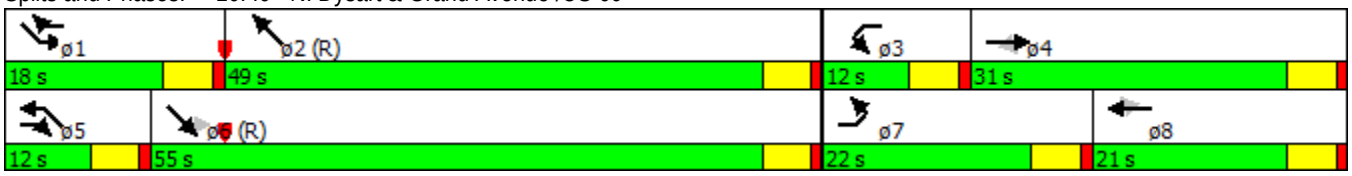


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	480	560	130	10	620	210	280	1340	540	180	1320	10
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	Free	Prot	NA	Free
Protected Phases	7	4	5	3	8	1	1	6		5	2	
Permitted Phases			4			8	6		Free			Free
Detector Phase	7	4	5	3	8	1	1	6		5	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0		12.0	21.0	
Total Split (s)	22.0	31.0	12.0	12.0	21.0	18.0	18.0	55.0		12.0	49.0	
Total Split (%)	20.0%	28.2%	10.9%	10.9%	19.1%	16.4%	16.4%	50.0%		10.9%	44.5%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)	17.0	35.7	47.7	5.9	16.0	34.0	62.0	50.0	110.0	7.0	44.0	110.0
Actuated g/C Ratio	0.15	0.32	0.43	0.05	0.15	0.31	0.56	0.45	1.00	0.06	0.40	1.00
v/c Ratio	0.98	0.37	0.19	0.06	0.91	0.40	1.07	0.91	0.37	0.90	1.01	0.01
Control Delay	82.6	30.1	5.4	49.9	64.2	16.3	103.3	37.3	0.7	91.3	60.9	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	82.6	30.1	5.4	49.9	64.2	16.3	103.3	37.3	0.7	91.3	60.9	0.0
LOS	F	C	A	D	E	B	F	D	A	F	E	A
Approach Delay		48.9			52.1			36.7			64.1	
Approach LOS		D			D			D			E	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:NWT and 6:SETL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 48.8 Intersection LOS: D
Intersection Capacity Utilization 94.3% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 10: I6 - N. Dysart & Grand Avenue /US 60

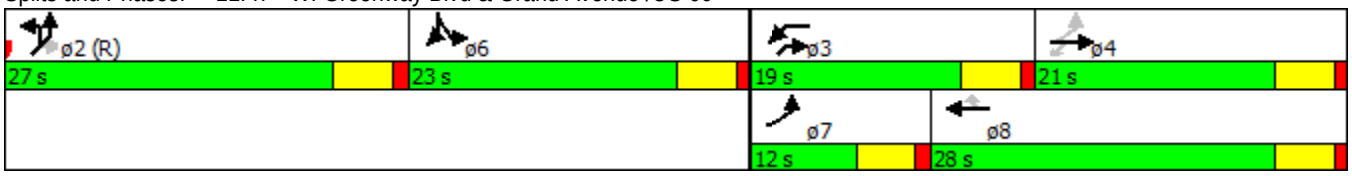


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL	NER
Lane Configurations										
Volume (vph)	30	710	120	470	530	110	160	380	410	220
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Prot	Prot	Prot	pm+ov
Protected Phases	7	4		3	8		6	6	2	3
Permitted Phases	4		4			8				2
Detector Phase	7	4	4	3	8	8	6	6	2	3
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	12.0	21.0	21.0	21.0	21.0	21.0	12.0
Total Split (s)	12.0	21.0	21.0	19.0	28.0	28.0	23.0	23.0	27.0	19.0
Total Split (%)	13.3%	23.3%	23.3%	21.1%	31.1%	31.1%	25.6%	25.6%	30.0%	21.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	None
Act Effct Green (s)	22.4	16.0	16.0	14.4	28.3	28.3	17.6	17.6	22.0	36.4
Actuated g/C Ratio	0.25	0.18	0.18	0.16	0.31	0.31	0.20	0.20	0.24	0.40
v/c Ratio	0.12	0.85	0.29	0.93	0.36	0.20	0.50	0.96	0.84	0.32
Control Delay	19.2	46.6	2.4	63.1	26.0	4.0	37.9	54.1	43.2	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.2	46.6	2.4	63.1	26.0	4.0	37.9	54.1	43.2	3.6
LOS	B	D	A	E	C	A	D	D	D	A
Approach Delay		39.5			39.5		49.7		33.2	
Approach LOS		D			D		D		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NEL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 39.6 Intersection LOS: D
Intersection Capacity Utilization 71.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 11: I7 - W. Greenway Blvd & Grand Avenue /US 60

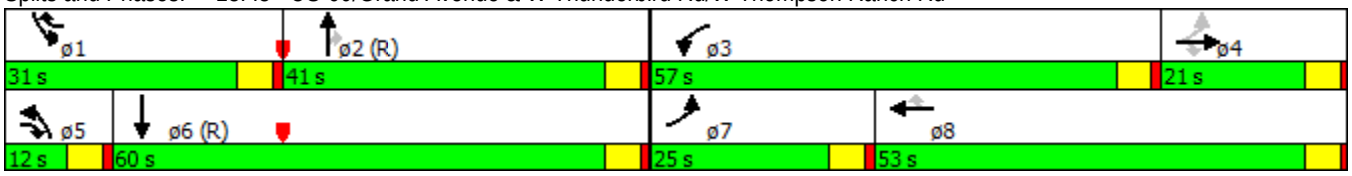


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations											
Volume (vph)	170	540	50	1240	1060	790	60	850	830	620	880
Turn Type	pm+pt	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6
Permitted Phases	4		4			8			2		
Detector Phase	7	4	5	3	8	1	5	2	2	1	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	21.0	12.0	21.0
Total Split (s)	25.0	21.0	12.0	57.0	53.0	31.0	12.0	41.0	41.0	31.0	60.0
Total Split (%)	16.7%	14.0%	8.0%	38.0%	35.3%	20.7%	8.0%	27.3%	27.3%	20.7%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	32.0	16.0	27.8	52.0	52.0	83.0	6.8	36.0	36.0	26.0	55.2
Actuated g/C Ratio	0.21	0.11	0.19	0.35	0.35	0.55	0.05	0.24	0.24	0.17	0.37
v/c Ratio	0.78	1.08	0.14	1.13	0.65	0.94	0.42	1.09	0.78	1.13	0.85
Control Delay	62.4	123.9	0.7	114.9	44.1	46.8	78.0	110.0	19.8	133.4	50.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.4	123.9	0.7	114.9	44.1	46.8	78.0	110.0	19.8	133.4	50.5
LOS	E	F	A	F	D	D	E	F	B	F	D
Approach Delay		102.0			73.2			65.9			82.2
Approach LOS		F			E			E			F

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.13
Intersection Signal Delay: 76.5 Intersection LOS: E
Intersection Capacity Utilization 103.7% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 13: I8 - US-60/Grand Avenue & W Thunderbird Rd/W Thompson Ranch Rd

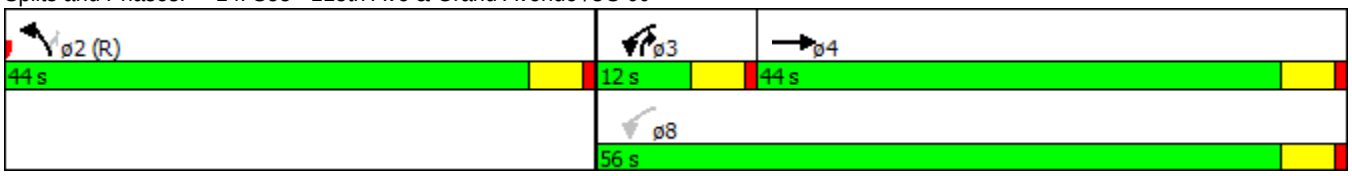


Lane Group	EBT	WBL	NBL	NBR	ø8
Lane Configurations					
Volume (vph)	1530	60	630	80	
Turn Type	NA	pm+pt	Prot	pm+ov	
Protected Phases	4	3	2	3	8
Permitted Phases		8		2	
Detector Phase	4	3	2	3	
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	12.0	21.0	12.0	21.0
Total Split (s)	44.0	12.0	44.0	12.0	56.0
Total Split (%)	44.0%	12.0%	44.0%	12.0%	56%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lead		Lead	
Lead-Lag Optimize?	Yes	Yes		Yes	
Recall Mode	None	None	C-Max	None	None
Act Effct Green (s)	41.5	51.0	39.0	50.6	
Actuated g/C Ratio	0.42	0.51	0.39	0.51	
v/c Ratio	1.01	0.35	0.99	0.11	
Control Delay	53.0	17.6	64.3	12.8	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	53.0	17.6	64.3	12.8	
LOS	D	B	E	B	
Approach Delay	53.0		58.5		
Approach LOS	D		E		

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 53.6 Intersection LOS: D
Intersection Capacity Utilization 88.8% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 14: S58 - 113th Ave & Grand Avenue /US 60

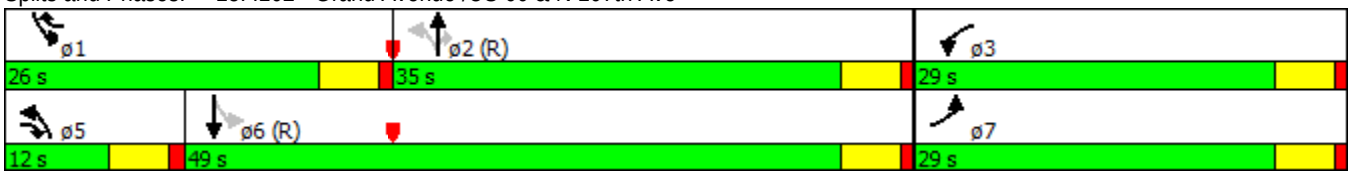


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	750	20	50	350	70	900	20	270	610
Turn Type	Prot	Over	Prot	Over	pm+pt	NA	Perm	pm+pt	NA
Protected Phases	7	5	3	1	5	2		1	6
Permitted Phases					2		2	6	
Detector Phase	7	5	3	1	5	2	2	1	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	21.0	21.0	12.0	21.0
Total Split (s)	29.0	12.0	29.0	26.0	12.0	35.0	35.0	26.0	49.0
Total Split (%)	32.2%	13.3%	32.2%	28.9%	13.3%	38.9%	38.9%	28.9%	54.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	23.5	6.6	20.3	20.0	38.1	31.5	31.5	56.5	47.0
Actuated g/C Ratio	0.26	0.07	0.23	0.22	0.42	0.35	0.35	0.63	0.52
v/c Ratio	0.91	0.09	0.07	0.91	0.36	0.79	0.03	0.62	0.73
Control Delay	47.8	0.7	25.0	54.4	15.6	32.5	0.1	21.8	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	0.7	25.0	54.4	15.6	32.5	0.1	21.8	14.4
LOS	D	A	C	D	B	C	A	C	B
Approach Delay						30.6			15.7
Approach LOS						C			B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 29.8 Intersection LOS: C
Intersection Capacity Utilization 79.6% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 15: I102 - Grand Avenue /US 60 & N 107th Ave

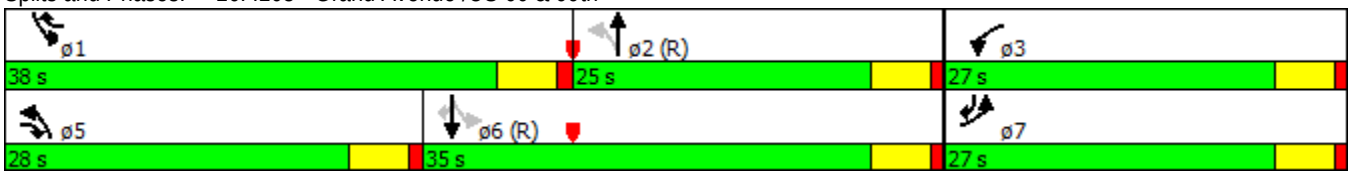


Lane Group	EBL	EBR	WBL	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	240	10	60	560	40	420	680	270	30
Turn Type	Prot	Over	Prot	Over	pm+pt	NA	pm+pt	NA	pm+ov
Protected Phases	7	5	3	1	5	2	1	6	7
Permitted Phases					2		6		6
Detector Phase	7	5	3	1	5	2	1	6	7
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	27.0	28.0	27.0	38.0	28.0	25.0	38.0	35.0	27.0
Total Split (%)	30.0%	31.1%	30.0%	42.2%	31.1%	27.8%	42.2%	38.9%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead		Lead	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?		Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)	12.1	6.1	11.5	36.3	32.6	26.6	67.9	61.0	80.2
Actuated g/C Ratio	0.13	0.07	0.13	0.40	0.36	0.30	0.75	0.68	0.89
v/c Ratio	0.56	0.05	0.15	0.82	0.10	0.46	0.80	0.12	0.02
Control Delay	41.0	0.4	36.5	19.6	12.2	29.1	16.6	6.4	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	0.4	36.5	19.6	12.2	29.1	16.6	6.4	0.6
LOS	D	A	D	B	B	C	B	A	A
Approach Delay						27.7		13.3	
Approach LOS						C		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 5 (6%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 69.3% ICU Level of Service C
Analysis Period (min) 15

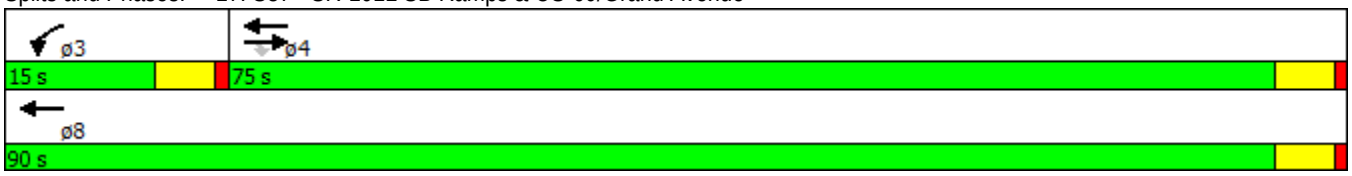
Splits and Phases: 16: I103 - Grand Avenue /US 60 & 99th



Lane Group	EBT	EBR	WBL	WBT	ø8
Lane Configurations					
Volume (vph)	1160	600	240	2110	
Turn Type	NA	Perm	Prot	NA	
Protected Phases	4		3	8 4	8
Permitted Phases		4			
Detector Phase	4	4	3	8 4	
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0		4.0
Minimum Split (s)	21.0	21.0	12.0		21.0
Total Split (s)	75.0	75.0	15.0		90.0
Total Split (%)	83.3%	83.3%	16.7%		100%
Yellow Time (s)	4.0	4.0	4.0		4.0
All-Red Time (s)	1.0	1.0	1.0		1.0
Lost Time Adjust (s)	0.0	0.0	0.0		
Total Lost Time (s)	5.0	5.0	5.0		
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	None	None	None		None
Act Effct Green (s)	70.2	70.2	9.8	90.0	
Actuated g/C Ratio	0.78	0.78	0.11	1.00	
v/c Ratio	0.32	0.52	0.70	0.45	
Control Delay	3.1	4.9	44.9	2.1	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	3.1	4.9	44.9	2.1	
LOS	A	A	D	A	
Approach Delay	3.7			6.5	
Approach LOS	A			A	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 52 (58%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 5.3	Intersection LOS: A
Intersection Capacity Utilization 89.8%	ICU Level of Service E
Analysis Period (min) 15	

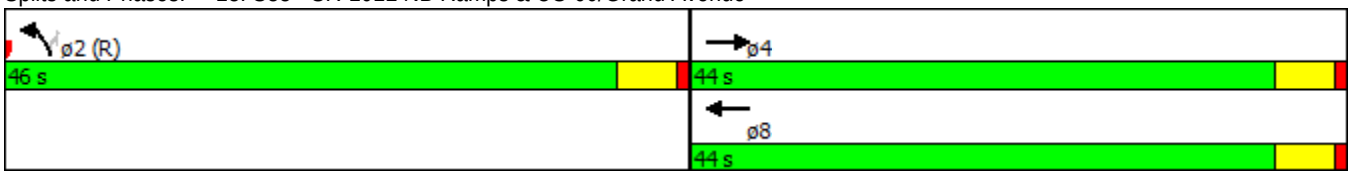
Splits and Phases: 17: S87 - SR-101L SB Ramps & US-60/Grand Avenue



Lane Group	EBT	WBT	NBL	NBR
Lane Configurations				
Volume (vph)	1160	1590	760	210
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Detector Phase	4	8	2	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	44.0	44.0	46.0	46.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	33.8	33.8	46.2	46.2
Actuated g/C Ratio	0.38	0.38	0.51	0.51
v/c Ratio	0.66	0.61	0.47	0.28
Control Delay	20.1	19.9	15.9	13.4
Queue Delay	0.4	0.0	0.0	0.0
Total Delay	20.5	19.9	15.9	13.4
LOS	C	B	B	B
Approach Delay	20.5	19.9	15.4	
Approach LOS	C	B	B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 49 (54%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 18.9	Intersection LOS: B
Intersection Capacity Utilization 89.8%	ICU Level of Service E
Analysis Period (min) 15	

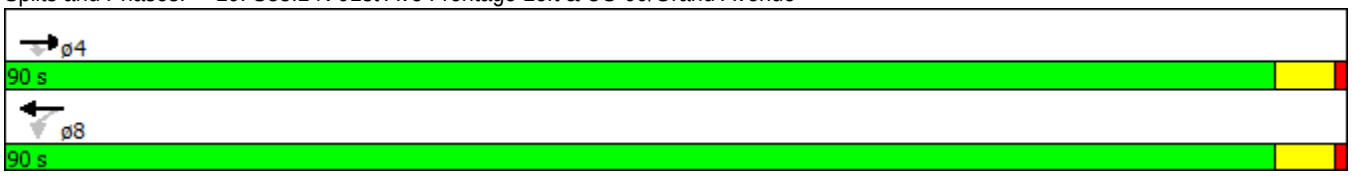
Splits and Phases: 18: S88 - SR-101L NB Ramps & US-60/Grand Avenue



Lane Group	EBT	EBR	WBL	WBT
Lane Configurations				
Volume (vph)	770	600	110	1590
Turn Type	NA	Perm	Perm	NA
Protected Phases	4			8
Permitted Phases		4	8	
Detector Phase	4	4	8	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	90.0	90.0	90.0	90.0
Total Split (%)	100.0%	100.0%	100.0%	100.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	None	None
Act Effct Green (s)	90.0	90.0	90.0	90.0
Actuated g/C Ratio	1.00	1.00	1.00	1.00
v/c Ratio	0.16	0.41	0.20	0.34
Control Delay	0.1	3.8	0.5	0.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	0.1	3.8	0.5	0.1
LOS	A	A	A	A
Approach Delay	1.7			0.2
Approach LOS	A			A

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.41	
Intersection Signal Delay: 0.8	Intersection LOS: A
Intersection Capacity Utilization 63.5%	ICU Level of Service B
Analysis Period (min) 15	

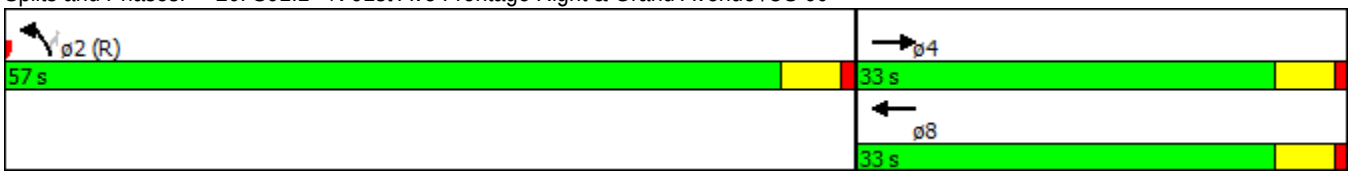
Splits and Phases: 19: S88.1 N 91st Ave Frontage Left & US-60/Grand Avenue



Lane Group	EBT	WBT	NBL	NBR
Lane Configurations				
Volume (vph)	770	1080	620	120
Turn Type	NA	NA	Prot	Perm
Protected Phases	4	8	2	
Permitted Phases				2
Detector Phase	4	8	2	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	33.0	33.0	57.0	57.0
Total Split (%)	36.7%	36.7%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	C-Max	C-Max
Act Effct Green (s)	27.2	27.2	52.8	52.8
Actuated g/C Ratio	0.30	0.30	0.59	0.59
v/c Ratio	0.55	0.76	0.65	0.14
Control Delay	13.2	32.3	16.4	7.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.2	32.3	16.4	7.1
LOS	B	C	B	A
Approach Delay	13.2	32.3	14.9	
Approach LOS	B	C	B	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 79 (88%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 63.5%	ICU Level of Service B
Analysis Period (min) 15	

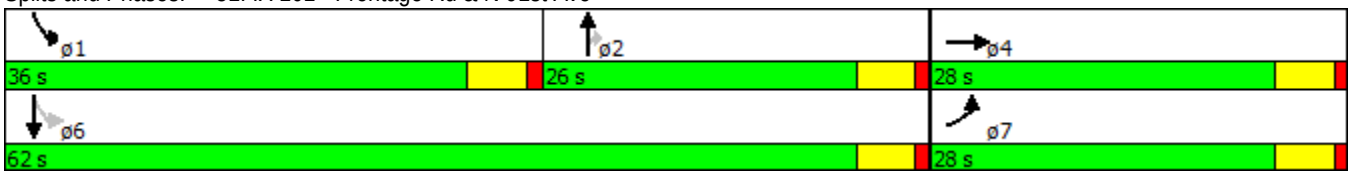
Splits and Phases: 20: S91.1 - N 91st Ave Frontage Right & Grand Avenue /US 60



Lane Group	EBL	EBT	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	420	50	610	320	580	650
Turn Type	Prot	NA	NA	Perm	pm+pt	NA
Protected Phases	7	4	2		1	6
Permitted Phases				2	6	
Detector Phase	7	4	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	12.0	21.0
Total Split (s)	28.0	28.0	26.0	26.0	36.0	62.0
Total Split (%)	31.1%	31.1%	28.9%	28.9%	40.0%	68.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	Max	Max	None	Max
Act Effct Green (s)	23.0	23.0	22.6	22.6	57.0	57.0
Actuated g/C Ratio	0.26	0.26	0.25	0.25	0.63	0.63
v/c Ratio	0.85	0.74	0.74	0.53	0.94	0.32
Control Delay	52.4	35.0	37.8	6.6	43.8	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.4	35.0	37.8	6.6	43.8	8.0
LOS	D	D	D	A	D	A
Approach Delay		44.0	27.1			24.9
Approach LOS		D	C			C

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 30.0	Intersection LOS: C
Intersection Capacity Utilization 82.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 51: IX 101 - Frontage Rd & N 91st Ave

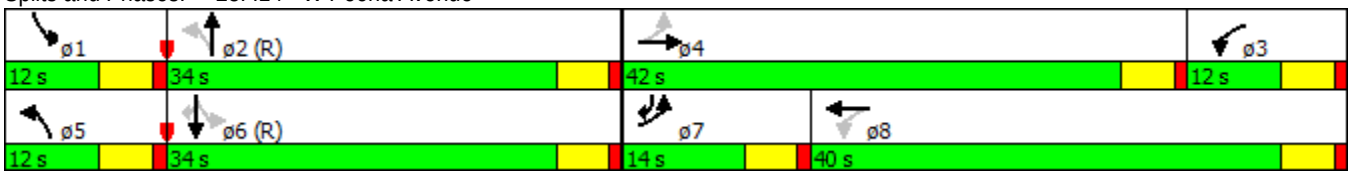


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	200	650	150	310	10	760	150	800	340
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+ov
Protected Phases	7	4	3	8	5	2	1	6	7
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	7
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	14.0	42.0	12.0	40.0	12.0	34.0	12.0	34.0	14.0
Total Split (%)	14.0%	42.0%	12.0%	40.0%	12.0%	34.0%	12.0%	34.0%	14.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)	37.0	37.0	35.0	35.0	34.9	29.0	40.1	38.7	52.7
Actuated g/C Ratio	0.37	0.37	0.35	0.35	0.35	0.29	0.40	0.39	0.53
v/c Ratio	0.93	1.04	0.83	0.97	0.05	1.00	0.83	0.64	0.37
Control Delay	70.5	78.4	43.6	36.4	18.3	64.7	54.8	28.5	2.8
Queue Delay	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.5	78.9	43.6	36.4	18.3	64.7	54.8	28.5	2.8
LOS	E	E	D	D	B	E	D	C	A
Approach Delay		77.0		37.9		64.2		24.8	
Approach LOS		E		D		E		C	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 8 (8%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 48.8 Intersection LOS: D
Intersection Capacity Utilization 95.0% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 23: I14 - W Peoria Avenue

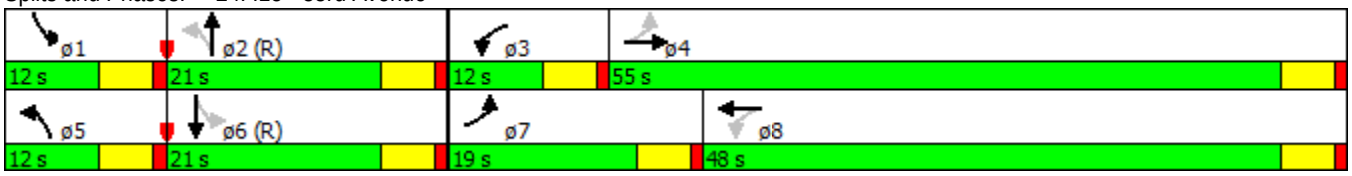


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	250	530	10	610	70	110	100	260
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	12.0	21.0	12.0	21.0
Total Split (s)	19.0	55.0	12.0	48.0	12.0	21.0	12.0	21.0
Total Split (%)	19.0%	55.0%	12.0%	48.0%	12.0%	21.0%	12.0%	21.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
Act Effct Green (s)	60.3	58.1	47.2	41.4	24.5	17.6	25.8	20.0
Actuated g/C Ratio	0.60	0.58	0.47	0.41	0.24	0.18	0.26	0.20
v/c Ratio	0.79	0.67	0.03	0.94	0.28	0.26	0.33	0.46
Control Delay	30.1	5.2	1.8	12.9	30.1	28.1	30.8	38.0
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.1	5.8	1.8	12.9	30.1	28.1	30.8	38.0
LOS	C	A	A	B	C	C	C	D
Approach Delay		12.6		12.7		28.7		36.2
Approach LOS		B		B		C		D

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 18.6 Intersection LOS: B
Intersection Capacity Utilization 78.0% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 24: I15 - 83rd Avenue

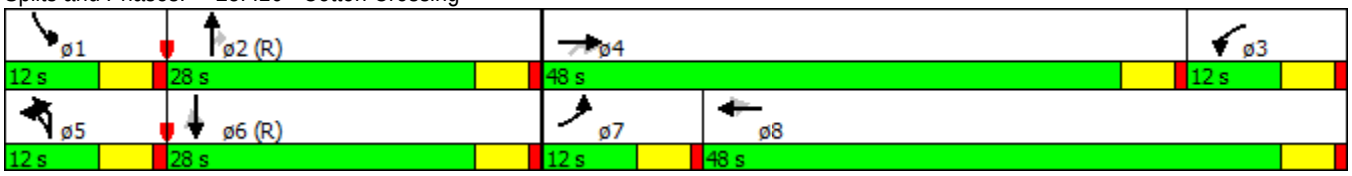


Lane Group	EBL	EBT	WBL2	WBT	WBR	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	420	60	660	670	100	0	690	200	70	750	70
Turn Type	Prot	NA	Prot	NA	Perm	Prot	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	3	8		5	5	2		1	6	
Permitted Phases					8				2			6
Detector Phase	7	4	3	8	8	5	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	21.0	12.0	12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	12.0	48.0	12.0	48.0	48.0	12.0	12.0	28.0	28.0	12.0	28.0	28.0
Total Split (%)	12.0%	48.0%	12.0%	48.0%	48.0%	12.0%	12.0%	28.0%	28.0%	12.0%	28.0%	28.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	7.0	44.4	7.7	43.0	43.0	6.7	6.7	25.4	25.4	6.7	25.4	25.4
Actuated g/C Ratio	0.07	0.44	0.08	0.43	0.43	0.07	0.07	0.25	0.25	0.07	0.25	0.25
v/c Ratio	0.82	0.20	0.25	0.33	1.14	0.53	0.49	0.58	0.39	0.33	0.91	0.19
Control Delay	72.4	17.9	46.0	19.4	102.2	64.4	60.0	35.5	6.8	48.5	52.6	32.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.4	17.9	46.0	19.4	102.2	64.4	60.0	35.5	6.8	48.5	52.6	32.6
LOS	E	B	D	B	F	E	E	D	A	D	D	C
Approach Delay		34.2		63.8				32.4			50.7	
Approach LOS		C		E				C			D	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 74 (74%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 47.2 Intersection LOS: D
Intersection Capacity Utilization 94.8% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 25: I16 - Cotton Crossing



Lane Group	NER
Lane Configurations	
Volume (vph)	520
Turn Type	Perm
Protected Phases	
Permitted Phases	4
Detector Phase	4
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	21.0
Total Split (s)	48.0
Total Split (%)	48.0%
Yellow Time (s)	4.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	5.0
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	44.4
Actuated g/C Ratio	0.44
v/c Ratio	0.79
Control Delay	36.0
Queue Delay	0.0
Total Delay	36.0
LOS	D
Approach Delay	
Approach LOS	

Intersection Summary

Timings
44: IX 102 - 75th Avenue/75th Avenue & W. Olive Avenue

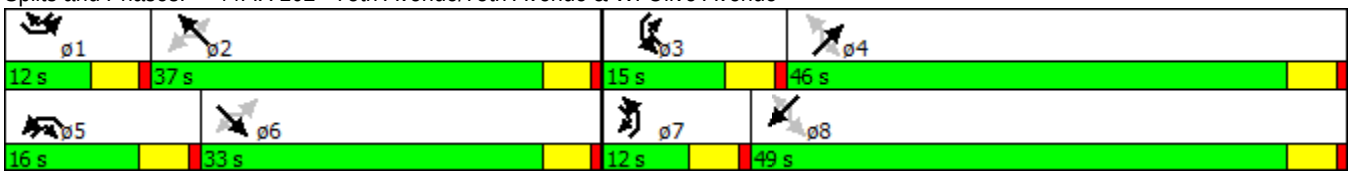
4/29/2015

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	70	520	100	190	950	330	50	1230	290	200	1340	110
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	12.0	33.0	12.0	16.0	37.0	15.0	12.0	46.0	16.0	15.0	49.0	12.0
Total Split (%)	10.9%	30.0%	10.9%	14.5%	33.6%	13.6%	10.9%	41.8%	14.5%	13.6%	44.5%	10.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	34.8	28.1	39.6	42.7	32.0	47.0	47.6	41.0	56.7	54.4	44.4	56.2
Actuated g/C Ratio	0.32	0.26	0.36	0.39	0.29	0.43	0.43	0.37	0.52	0.50	0.40	0.51
v/c Ratio	0.43	0.62	0.18	0.69	1.00	0.50	0.31	1.01	0.37	0.95	1.02	0.14
Control Delay	29.1	39.9	10.9	36.2	67.9	21.0	19.0	62.5	13.5	74.5	61.5	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	39.9	10.9	36.2	67.9	21.0	19.0	62.5	13.5	74.5	61.5	3.3
LOS	C	D	B	D	E	C	B	E	B	E	E	A
Approach Delay		34.6			53.3			52.0			59.2	
Approach LOS		C			D			D			E	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 109.8
Natural Cycle: 110
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.02
Intersection Signal Delay: 52.3 — Intersection LOS: D
Intersection Capacity Utilization 91.9% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 44: IX 102 - 75th Avenue/75th Avenue & W. Olive Avenue



Lane Group	SEL	SET	NWT	SWL
Lane Configurations				
Volume (vph)	80	910	1110	20
Turn Type	Perm	NA	NA	Prot
Protected Phases		6	2	8
Permitted Phases	6			
Detector Phase	6	6	2	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	69.0	69.0	69.0	21.0
Total Split (%)	76.7%	76.7%	76.7%	23.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	C-Max	None
Act Effct Green (s)		66.7	66.7	13.3
Actuated g/C Ratio		0.74	0.74	0.15
v/c Ratio		0.58	0.52	1.13dr
Control Delay		7.3	5.9	20.2
Queue Delay		0.0	0.0	0.0
Total Delay		7.3	5.9	20.2
LOS		A	A	C
Approach Delay		7.3	5.9	20.2
Approach LOS		A	A	C

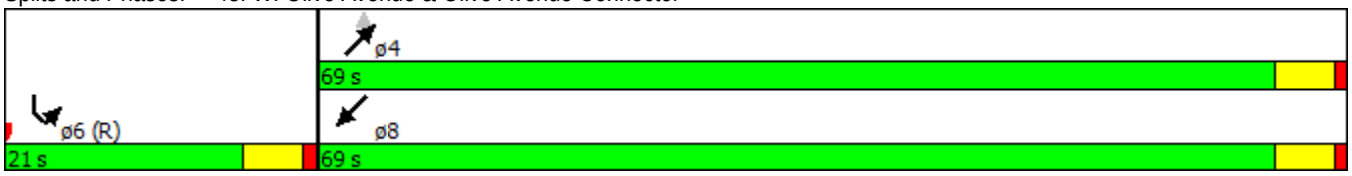
Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NWT and 6:SETL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 8.5	Intersection LOS: A
Intersection Capacity Utilization 86.2%	ICU Level of Service E
Analysis Period (min) 15	
dr Defacto Right Lane. Recode with 1 though lane as a right lane.	

Splits and Phases: 46: 75th Avenue & W Golden Ln

Lane Group	SBL	NEL	NET	SWT
Lane Configurations				
Volume (vph)	360	100	1210	1530
Turn Type	Prot	Perm	NA	NA
Protected Phases	6		4	8
Permitted Phases		4		
Detector Phase	6	4	4	8
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	21.0	69.0	69.0	69.0
Total Split (%)	23.3%	76.7%	76.7%	76.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	None	None	None
Act Effct Green (s)	16.0		64.0	64.0
Actuated g/C Ratio	0.18		0.71	0.71
v/c Ratio	0.71		0.98	0.71
Control Delay	40.9		34.4	9.6
Queue Delay	0.0		0.0	0.0
Total Delay	40.9		34.4	9.6
LOS	D		C	A
Approach Delay	40.9		34.4	9.6
Approach LOS	D		C	A

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 23.0	Intersection LOS: C
Intersection Capacity Utilization 106.2%	ICU Level of Service G
Analysis Period (min) 15	

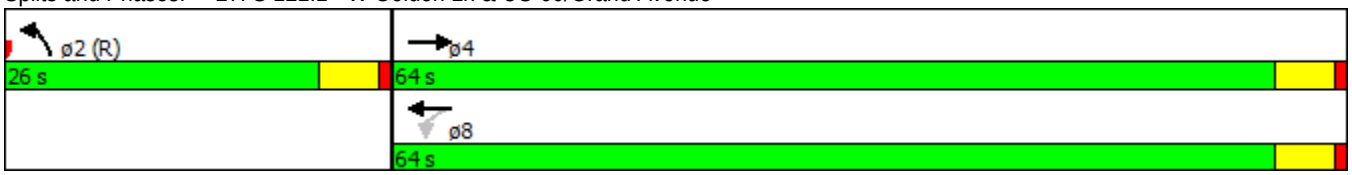
Splits and Phases: 48: W. Olive Avenue & Olive Avenue Connector



Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1330	370	1290	90
Turn Type	NA	Perm	NA	Prot
Protected Phases	4		8	2
Permitted Phases		8		
Detector Phase	4	8	8	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0
Total Split (s)	64.0	64.0	64.0	26.0
Total Split (%)	71.1%	71.1%	71.1%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	None	None	None	C-Max
Act Effct Green (s)	58.2		58.2	21.8
Actuated g/C Ratio	0.65		0.65	0.24
v/c Ratio	0.44		2.27dl	0.48
Control Delay	8.3		17.3	23.0
Queue Delay	0.0		0.0	0.0
Total Delay	8.3		17.3	23.0
LOS	A		B	C
Approach Delay	8.3		17.3	23.0
Approach LOS	A		B	C

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 68 (76%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 13.9	Intersection LOS: B
Intersection Capacity Utilization 82.4%	ICU Level of Service E
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

Splits and Phases: 27: S 121.1 - W Golden Ln & US-60/Grand Avenue



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1440	1500	100	0	160
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1565	1630	109	0	174
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1630				2152	543
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1630				2152	543
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	64
cM capacity (veh/h)	394				41	484

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	SB 1
Volume Total	522	522	522	543	543	543	109	174
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	109	174
cSH	1700	1700	1700	1700	1700	1700	1700	484
Volume to Capacity	0.31	0.31	0.31	0.32	0.32	0.32	0.06	0.36
Queue Length 95th (ft)	0	0	0	0	0	0	0	40
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.6
Lane LOS								C
Approach Delay (s)	0.0			0.0				16.6
Approach LOS								C

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
29: N4 - US-60/Grand Avenue & W. Butler Drive

4/29/2015

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1770	1550	100	0	50
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1924	1685	109	0	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1685				2380	616
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1685				2380	616
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	87
cM capacity (veh/h)	376				29	434

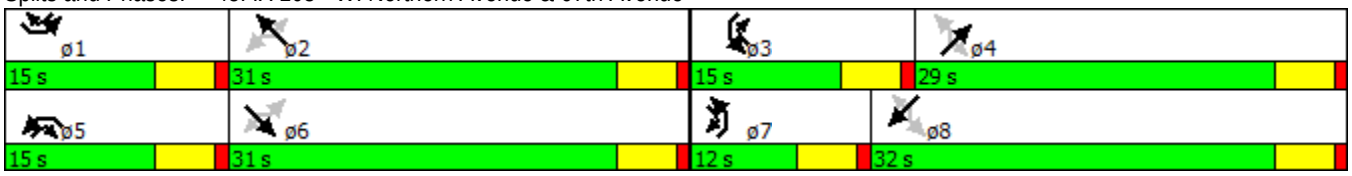
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	641	641	641	674	674	446	54
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	109	54
cSH	1700	1700	1700	1700	1700	1700	434
Volume to Capacity	0.38	0.38	0.38	0.40	0.40	0.26	0.13
Queue Length 95th (ft)	0	0	0	0	0	0	11
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	14.5
Lane LOS							B
Approach Delay (s)	0.0			0.0			14.5
Approach LOS							B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	280	840	40	280	870	320	70	850	270	230	860	300
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	15.0	31.0	12.0	15.0	31.0	15.0	12.0	29.0	15.0	15.0	32.0	15.0
Total Split (%)	16.7%	34.4%	13.3%	16.7%	34.4%	16.7%	13.3%	32.2%	16.7%	16.7%	35.6%	16.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	36.0	26.0	37.7	36.0	26.0	41.0	30.7	24.0	39.0	37.4	29.4	44.4
Actuated g/C Ratio	0.40	0.29	0.42	0.40	0.29	0.46	0.34	0.27	0.43	0.42	0.33	0.49
v/c Ratio	1.09	0.89	0.06	1.09	0.93	0.45	0.36	0.98	0.40	0.92	0.81	0.39
Control Delay	104.0	43.3	0.9	104.0	47.2	14.6	20.7	58.8	14.0	59.5	35.5	11.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	104.0	43.3	0.9	104.0	47.2	14.6	20.7	58.8	14.0	59.5	35.5	11.3
LOS	F	D	A	F	D	B	C	E	B	E	D	B
Approach Delay		56.5			50.9			46.4			34.2	
Approach LOS		E			D			D			C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 46.7	Intersection LOS: D
Intersection Capacity Utilization 92.5%	ICU Level of Service F
Analysis Period (min) 15	

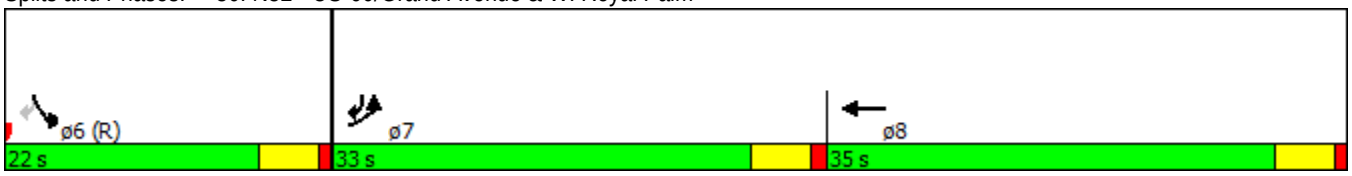
Splits and Phases: 45: IX 103 - W. Northern Avenue & 67th Avenue



Lane Group	EBL	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	450	1390	100	150
Turn Type	Prot	NA	Prot	pm+ov
Protected Phases	7	8	6	7
Permitted Phases				6
Detector Phase	7	8	6	7
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	12.0
Total Split (s)	33.0	35.0	22.0	33.0
Total Split (%)	36.7%	38.9%	24.4%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag		Lead
Lead-Lag Optimize?	Yes	Yes		Yes
Recall Mode	None	None	C-Max	None
Act Effct Green (s)	27.0	31.0	17.0	49.0
Actuated g/C Ratio	0.30	0.34	0.19	0.54
v/c Ratio	0.92	0.95	0.33	0.19
Control Delay	55.3	42.2	34.7	10.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	55.3	42.2	34.7	10.7
LOS	E	D	C	B
Approach Delay		42.2	20.3	
Approach LOS		D	C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 42.4	Intersection LOS: D
Intersection Capacity Utilization 71.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 30: N32 - US-60/Grand Avenue & W. Royal Palm



Lane Group	EBL	EBR	SET	NWL	NWT
Lane Configurations					
Volume (vph)	230	350	810	200	1040
Turn Type	Prot	Perm	NA	Perm	NA
Protected Phases	4		6		2
Permitted Phases		4		2	
Detector Phase	4	4	6	2	2
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0
Total Split (s)	25.0	25.0	65.0	65.0	65.0
Total Split (%)	27.8%	27.8%	72.2%	72.2%	72.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	16.9	16.9	63.1	63.1	63.1
Actuated g/C Ratio	0.19	0.19	0.70	0.70	0.70
v/c Ratio	0.75	0.84	0.38	0.59	0.46
Control Delay	23.9	12.2	6.3	16.3	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.9	12.2	6.3	16.3	7.0
LOS	C	B	A	B	A
Approach Delay	16.9		6.3		8.5
Approach LOS	B		A		A

Intersection Summary

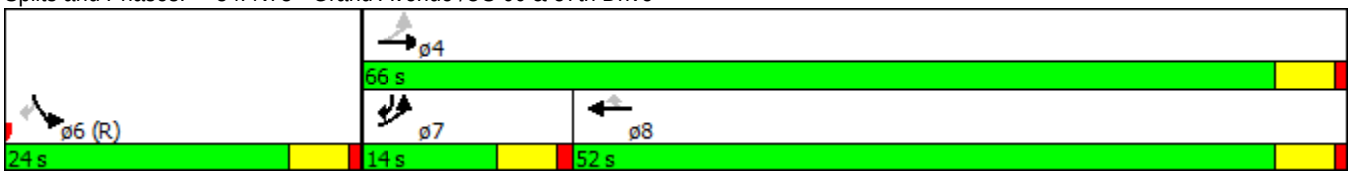
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 73 (81%), Referenced to phase 2:NWTL and 6:SET, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 9.6 Intersection LOS: A
Intersection Capacity Utilization 60.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 36: 67th Avenue & W Royal Palm

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	60	1210	1620	210	180	110
Turn Type	pm+pt	NA	NA	Perm	Prot	pm+ov
Protected Phases	7	4	8		6	7
Permitted Phases	4			8		6
Detector Phase	7	4	8	8	6	7
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	21.0	12.0
Total Split (s)	14.0	66.0	52.0	52.0	24.0	14.0
Total Split (%)	15.6%	73.3%	57.8%	57.8%	26.7%	15.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		Lead
Lead-Lag Optimize?	Yes		Yes	Yes		Yes
Recall Mode	None	None	None	None	C-Max	None
Act Effct Green (s)	56.7	56.7	44.0	44.0	23.3	36.0
Actuated g/C Ratio	0.63	0.63	0.49	0.49	0.26	0.40
v/c Ratio	0.28	0.41	0.71	0.26	0.22	0.19
Control Delay	12.8	1.5	19.5	2.4	28.7	18.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	1.5	19.5	2.4	28.7	18.1
LOS	B	A	B	A	C	B
Approach Delay		2.0	17.5		24.7	
Approach LOS		A	B		C	

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 59 (66%), Referenced to phase 2: and 6:SBL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 12.4	Intersection LOS: B
Intersection Capacity Utilization 52.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 34: N73 - Grand Avenue /US 60 & 57th Drive

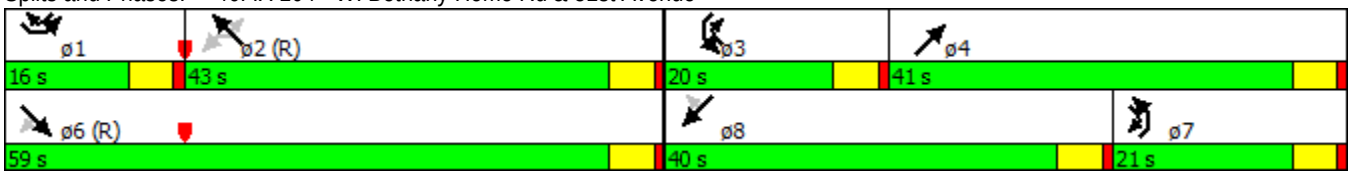


Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	SWL	SWT	SWR
Lane Configurations											
Volume (vph)	290	890	420	10	1430	290	450	700	300	1000	480
Turn Type	Prot	NA	pm+ov	Perm	NA	pm+ov	Prot	NA	Prot	NA	pm+ov
Protected Phases	1	6	7		2	3	7	4	3	8	1
Permitted Phases			6	2		2					8
Detector Phase	1	6	7	2	2	3	7	4	3	8	1
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	21.0	21.0	12.0	12.0	21.0	12.0	21.0	12.0
Total Split (s)	16.0	59.0	21.0	43.0	43.0	20.0	21.0	41.0	20.0	40.0	16.0
Total Split (%)	13.3%	49.2%	17.5%	35.8%	35.8%	16.7%	17.5%	34.2%	16.7%	33.3%	13.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effct Green (s)	11.0	54.0	75.0	38.0	38.0	57.5	16.0	36.5	14.5	35.0	46.0
Actuated g/C Ratio	0.09	0.45	0.62	0.32	0.32	0.48	0.13	0.30	0.12	0.29	0.38
v/c Ratio	1.00	0.61	0.45	0.07	0.97	0.39	1.07	0.72	0.79	1.05	0.81
Control Delay	106.1	27.0	11.6	30.5	56.1	14.0	111.2	41.8	65.4	84.4	28.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	106.1	27.0	11.6	30.5	56.1	14.0	111.2	41.8	65.4	84.4	28.8
LOS	F	C	B	C	E	B	F	D	E	F	C
Approach Delay		37.3			48.9			68.7		66.2	
Approach LOS		D			D			E		E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SET, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 54.5 Intersection LOS: D
Intersection Capacity Utilization 93.0% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 46: IX 104 - W. Bethany Home Rd & 51st Avenue

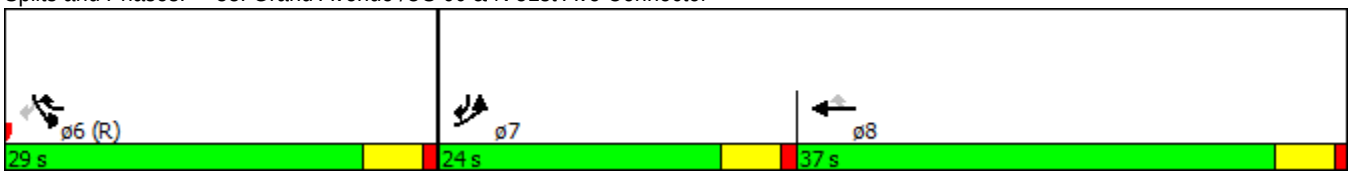


Lane Group	EBL	WBT	WBR	SBL	SBR
Lane Configurations					
Volume (vph)	300	1570	470	350	460
Turn Type	Prot	NA	pm+ov	Prot	pm+ov
Protected Phases	7	8	6	6	7
Permitted Phases	7		8		6
Detector Phase	7	8	6	6	7
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	12.0
Total Split (s)	24.0	37.0	29.0	29.0	24.0
Total Split (%)	26.7%	41.1%	32.2%	32.2%	26.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag			Lead
Lead-Lag Optimize?	Yes	Yes			Yes
Recall Mode	None	None	C-Max	C-Max	None
Act Effct Green (s)	18.4	32.6	61.6	24.0	47.4
Actuated g/C Ratio	0.20	0.36	0.68	0.27	0.53
v/c Ratio	0.90	0.93	0.45	0.81	0.60
Control Delay	64.1	38.2	6.0	45.7	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	64.1	38.2	6.0	45.7	18.3
LOS	E	D	A	D	B
Approach Delay		30.8		30.1	
Approach LOS		C		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 33.8 Intersection LOS: C
Intersection Capacity Utilization 78.0% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 38: Grand Avenue /US 60 & N 51st Ave Connector

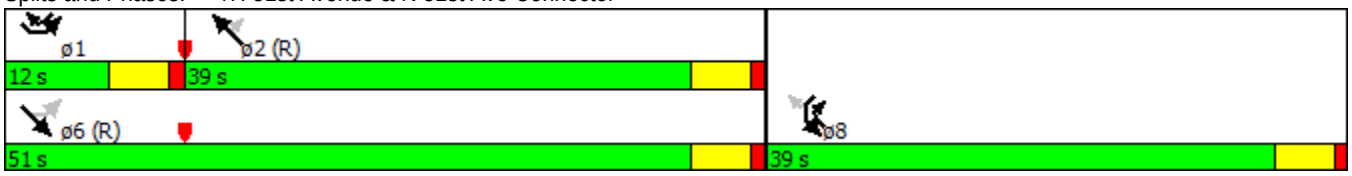


Lane Group	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	190	970	1740	620	630	130
Turn Type	pm+pt	NA	NA	pm+ov	Prot	pm+ov
Protected Phases	1	6	2	8	8	1
Permitted Phases	6			2		8
Detector Phase	1	6	2	8	8	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	21.0	12.0
Total Split (s)	12.0	51.0	39.0	39.0	39.0	12.0
Total Split (%)	13.3%	56.7%	43.3%	43.3%	43.3%	13.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Recall Mode	None	C-Max	C-Max	None	None	None
Act Effct Green (s)	46.0	46.0	34.0	73.0	34.0	46.0
Actuated g/C Ratio	0.51	0.51	0.38	0.81	0.38	0.51
v/c Ratio	0.94	0.58	0.98	0.52	1.03	0.17
Control Delay	67.6	17.0	45.8	3.7	61.0	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.6	17.0	45.8	3.7	61.0	8.3
LOS	E	B	D	A	E	A
Approach Delay		25.3	34.8		52.0	
Approach LOS		C	C		D	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 33 (37%), Referenced to phase 2:NWT and 6:SETL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 35.3 Intersection LOS: D
Intersection Capacity Utilization 91.5% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 47: 51st Avenue & N 51st Ave Connector



Lane Group	NWL	NET	SWT
Lane Configurations			
Volume (vph)	100	1150	1430
Turn Type	Prot	NA	NA
Protected Phases	2	4	8
Permitted Phases			
Detector Phase	2	4	8
Switch Phase			
Minimum Initial (s)	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0
Total Split (s)	24.0	66.0	66.0
Total Split (%)	26.7%	73.3%	73.3%
Yellow Time (s)	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0
Lead/Lag			
Lead-Lag Optimize?			
Recall Mode	C-Max	None	None
Act Effct Green (s)	24.5	55.5	55.5
Actuated g/C Ratio	0.27	0.62	0.62
v/c Ratio	0.25	0.63	0.71
Control Delay	28.4	11.7	13.5
Queue Delay	0.0	0.0	0.0
Total Delay	28.4	11.7	13.5
LOS	C	B	B
Approach Delay	28.4	11.7	13.5
Approach LOS	C	B	B

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NWL and 6:, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 13.3	Intersection LOS: B
Intersection Capacity Utilization 54.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 11: W Bethany h & N. 52nd Ave

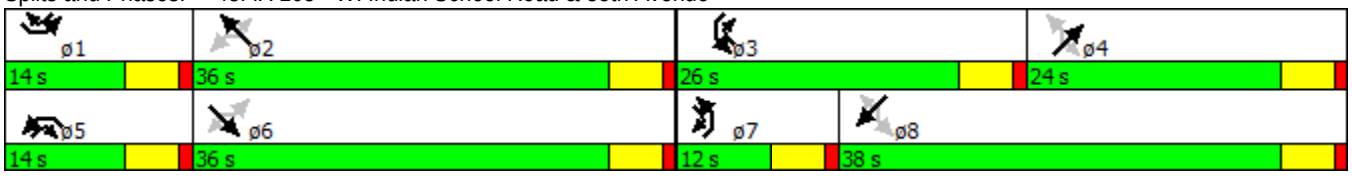
Timings
48: IX 105 - W. Indian School Road & 35th Avenue

4/29/2015

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	200	680	210	100	1450	350	200	850	120	450	1600	380
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	1	6	7	5	2	3	7	4	5	3	8	1
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	7	5	2	3	7	4	5	3	8	1
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0	12.0	21.0	12.0
Total Split (s)	14.0	36.0	12.0	14.0	36.0	26.0	12.0	24.0	14.0	26.0	38.0	14.0
Total Split (%)	14.0%	36.0%	12.0%	14.0%	36.0%	26.0%	12.0%	24.0%	14.0%	26.0%	38.0%	14.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	40.7	31.7	43.7	39.3	31.0	57.0	26.0	19.0	32.3	45.0	33.0	47.0
Actuated g/C Ratio	0.41	0.32	0.44	0.39	0.31	0.57	0.26	0.19	0.32	0.45	0.33	0.47
v/c Ratio	0.93	0.66	0.30	0.41	1.00	0.41	1.10	0.96	0.22	1.10	1.04	0.53
Control Delay	67.7	33.0	9.0	21.1	57.9	10.9	117.7	61.0	5.3	99.0	65.7	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.7	33.0	9.0	21.1	57.9	10.9	117.7	61.0	5.3	99.0	65.7	17.8
LOS	E	C	A	C	E	B	F	E	A	F	E	B
Approach Delay		34.7			47.3			65.0			64.4	
Approach LOS		C			D			E			E	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Natural Cycle: 100	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.10	
Intersection Signal Delay: 54.6	Intersection LOS: D
Intersection Capacity Utilization 97.8%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 48: IX 105 - W. Indian School Road & 35th Avenue

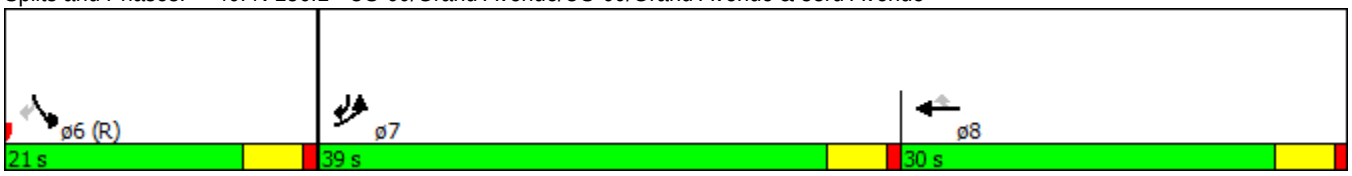


Lane Group	EBL	WBT	WBR	SBL	SBR
Lane Configurations					
Volume (vph)	520	1300	640	230	920
Turn Type	Prot	NA	Perm	Prot	pm+ov
Protected Phases	7	8		6	7
Permitted Phases			8		6
Detector Phase	7	8	8	6	7
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	21.0	21.0	21.0	12.0
Total Split (s)	39.0	30.0	30.0	21.0	39.0
Total Split (%)	43.3%	33.3%	33.3%	23.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag		Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes
Recall Mode	None	None	None	C-Max	None
Act Effct Green (s)	34.0	25.0	25.0	16.0	55.0
Actuated g/C Ratio	0.38	0.28	0.28	0.18	0.61
v/c Ratio	0.85	1.00	0.91	0.80	1.03
Control Delay	39.4	57.7	28.8	55.5	57.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	39.4	57.7	28.8	55.5	57.8
LOS	D	E	C	E	E
Approach Delay		48.1		57.3	
Approach LOS		D		E	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 49.8 Intersection LOS: D
Intersection Capacity Utilization 90.4% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 40: N 186.1 - US-60/Grand Avenue/US-60/Grand Avenue & 33rd Avenue



Lane Group	NWL	NET	NER	SWL	SWT
Lane Configurations					
Volume (vph)	660	1100	130	1020	1600
Turn Type	Prot	NA	pm+ov	Prot	NA
Protected Phases	2	4	2	3	8
Permitted Phases			4		
Detector Phase	2	4	2	3	8
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	12.0	21.0
Total Split (s)	41.0	30.0	41.0	39.0	69.0
Total Split (%)	37.3%	27.3%	37.3%	35.5%	62.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lag		Lead	
Lead-Lag Optimize?		Yes		Yes	
Recall Mode	C-Max	None	C-Max	None	None
Act Effct Green (s)	36.0	25.0	66.0	34.0	64.0
Actuated g/C Ratio	0.33	0.23	0.60	0.31	0.58
v/c Ratio	1.04	1.04	0.15	1.05	0.59
Control Delay	69.9	78.0	9.6	77.8	15.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	69.9	78.0	9.6	77.8	15.6
LOS	E	E	A	E	B
Approach Delay	69.9	70.8			39.8
Approach LOS	E	E			D

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:NWL and 6:, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 54.4 Intersection LOS: D
Intersection Capacity Utilization 97.1% ICU Level of Service F
Analysis Period (min) 15

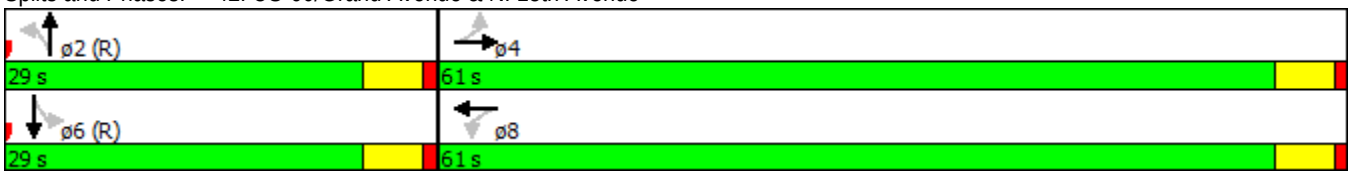
Splits and Phases: 49: N 33rd Ave & Indian School Rd

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	80	460	30	970	30	100	30	80
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	61.0	61.0	61.0	61.0	29.0	29.0	29.0	29.0
Total Split (%)	67.8%	67.8%	67.8%	67.8%	32.2%	32.2%	32.2%	32.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	39.5	39.5	39.5	39.5		40.5		40.5
Actuated g/C Ratio	0.44	0.44	0.44	0.44		0.45		0.45
v/c Ratio	0.76	0.34	0.10	0.70		0.23		0.20
Control Delay	60.4	16.0	1.0	2.9		17.1		16.5
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	60.4	16.0	1.0	2.9		17.1		16.5
LOS	E	B	A	A		B		B
Approach Delay		22.3		2.9		17.1		16.5
Approach LOS		C		A		B		B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 21 (23%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 10.9 Intersection LOS: B
Intersection Capacity Utilization 55.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 42: US-60/Grand Avenue & N. 18th Avenue

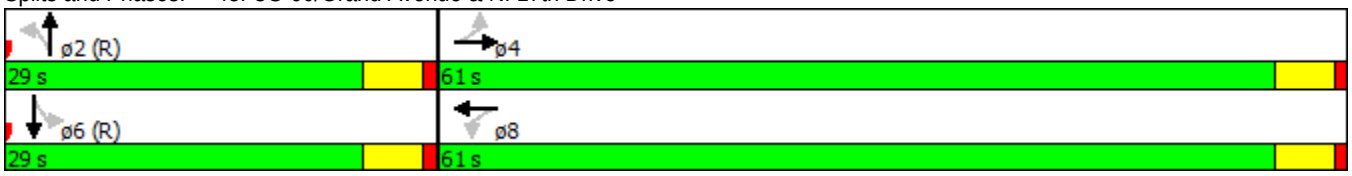


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	30	480	10	1010	10	90	20	40
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	61.0	61.0	61.0	61.0	29.0	29.0	29.0	29.0
Total Split (%)	67.8%	67.8%	67.8%	67.8%	32.2%	32.2%	32.2%	32.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	40.0	40.0	40.0	40.0		40.0		40.0
Actuated g/C Ratio	0.44	0.44	0.44	0.44		0.44		0.44
v/c Ratio	0.30	0.34	0.03	0.71		0.15		0.10
Control Delay	16.0	9.9	11.3	22.3		17.0		16.1
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	16.0	9.9	11.3	22.3		17.0		16.1
LOS	B	A	B	C		B		B
Approach Delay		10.3		22.2		17.0		16.1
Approach LOS		B		C		B		B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 12 (13%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 18.0 Intersection LOS: B
Intersection Capacity Utilization 45.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 43: US-60/Grand Avenue & N. 17th Drive



	EB Avg Speed	WB Avg Speed	EB LOS	WB LOS
AM Peak	33.66	46.04	D	C
PM Peak	38.25	44.25	D	D

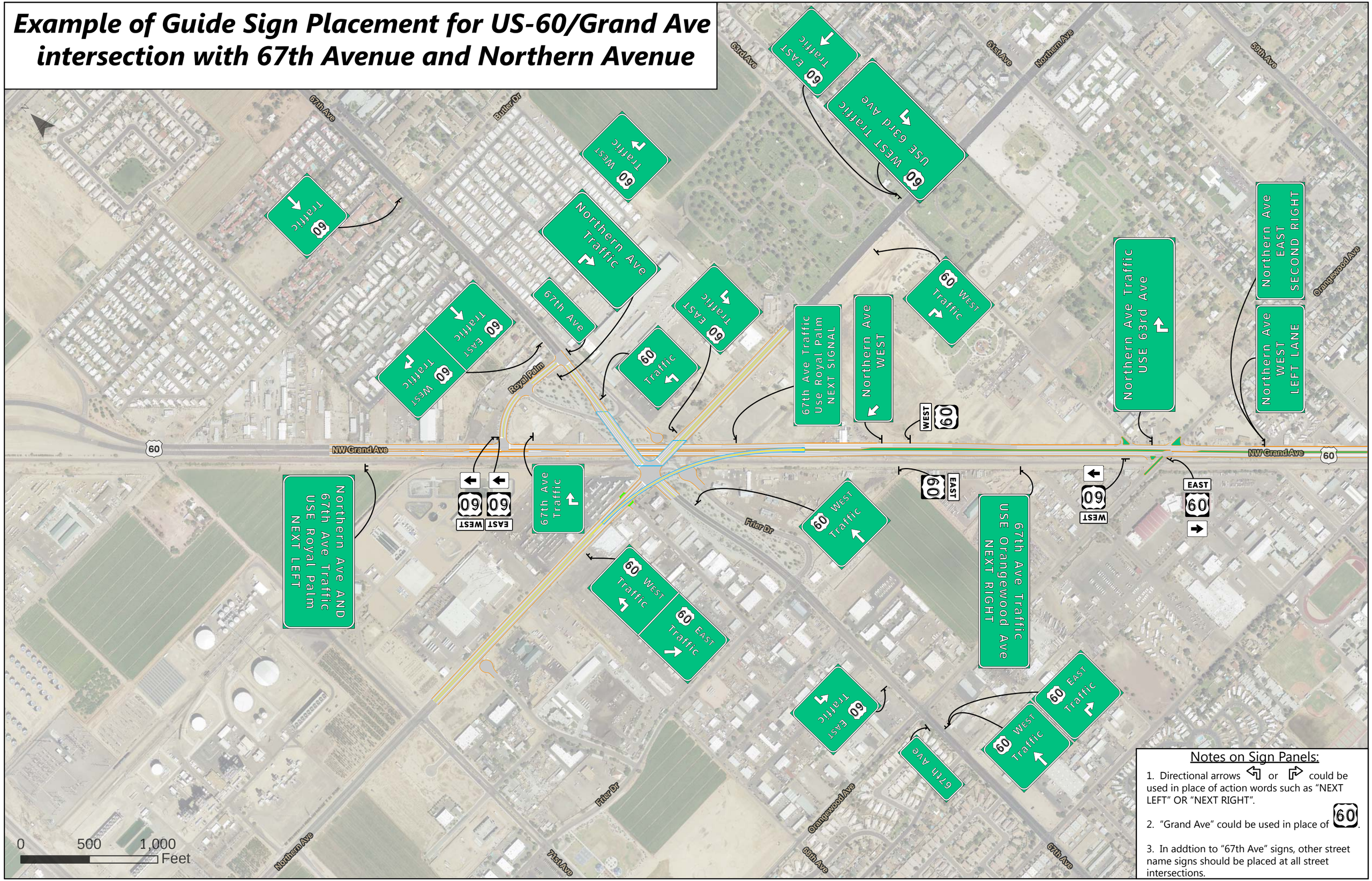
AM Peak Hour				
Approach	Movement	Volume	Delay	LOS
19th Avenue North Leg	TL	379	10.17547	B
19th Avenue North Leg	TR	507	10.99684	B
19th Avenue South Leg	TL	238	12.67295	B
19th Avenue South Leg	T	330	15.39053	C
19th Avenue South Leg	TR	447	21.08615	C
Grand Avenue West Leg	TL	330	18.56062	C
Grand Avenue West Leg	T	780	41.98645	E
Grand Avenue East Leg	TL	57	11.95969	B
Grand Avenue East Leg	T	48	10.90813	B
Grand Avenue East Leg	TR	240	9.820357	A

PM Peak Hour				
Approach	Movement	Volume	Delay	LOS
19th Avenue North Leg	TL	316	13.71582	B
19th Avenue North Leg	TR	456	17.65215	C
19th Avenue South Leg	TL	311	10.83336	B
19th Avenue South Leg	T	438	12.02625	B
19th Avenue South Leg	TR	629	14.76511	B
Grand Avenue West Leg	TL	128	8.701741	A
Grand Avenue West Leg	T	395	7.873196	A
Grand Avenue East Leg	TL	146	16.47842	C
Grand Avenue East Leg	T	157	13.396	B
Grand Avenue East Leg	TR	626	22.8078	C

APPENDIX TM6-3

Example Signing Concept

Example of Guide Sign Placement for US-60/Grand Ave intersection with 67th Avenue and Northern Avenue



Notes on Sign Panels:

1. Directional arrows ↰ or ↱ could be used in place of action words such as "NEXT LEFT" OR "NEXT RIGHT".

2. "Grand Ave" could be used in place of 60.

3. In addtion to "67th Ave" signs, other street name signs should be placed at all street intersections.

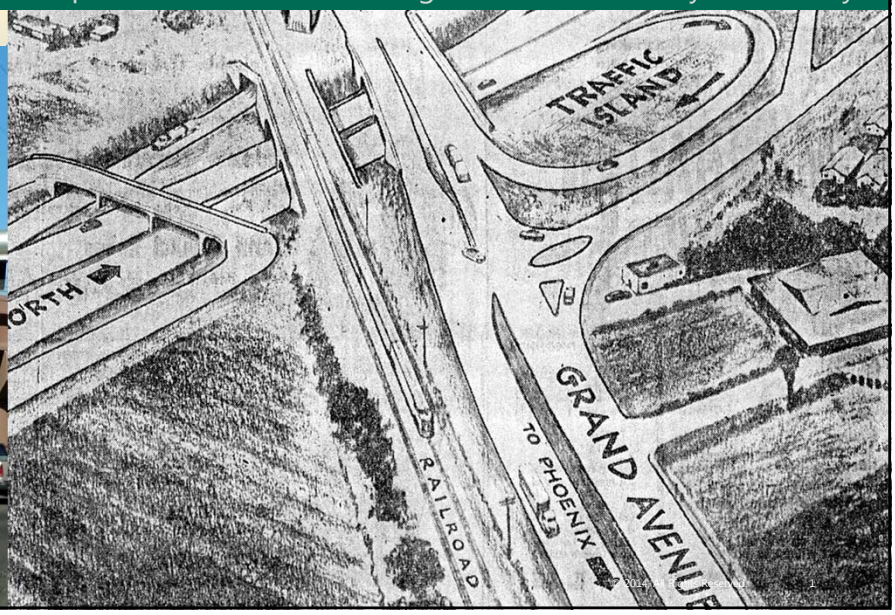
APPENDIX TM6-4

Access Management Workshop PowerPoint

US-60/**Grand Avenue** **C**orridor **O**ptimization, Access **M**anagement **P**lan, **A**nd **S**ystem **S**tudy

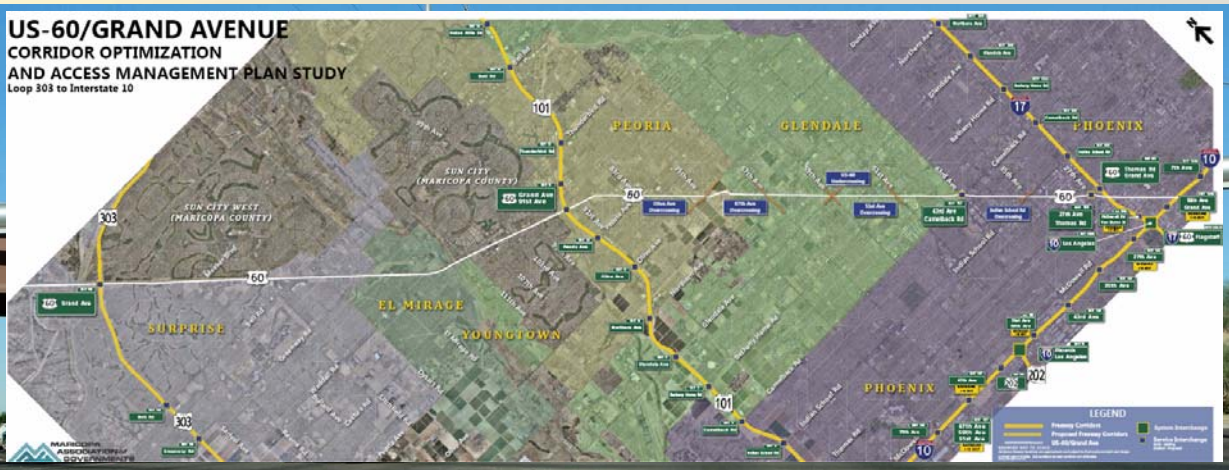
Planning Partners Access Management Workshop

March 4 and 5, 2014



Corridor Limits

SR-303L (r.m. 138.051) to Willetta St (r.m. 161.880 on US-60X) (about 23.8 miles)



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Project Tasks

1 - Initiate Project → 2 - Develop Public Involvement Plan → 3 - Perform Existing Conditions Analysis → 4 - Review Past Studies and Identify Recurring Themes

5 - Formulate Corridor Goals and Visions → 6 - Establish Alternative Schematics → 7 - Analyze Alternatives and Develop Recommendations → 8 - Establish Access Management Plan and Policies

9 - Develop Implementation Plan

10 - Document Project

Tasks Underway

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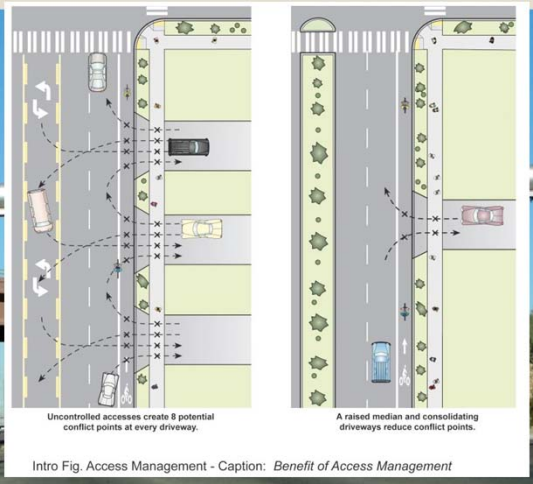
Workshop Purpose

- Discuss the techniques and results of access management.
- Illustrate how these techniques could be applied to Grand Avenue.
- Focus on a few key locations to experiment with techniques. Discuss pilot plots, wrap up ideas and possibilities.
- Discuss cost and strategies that should be successful on Grand Avenue.
- Discuss corridor zoning overlays as a method to manage access on Grand Avenue.



Intro Fig. Access Management - Caption: *Benefit of Access Management*

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Establish Access Management Plan and Policies

- **GOAL: Greater efficiency and Safety.**
- Improve traffic signal spacing for better progression, fewer stops.
- No non-controlled left-turn out access points - Improves safety.
- Reduce number of private direct driveways - Less vehicle friction and crashes.
- Improve turning lane designs - Less speed differential issues, no thru lane blockage.
- Improve side street circulation - Lower driveway demand.
- Improve site circulation – Means fewer trips on Grand Ave and fewer driveways.
- Improve driveway design - Smoother transition off Grand Avenue.

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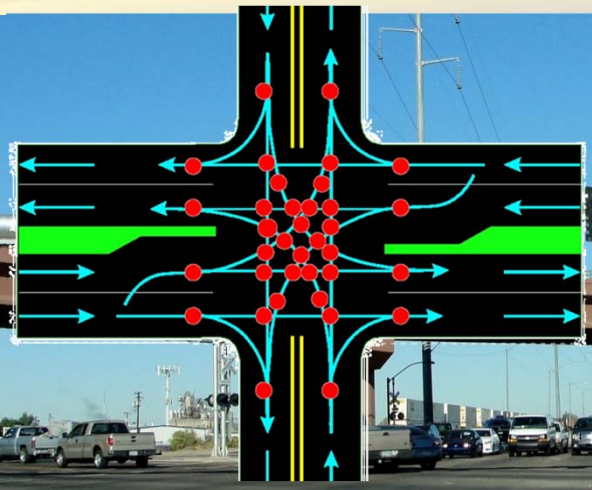
Open Four-leg Intersection
CONFLICT POINTS



- Up to **32** Conflict Points.
- About **28 dangerous crossing conflicts** with 8 lanes from 6 through lanes, 2 turn lanes and far side entries.

Source: Teachamerica and Florida Department of Transportation.

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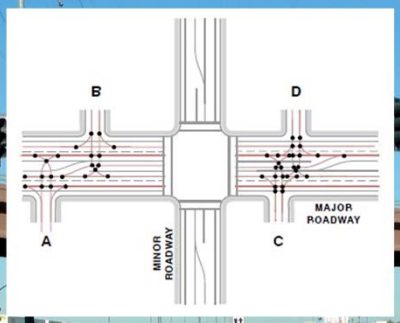
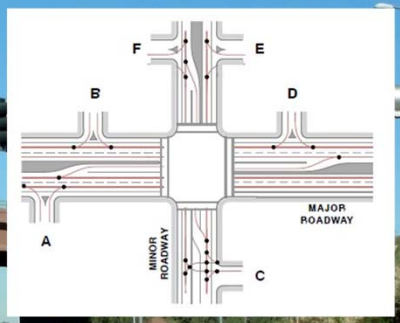
Goal of Access Management

LIMIT ACCESS CONFLICTS AND SEVERE TYPES





Source: Florida Department of Transportation and Federal Highway Administration.

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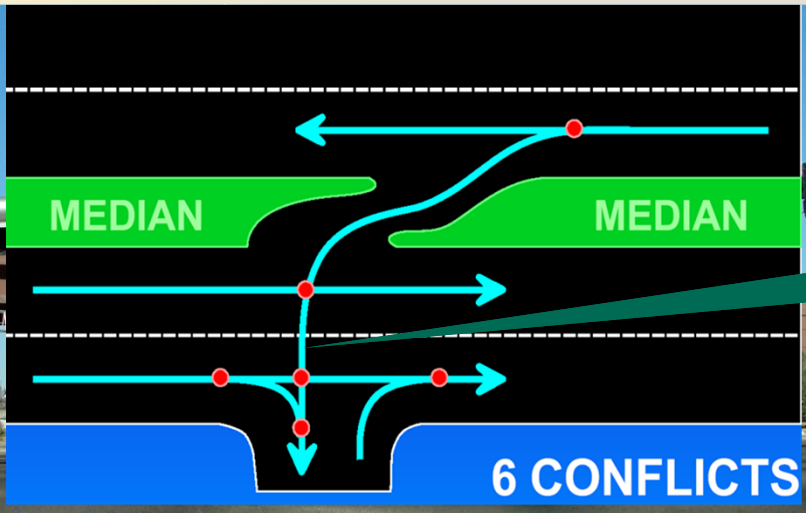
"3/4 Intersection" – No Lefts Out



Add another conflict point for a third lane.

Source: Florida Department of Transportation.

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There is no such thing as Safe Access.

- As the number of access points per mile **increase**, the **frequency and rate of crashes increases**.
- Each access = 4%.

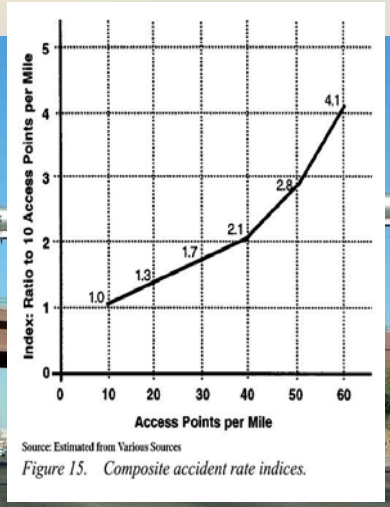

Figure 15. Composite accident rate indices.

Source: NCHRP 420, Access Management Manual.

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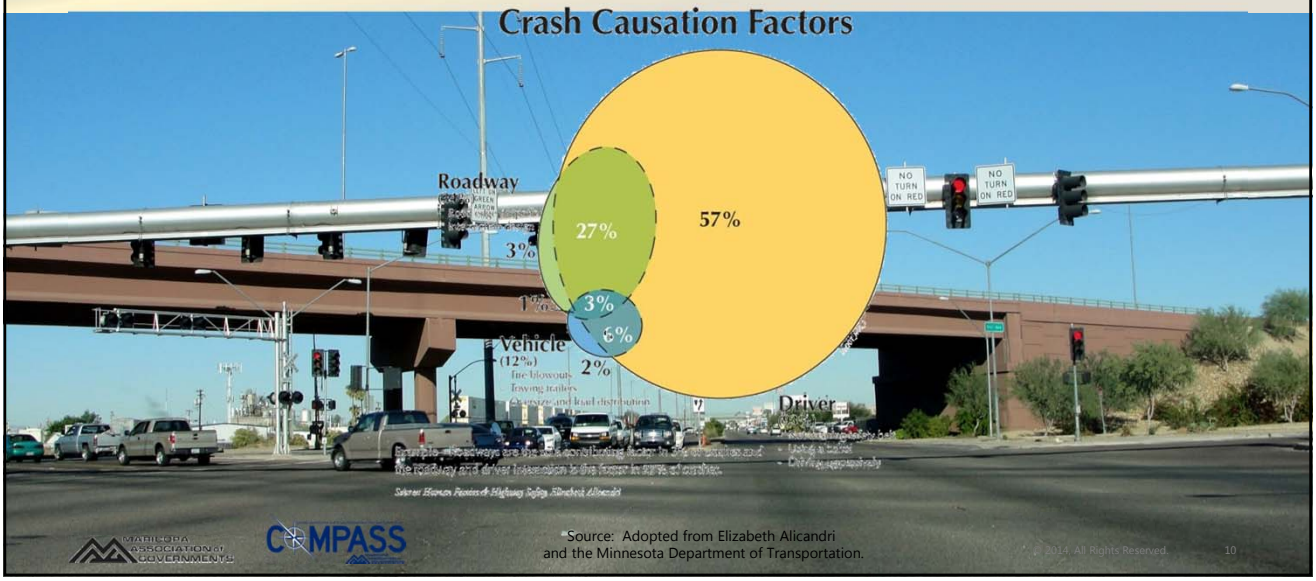
It is not so much the design, it is driver error.

But if we (agencies) reduce the conflicts, then we reduce the crash rates.



*Source: Adopted from Elizabeth Alicandri and the Minnesota Department of Transportation.

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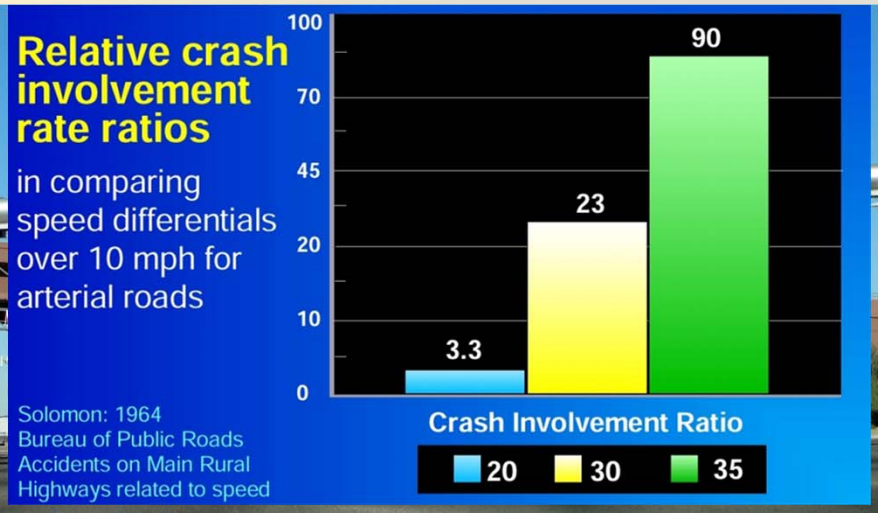
Speed Differential – A Critical Element in Design



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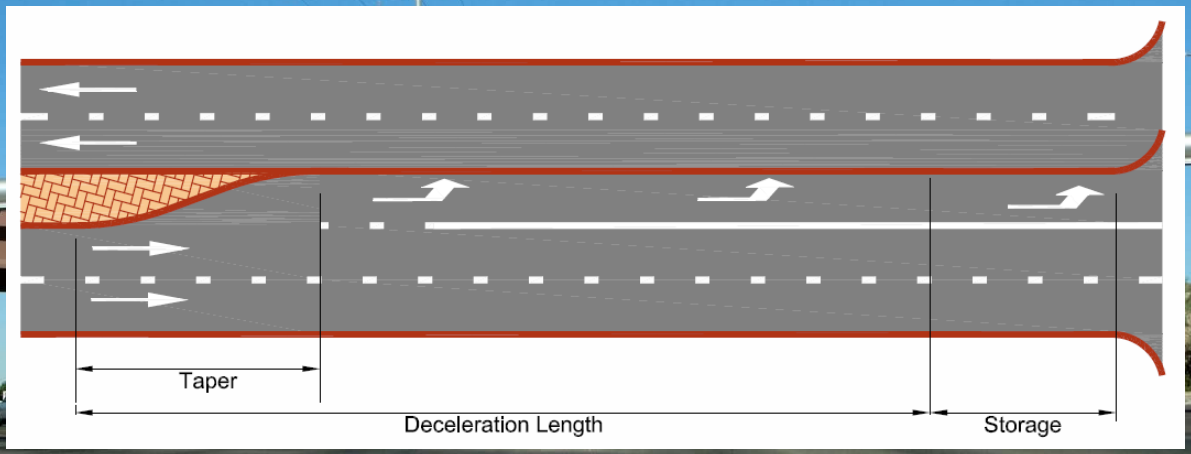
Left-Turn Lane Elements



Not to Scale.

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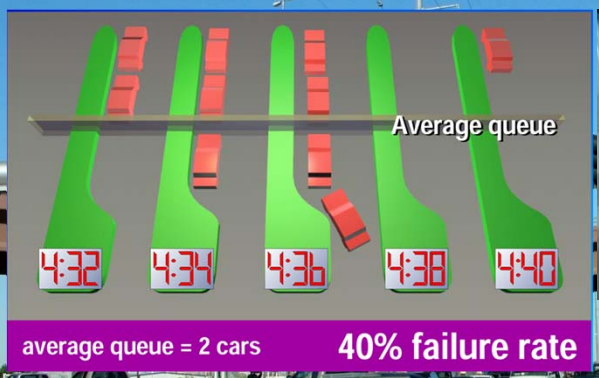
Average Queue Design Failures



Left turn Queue backing up into and blocking through lanes on Grand Avenue.

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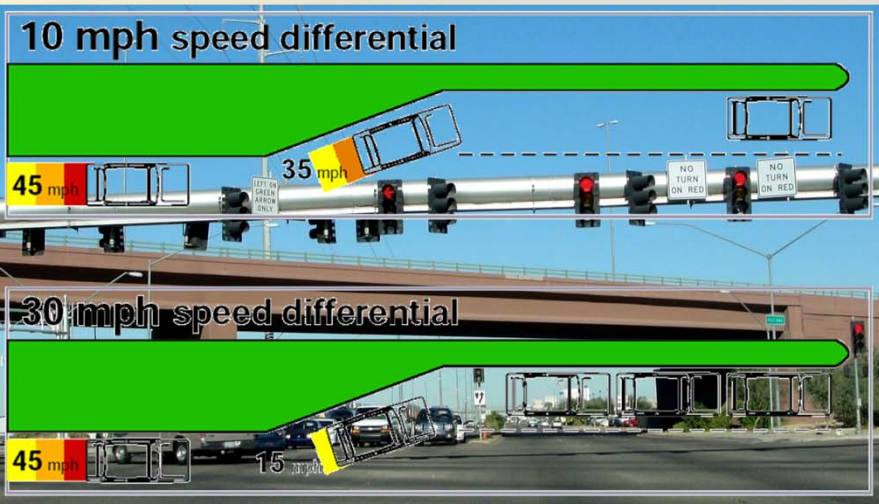
Combining Storage and Deceleration Lengths defeat Speed Differential Mitigation



Source: Florida Department of Transportation.

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Deceleration Lane Length Options

Speed in MPH	35	45	55	65
Deceleration Length, Ft.	215	345	510	710

10 mph speed differential for normal arterial

Speed in MPH	35	45	55	65
Deceleration Length, Ft.	350	630	810	1060

Zero mph speed differential for major arterial and expressway

Source: Florida Department of Transportation.

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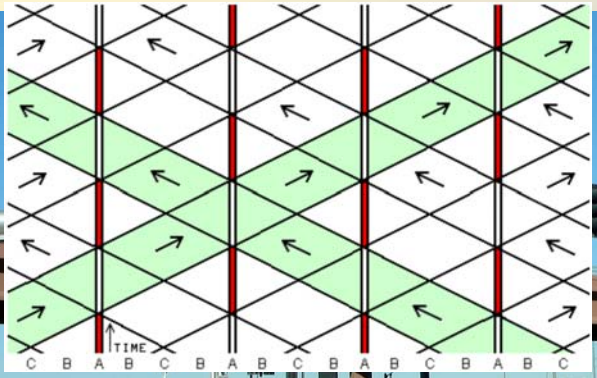
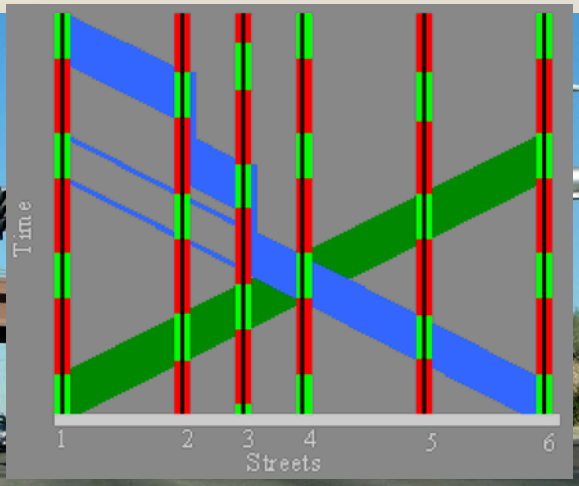
Evenly spaced Traffic Signals really Help





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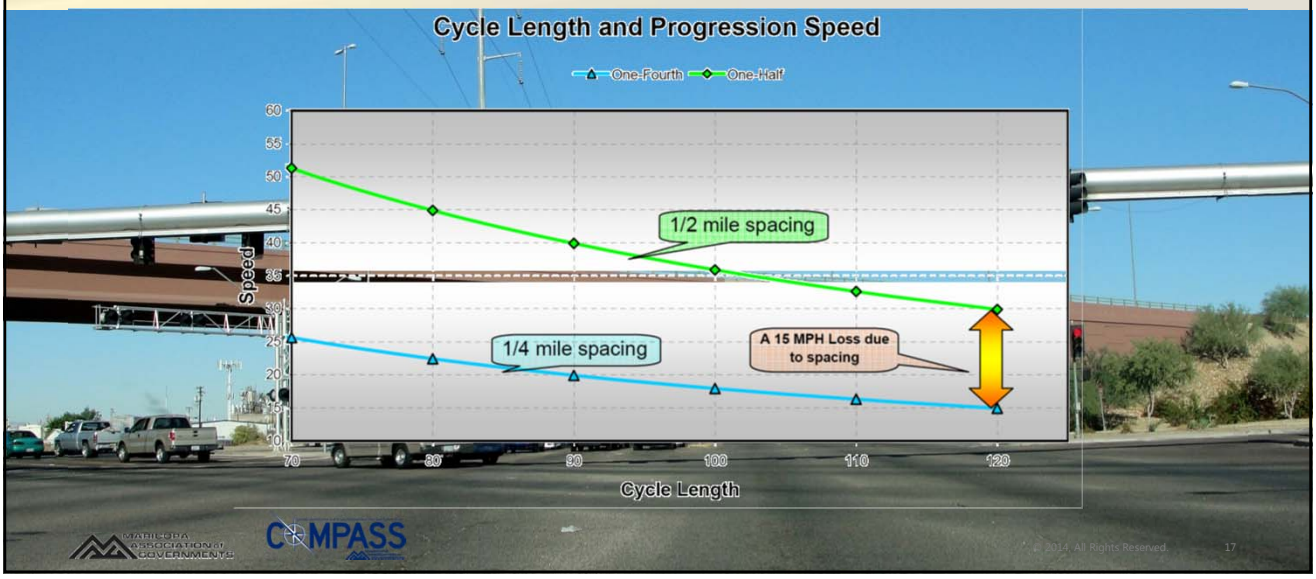
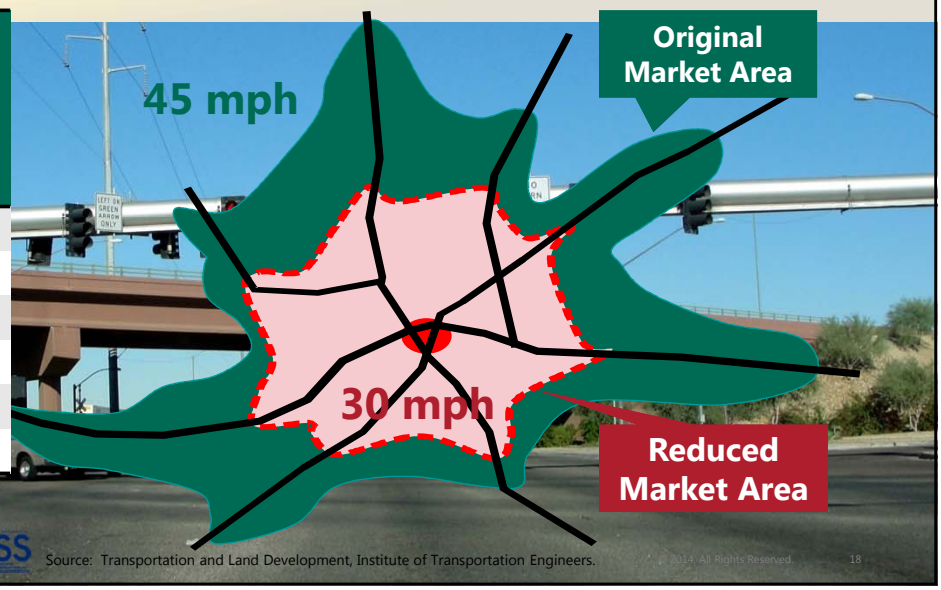
The longer the Spacing between Signals, the faster the Progression Speeds.



Market Area Shrinks as Arterial Speed is Reduced

Dropping from 45 mph to 30 mph means greater than 45% reduction

Reduction in Average System Speed	Market Area Relative to Previous Size
0%	100%
10%	81%
20%	65%
30%	45%
40%	36%
50%	25%



Source: Transportation and Land Development, Institute of Transportation Engineers.

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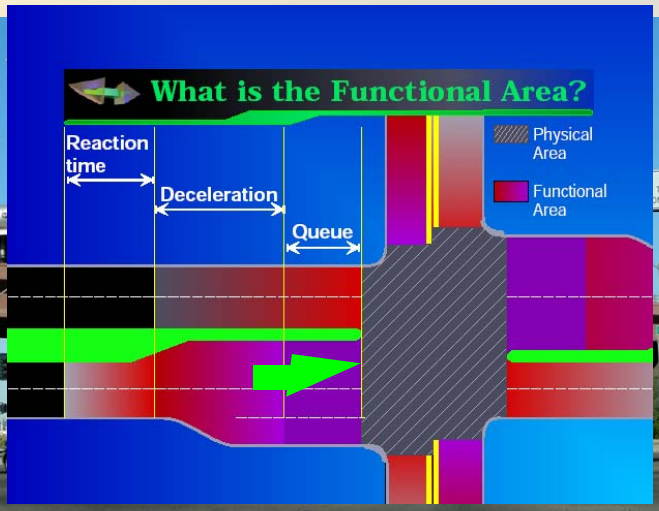
Keep Functional Areas Free



Source: Florida Department of Transportation.

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Improve Access Designs

- Smoother driveway movements.
- Longer turn lanes.
- Add turn lanes.

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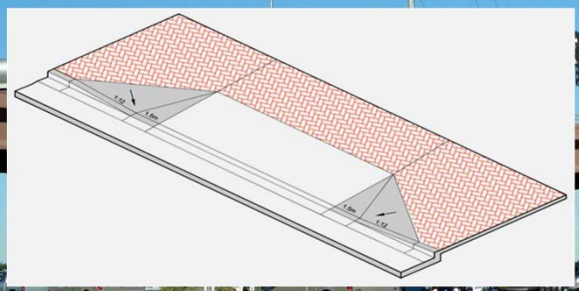
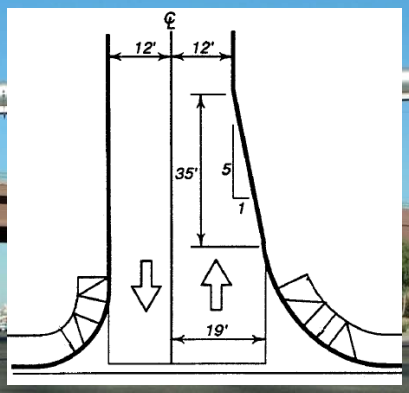
Flared Entry Layout

Better radius and lane width for both right and left turns.

12:1 Transition wing, 5-ft flat flair.



Detail from Scottsdale.



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Meeker Road/Reems Road

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Back to Back Left Turn Lanes

- Left-turn in:
- It has about 200-ft.
- Should the opening be closed?
- Left-turn at signal.
- AASHTO recommends 345-ft for deceleration length at 45 mph prior to storage calculation.
- Queue turning left.
- At signals, left turn lanes should be 600- to 800-ft depending on turning movement counts.

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Meeker Rd/Reems Rd
Recommendation

- **Closest, in deceleration, often inside the signal queue, allows diagonal across to Meeker Rd left-turns.**
- **Close #2, Better than 1, but has other reasonable access.**
- **Close left–in . . . too short, reduces primary left deceleration and storage; has speed differential issue.**

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Southeast of Meeker Road/Reems Road

Recommendation

- [illegible] 300-ft spacing.
- Left turn bay 600-ft good length.
- No critical need for ¾ opening.
- 300-ft, but not high volume.
- Backage road excellent planning.
- **Eight** driveway closures.
- **Three Right-in/Rig[illegible]** main.

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Parkview Place to Mountain View Boulevard

- First, second, too close to signal.
- Left Deceleration is 600-ft, [illegible] de[illegible]
- First (left) driveway too close to signal.
- Second is optional, connects to back road.
- Third is a street design access and serves several [illegible] businesses and back road.
- Fourth, not a necessity, access from side road and backage. But this is where the short ¾ left is.
- Fifth and sixth, are cl[illegible] signal.
- East of signal the ce[illegible]cess can serve both properties as well [illegible] the Mountain View Blvd signal.

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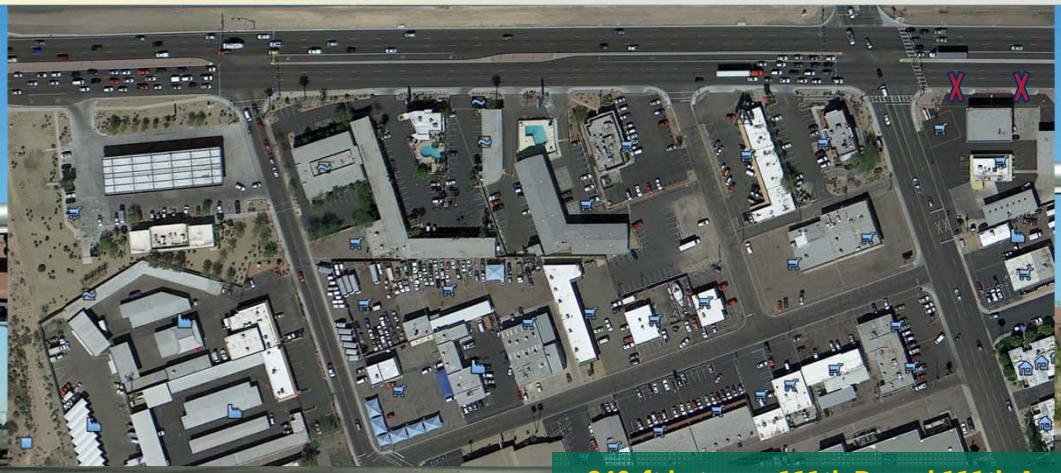
113th Avenue to 111th Avenue

950-ft separate intersections . . . Entry to Youngtown



- 240-ft between 111th Dr and 111th Ave

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113th Avenue to 111th Avenue

Recommendation

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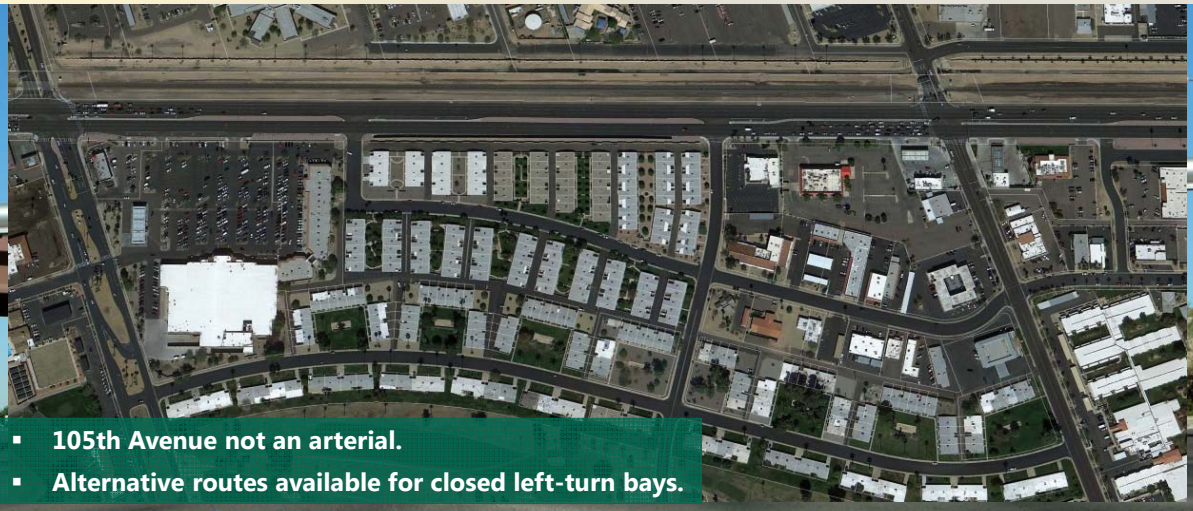
107th Avenue to 103rd Avenue



- 105th Avenue not an arterial.
- Alternative routes available for closed left-turn bays.

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107th Avenue to 103rd Avenue
Recommendation

- Change 105 to RTO. No necessity for lefts, Not enough length for deceleration lane
- Close all close driveways where alternative access is available.

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Northern Avenue to Myrtle Avenue
Recommendation

- Close Median Access.
- Includes Orangewood Avenue and 63rd Avenue intersections.

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63rd Avenue/Orangewood Avenue
Nine Turning Movements across Multiple Through Lanes

- **Proposal is to extend the median, no left-turns.**
- **Only 1,600-ft to West Myrtle Avenue.**

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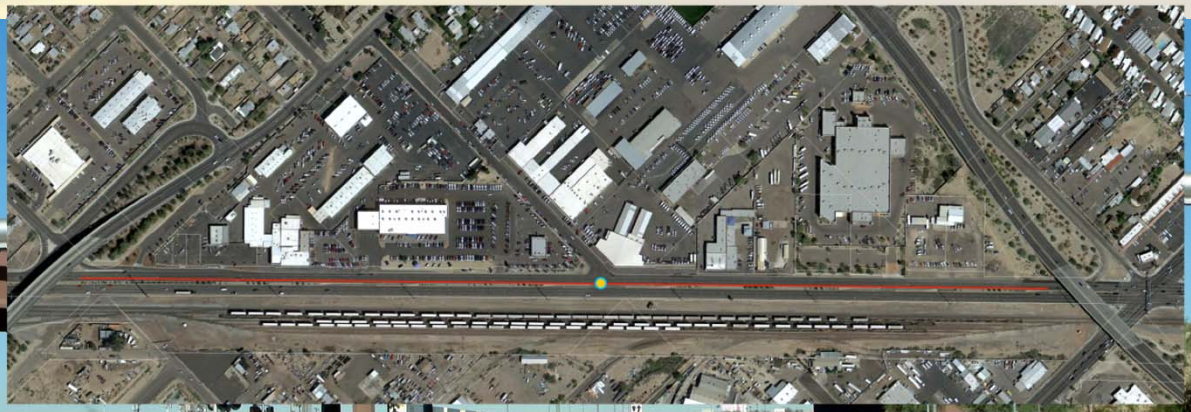
Maryland Avenue to Bethany Home Road

Recommendation



- Close median and reduce driveways.
- Identify potential for ¾ intersections, opportunities for U-Turn ramps, and improved access to Maryland Avenue.

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Interstate 17 to McDowell Road/19th Avenue

Recommendation

- No median openings.
- Close, combine, consolidate driveways were feasible.
- No crossovers.
- No ¾-intersections.
- With exception at Encanto Blvd to mitigate futu[illegible]e-separated interchange [illegible]Dowell Road/19th Avenue.

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Interstate 17 to McDowell Road/19th Avenue

Recommendation

- Remove signal at Encanto Blvd.
- Raised median entire length.
- Allow Right-in/Right-out only when necessary and no other access alternative.

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Corridor Overlay Zoning

- Create requirements that will ensure careful consideration of access impacts.
- Decisions will be consistent with the adopted access management plan for Grand Avenue.
- Each municipality and the county may adopt their own overlay zoning language.
- "The standards of this overlay district were created to help ensure a collaborative process between all jurisdictions along Grand Avenue regarding access decisions and to implement the recommendations of the adopted Grand Ave Access Management Plan."

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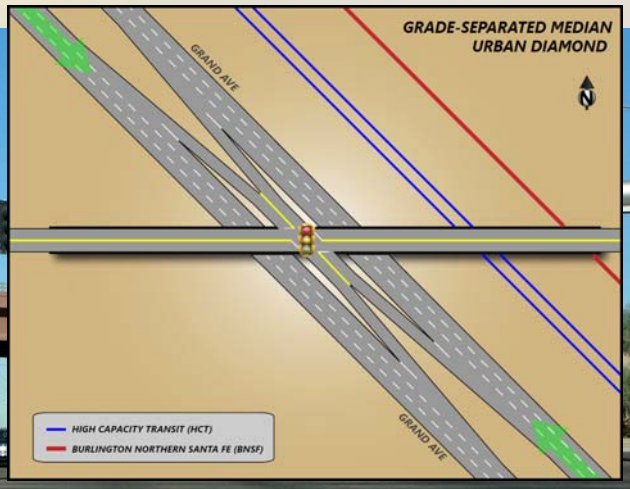
Operational Improvements

- General approach is to:
  - Reduce traffic signal phases,
  - Reduce number of intersection approaches, and
  - Introduce new grade separations.
- Median Urban Diamond (MUD).
- Upstream Signalized Crossover (USC).



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Operational Improvements

- General approach is to:
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  - Reduce number of intersection approaches, and
  - Introduce new grade separations.
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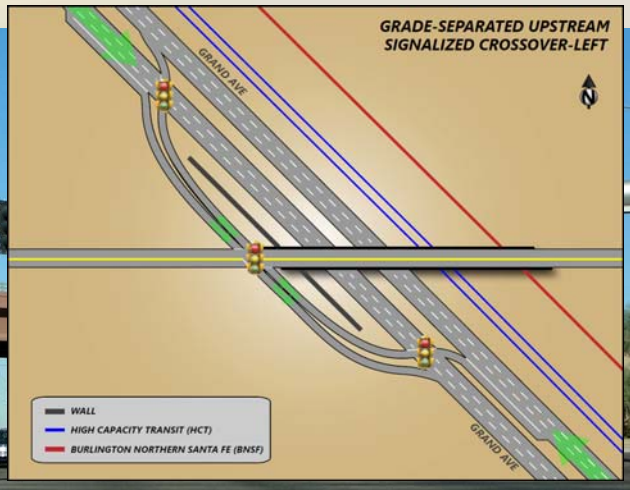
- Upstream Signalized Crossover (USC).



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US-60/Grand Avenue Corridor Optimization, Access Management Plan, And System Study
Planning Partners Access Management Workshop
March 4 and 5, 2014
TRAFFIC ISLAND
GRAND AVENUE
TO PHOENIX
RAILROAD
COMPASS

APPENDIX TM6-5

Corridor Zoning Overlay District Model Ordinance

US-60/GRAND AVENUE CORRIDOR ZONING OVERLAY DISTRICT
Model Ordinance

I. Title and Authority:

Title: This Ordinance shall be known as the US-60/Grand Avenue Corridor Zoning Overlay District.

Authority: ARS 9-463.01.(municipality) or ARS 11-251.05 (county).

II. Purpose (intent):

The purpose of this overlay district is to enhance the safety, function, and capacity of the US-60/Grand Avenue Corridor. This ordinance implements the US-60/Grand Avenue Access Management Plan (AMP) which has been adopted by resolution by the City. The US-60/Grand Avenue Corridor Optimization, Access Management Plan, and System Study (COMPASS) developed a vision and plan for the US-60/Grand Avenue Corridor that embraces the important regional function of US-60/Grand Avenue, along with defining the operational character, establishing an access management plan, and outlining a process for moving forward with improvements.

As a major regional traffic route and economic development area, this highway corridor represents significant community investments and contributes to public health, safety, and welfare. The corridor provides access to jobs and schools, facilitates delivery of emergency services, supports the movement of goods, services and people, and thereby enhances economic development and opportunities. Furthermore, this corridor serves as a first impression of the community for visitors and the traveling public. The long term functional integrity of this corridor is vital to the long term health and vitality of the community it serves.

In carrying out this purpose, this Ordinance is designed to promote development, public safety and maintain a high level of access management along US-60/Grand Avenue that:

a. Will enhance City growth by preserving the mobility of this community asset;

b. Will encourage creative solutions in the utilization of land to accomplish a more efficient, aesthetic, safe and desirable development;

c. Improves the overall transportation efficiency of the corridor;

d. Will increase the safety of the traveling public;

e. Maintains vehicle speeds at acceptable levels for regional mobility;

f. Improves the location and design of all vehicular access connections;

g. Promotes shared parking and connectivity between existing and future developments;

h. Improves the overall streetscape and livability of the corridor;

i. Encourages and promotes alternative modes of transportation, including pedestrian, biking and public transit;

j. Provides safe and functional access between US-60/Grand Avenue and the surrounding area;

k. Ensures that all property is provided reasonable and suitable access to the public street system;

l. Supports orderly economic development and redevelopment of the surrounding area; and

m. Supports the continuing development of a coordinated state and local road network.

III. Applicability and Conformity:

The US-60/Grand Avenue Corridor Zoning Overlay District shall regulate the use of land within the designated district as shown on the municipal zoning map and described herein. As an overlay district it shall complement the requirements of the underlying zone district which shall remain in effect. Wherever the requirements of the overlay district conflict with those of the underlying district, then the greater or more stringent standard shall apply. Where no standards are mentioned herein, the provisions of the underlying district shall apply.

Overlay district requirements apply to redevelopment projects regardless of whether such redevelopment requires site plan or subdivision review. To ensure adequate coordination with the US-60/Grand Avenue Access Management Plan, no site plan or subdivision plat shall be approved without a written finding that the proposed public ways, driveways, and circulation systems are consistent with the adopted AMP.

Existing non-conforming lots, traffic circulation and access conditions are allowed to continue within the overlay district but should be brought into conformity at the earliest opportunity so that public safety can be improved and the purposes of the overlay district can be achieved. The provisions as set forth in this Ordinance shall apply to redevelopments, applications for site plan and subdivision review.

IV. District Boundaries:

The US-60/Grand Avenue Corridor Zoning Overlay District shall apply to all land within the jurisdiction of the City that is within 600-feet of the right-of-way of US-60/Grand Avenue. If a portion

of a lot, plat or subdivision is within the overlay district, the entire lot, plat or subdivision will conform to overlay district requirements.

V. Development Standards:

Unless shown as necessary on the adopted AMP, no new or existing tract of land within the overlay district shall be provided direct access to US-60/Grand Avenue when adequate alternative access can be provided by way of a secondary, primary, collector or marginal access street or through joint access with a neighboring property already provided with access. All individual uses shall be accessed from an internal circulation system designed to serve the development of which they are a part. Potentially negative impacts on the quality and character of surrounding properties or neighborhoods shall be satisfactorily mitigated by the landowner/developer. Where there is no adequate alternative access, direct access to US-60/Grand Avenue may be conditionally permitted in accordance with the design standards that follow.

All site plans should include an access plan drawn to the same scale as the site plan. These plans should show the location and dimensions of all streets, driveways, cross parcel connections, parking areas and aisles, bike paths, sidewalks, and any other relevant circulation information and details. The proposed access plan shall be consistent with the access management techniques, policies and specific details of the adopted AMP.

VI. Consistency with Plans and Studies:

Each access location should be consistent with the locations and criteria provided by the US-60/Grand Avenue AMP. The applicant shall demonstrate how the proposed development plan is consistent with the adopted AMP.

When site conditions prevent immediately meeting the AMP access location requirements the development proposal will include a plan detailing how the AMP access requirements will be met in the future.

Interconnecting driveways or provisions for future connections to adjacent properties shall be provided through easements for all new development with access to US-60/Grand Avenue. This includes bicycle and pedestrian access to adjacent residential areas where practical.

VII. Non-conforming Access:

This overlay zone recognizes the existence of access connections to US-60/Grand Avenue which were lawful when the overlay was adopted but do not meet the requirements of this Ordinance. It is not the goal of this ordinance to discourage the expansion and/or intensification in the use of properties but it is the goal of the ordinance to encourage the elimination of non-conforming accesses or reduce their negative impacts on US-60/Grand Avenue and the surrounding area.

Any access connection in place as of the date of adoption of this Ordinance that does not conform with the standards herein is a non-conforming feature that will be allowed to continue as long as the access or the land use it serves is not expanded or discontinued and the opportunity to conform is not available.

If there is a need to expand a non-conforming access or the land use served by a non-conforming access, the non-conforming access must either be eliminated or brought into conformance with the standards of this Ordinance to the extent feasible.

If a non-conforming access or the use or structures of the property served by a non-conforming access is discontinued for more than one year, use of the access must not be re-established unless approved under the provisions of this Ordinance.

If the use or structures of the property served by a non-conforming access is destroyed, subsequent access to the property may be required to conform to the provisions of this Ordinance upon re-construction.

VIII. Coordination with Affected Road Authorities:

The City shall notify and consult with the Arizona Department of Transportation (ADOT) and any other affected local authority regarding the proposed development access plan and must consider their comments and recommendations in the review of the proposed development. Review and approval of a document required under this Ordinance does not substitute for compliance with the access permit regulations of the State of Arizona. But where this Ordinance sets more stringent standards, the more stringent standards apply to any access authorization. A driveway may not be constructed or reconstructed if it is not consistent with the requirements of the City even if permitted by the State.

The City shall notify ADOT a minimum of 10 days prior to the scheduled public hearing for any private appeal of the requirements of this Ordinance.

IX. General Considerations:

To determine whether the proposed development plans including any division of property meets the standards of this overlay ordinance, the approving authority must consider all of the following factors:

a. The relationship to the existing and proposed land use to City plans;

b. The transportation and road network plans of the City;

c. The US-60/Grand Avenue Access Management Plan;

d. The potential for future subdivision and development of the property and other properties in the vicinity of the proposed access;

e. The adequacy of existing or planned roadways to accommodate the proposed development in a safe and cost effective manner;

f. Existing, planned, and potential future access to and circulation on adjacent properties;

g. Comments from ADOT or any other affected local agencies;

h. The findings and conclusions of any related studies such as an environmental assessment, drainage analysis, traffic impact analysis, roadway design modifications or traffic signal improvements.

X. Standards for All Street and Driveway Connections:

An access connection should not be located within a turn lane to another public street or a private driveway.

At a non-signalized intersection or any location where a motorist may turn right without the aid of a traffic signal, intersection sight distance should be no less than 515-feet to the left.

If a left turn onto the highway is allowed at a non-signalized intersection, there should be no less than 700-feet of clear sight distance to the right. (50 mph prevailing, crossing 5 lane widths AASHTO Case B1). If there will be a higher percentage of single unit trucks, the sight distance should be over 850-feet.

From a motorist on the highway to the access there shall be a clear line of sight for adequate stopping sight distance. There shall be a minimum of 425-feet of stopping sight distance to each access connection (assumes 50 mph prevailing highway speeds). It is preferable to have a driver decision sight distance of 890-feet.

For every access connection where the peak hour turning volume exceeds ten, a turn lane should be available. The design of the turn lane will be long enough that during the peak hour of the turn lane the speed differential at the point of vehicle departure from the through highway lane will not exceed ten miles per hour.

To ensure adequate corner clearance on every approach to US-60/Grand Avenue, any public or private access to a street that intersects with the highway should be located a minimum distance of 500-feet from the edge of the travel lane of US-60/Grand Avenue or greater if required by the City/County Engineer. The minimum distance set-back for a low volume secondary road is 125-feet and for a driveway is 75-feet. If an approach queue analysis is prepared, then the first access should be greater than the expected queue.

XI. Private Access:

When it is not feasible at the time of development to close a driveway, an ownership will be permitted one conditional driveway to US-60/Grand Avenue only of there is a necessity for the driveway and if reasonably and suitable alternative access is not available or attainable from the local road network or by a shared driveway with an adjacent parcel. A self-inflicted hardship, the creation of a parcel where the only option is access to US-60/Grand Avenue, does not qualify for direct highway access.

A private driveway must maintain adequate intersection sight distance at all times or the access permit may be revoked and the access closed to protect public safety.

If not otherwise defined in the AMP the minimum spacing between access connections shall be the stopping sight distance at the posted speed, 425-feet at 50 MPH.

If any safety standard cannot be met, the access may not be approved.

If lot frontage is inadequate to provide the required minimum spacing, access should be provided via a shared entrance or cross access easement with an adjacent property. A driveway access may be required to serve adjacent property via a shared entrance located on the common property line or a cross access easement; and when required to provide a shared entrance or cross access easement, the property owners must record an easement allowing cross access to and from the properties served by the shared driveway or cross access. The easement must include a joint maintenance agreement defining the responsibilities of the property owners.

XII. Subdivision Standards:

The street system of a proposed subdivision shall be designed to coordinate with existing, proposed, and planned streets serving the surrounding area and shall be consistent with the AMP.

All access to individual lots shall be provided from the internal street system. A prohibition of access to US-60/Grand Avenue shall be recorded in the chain of title of each lot within the subdivision that abuts US-60/Grand Avenue right-of-way.

Where a proposed development abuts undeveloped land or a future phase of the same development, stubs for future public ways shall be provided as deemed necessary by the City to provide access to abutting properties or to logically extend the street system into the surrounding area. All street stubs shall be provided with a temporary turn-around or cul-de-sac and shall be signed to indicate that future extension is planned.

XIII. Site Design Standards:

Sites must be designed to promote safe internal access between parking areas, buildings, and future development areas on the property and on adjacent properties;

Backing, loading, unloading, or other maneuvers must be accommodated on the site;

The design of any access to US-60/Grand Avenue including the width, grade, and radii be no less than ADOT guidelines and standards; and

The driveway's throat length must be sufficient to prevent vehicles from stopping and queuing on the highway due to regular conflicts and stopping in the driveway.

XIV. Conditions of Approval:

The City may attach terms and conditions to the approval of a development plan as deemed necessary to promote the spirit and intent of this overlay ordinance.

The access may be approved as an interim access to be phased out at a future time or condition.

Turning movements to and from the access may be restricted at the time of development or at a future date, based upon existing or anticipated traffic volumes.

The access may be required to serve existing or future adjacent property by a shared entrance or cross access easement.

Other conditions may be required based on the conclusions and recommendations of a traffic impact study and/or the review by the City or another affected agencies.

XV. US-60/Grand Avenue is a multi-modal corridor:

It is necessary that the development of land accommodate and enhance efforts to increase the convenience and use of all modes of travel.

XVI. Transit Facilities:

The development of future transit facilities shall be incorporated within all site plan developments that could generate moderate or higher demands of transit use. Transit facilities shall be provided in a manner to encourage public transit as an alternative mode of travel. Potential access points, bus pull-outs, bus stops, signage and shelter locations may be designated along US-60/Grand Avenue and within the perimeter of the development and easements should be reserved for such facilities. Americans with Disabilities Act (ADA) compliant pedestrian pathways from the development buildings to transit stops should be defined.

XVII. Bicycle Facilities:

Separate bicycle facilities may be required where recommended by transportation studies and plans or where otherwise appropriate to support City bicycle goals and objectives. Bicycle racks and other amenities may be required for all developments and shall be located in a convenient and secure location.

XVIII. Pedestrian Facilities:

All sidewalks shall be constructed by the applicant/property owner as required by the City. Sidewalks located along a public street shall be designed and constructed in accordance with City standards and specifications. Sidewalks shall comply with the ADA. Pedestrian cross-walks shall be provided within the development as necessary to connect sidewalks along public streets to the pedestrian ways within the private property.

XIX. Saving Clause:

Where any provision of this Ordinance is found to be invalid, such determination shall not affect the validity of the remainder of this Ordinance.

XX. Effective Date:

APPENDIX TM6-6

Planning Partner Comments and Responses

NOTES

US-60/Grand Avenue COMPASS

Loop 303 to Interstate 10

Planning Partners Meeting
April 30, 2015

PLANNING PARTNER ATTENDEES

Debbie Albert, City of Glendale
Grant Anderson, Town of Youngtown
Eunice Chan, FHWA
Stephen Chang, City of Surprise
Tom Deitering, FHWA
Jorge Gastelum, City of El Mirage
Sayeed Hani, ADOT
Peter Knudson, Dibble Engineering
Shawn Krenzwiesner, City of Peoria
Denise Lacey, MCDOT
Nicole Lance, City of Surprise
Martin Lucero, City of Surprise
Mark Melnychenko, City of Phoenix
Jamal Rahimi, City of Peoria
Patrick Sage, City of Glendale
Leticia Vargas, City of Phoenix
Amber Wakeman, City of El Mirage
Tim Wolfe, Dibble Engineering
Mohammad Zaid, ADOT

MAG STAFF

Bob Hazlett
Chaun Hill
Marc Pearsall
Nathan Pryor

CONSULTANT TEAM

Jason Pagnard, Burgess & Niple
Marina Stender, Burgess & Niple
Audra Koester Thomas, PSA

HANDOUTS

Agenda, PowerPoint presentation, zoning overlay district model ordinance, conceptual guide sign example, draft Recommendations Map Book.

Bob Hazlett, MAG project manager, convened the meeting at 1:34 P.M.

1. INTRODUCTIONS

Mr. Hazlett welcomed everyone and asked all participants to introduce themselves.

2. RECENT PROJECT ACTIVITIES

Mr. Hazlett provided a summary of recent activities, listing meetings held with stakeholders since the last Planning Partners meeting. A key recommendation that

came from these meetings, Mr. Hazlett noted, was the suggestion to reduce at-grade railroad crossings. Mr. Hazlett reported that the study team was largely able to meet this request (see: draft Recommendations Map Book).

Travel Demand and Operations Modeling: Mr. Hazlett briefly reviewed the 2040 operational performance of intersections through the corridor. With the exception of SR-303L TI and Thunderbird Road/Thompson Ranch Road intersections, all achieved an overall level of service of D or better. Mr. Hazlett noted that the SR-303L ramps modeled were the interim configuration only, and performed better in the 2035 model.

Project Documentation: Jason Pagnard, Burgess & Niple project manager, briefly reviewed the components within completed Technical Memorandums 1 through 5, noting work on Technical Memorandum 6 will be complete after input was received from today's Planning Partners meeting.

3. STUDY RECOMMENDATIONS

Mr. Hazlett noted several highlights of the study's recommendations, including the achievement of consolidating over 200 access points. Mr. Hazlett then led participants through the recommendations for the entire corridor as depicted in the draft Recommendations Map Book. The following summarizes discussion points through the corridor, citing the Recommendations Map Book page for reference:

- Page 9: Mohammad Zaid, ADOT, reported that ADOT recently shortlisted teams for the Bell Road/US-60 interchange improvements. Mr. Zaid indicated that the design-build RFP would be distributed June 5 with submittals due September 29; the award date is anticipated for December 18 with construction beginning the second week of January 2016. Mr. Zaid indicated the design-build budget was set at $49 million, with $12 million for right-of-way acquisition.
- Page 16: Mr. Zaid reported that Kimley-Horn and Associates was currently designing the Thunderbird Road/Thompson Ranch Road interchange while Burgess & Niple would be designing the frontage improvements; construction is anticipated to begin in May 2016. While the intent is to advertise both the interchange and frontage improvements at the same time, Mr. Zaid indicated there is currently only funding available for the interchange improvements.
- Page 17: Grant Anderson, Town of Youngtown, asked the study team to investigate the number of access points eliminated between North 113th Avenue and North 111th Drive as it appeared all access to the existing hotels was recommended to be eliminated. Mr. Anderson also noted that, because of the recommendations, additional improvements to North 113th Avenue may need to be considered.

NOTES

- Page 18: Mr. Grant asked that access to businesses at the Southeast corner of North 111th Avenue and US-60/Grand Avenue be added.
- Page 22: Marc Pearsall, MAG, suggested that there might be a possibility to request BNSF to lower the track grade (effectively "trenching" the currently raised track) between the Agua Fria River and New River. Mr. Pearsall indicated that this has been occurring in other locations; it would assist the US-60/Grand Avenue effort by lowering the overall height of the elevated parts of the facility. Tom Deitering, FHWA, shared that their policy states that railroads shall reduce grades 5% when a crossing has been eliminated. Martin Lucero, City of Surprise, and Denise Lacey, MCDOT, noted that access from US-60/Grand Avenue to the popular sidewalk/trail system must be maintained.
- Page 44: Mr. Hazlett noted that of all the draft recommended improvements, the Indian School Road interchange would be the corridor's priority improvement. Not only does the intersection exhibit the highest crash rates within the corridor, but Mr. Hazlett observed the existing interchange is also at the end of its useful life. Mr. Lucero observed that the westward private property access point from southbound US-60/Grand Avenue appears to be crossing several rail tracks.
- Page 48: Mr. Hazlett noted that the recommended improvements over I-17 could include a DHOV option; Mr. Deitering observed that US-60/Grand Avenue could serve as the HOV terminus, eliminating the need to design a direct access point onto I-17.
- Page 50: Mr. Deitering requested that the study team look at movements from eastbound McDowell Road to southbound 19th Avenue. It was also reiterated that pedestrian access to the Fairgrounds needs to be preserved.

The study team noted the Recommendations Map Book is draft in nature and that there may be minor graphical details that will be resolved prior to finalization of the Recommendations Map Book:

- Page i: add Maricopa County to Map Book Index
- Page 17: resolve what appears as a "green" layer situated between North 113th Avenue and North 111th Drive
- Page 23: remove extraneous red "X's" located on two properties adjacent to North 91st Avenue
- Page 25: add two planned pedestrian bridges South of North 87th Avenue in Peoria
- Page 34: correct symbology to reflect a two-phase signal at West Myrtle Avenue and US-60/Grand Avenue

Mr. Hazlett asked that additional observations, comments and suggested edits regarding the draft Recommendations Map Book were requested by end of business May 6, 2015.

Mr. Zaid inquired as to the implementation program for these recommended improvements. Mr. Hazlett indicated that these were largely long-term planning recommendations, and could serve to inform the next transportation proposition (i.e., "Prop 500").

Mark Melnychenko, City of Phoenix, asked that, with fairly railroad-friendly recommendations (i.e., reduction of at-grade crossings) whether BNSF would be more favorable to working with and/or assisting implementation of future commuter rail or other improvements. Mr. Pearsall offered that, while no guarantee could be made, the region should insist on collaborative partnership from the railroad.

Mr. Hazlett reminded participants that the draft recommendations were only conceptual, and formal alternatives would need to be formulated through design concept reports (ADOT Scoping Phase). While the Valley often facilitates design concept reports for vary specified projects or locations, Mr. Hazlett offered that for purposes of implementation, "super DCRs" may be a strategy to look at regional considerations and not just localized infrastructure.

Marina Stender, Burgess & Niple, briefly reviewed the conceptual guide sign example, noting the signage guidelines was included in Technical Memorandum 6.

Both Mr. Hazlett and Mr. Pagnard underscored the importance for jurisdictions along the corridor to implement a zoning overlay district model ordinance; without the policy to enforce the recommended future development pattern (i.e., reduction of access points) the recommended improvements and operational character cannot be implemented successfully.

Mr. Hazlett concluded the discussion by reviewing the planning-level cost estimates for construction of the recommended improvements. In current dollars, Mr. Hazlett reported an estimated $525 million would be needed for outlined improvements.

4. NEXT STEPS

Mr. Hazlett thanked participants for their participation in the project and reviewed project next steps:

- Complete Technical Memorandum 6
- Conduct meetings with Management and Charter partners

NOTES

- Brief member agency councils, advisory boards
- Prepare recommendations for Regional Council acceptance

Meeting was adjourned at 3:27 P.M.

Pagnard, Jason

From: Pagnard, Jason
Sent: Monday, June 22, 2015 8:07 PM
To: 'Marc Pearsall'
Cc: Bob Hazlett
Subject: RE: Scans of Compass Reco Map Book (MAG Comments)

Marc,

We appreciate your thorough review. With coordination and approval from Bob Hazlett, your comments were included in Technical Memorandum 6 in two ways. First, several key items you point out are stated within the document. Second, your comments/markups in total are included in the appendix so that they are carried forward with the project, ensuring nothing is missed.

Respectfully,
Jason

-----Original Message-----
From: Marc Pearsall [mailto:MPearsall@azmag.gov]
Sent: Friday, May 08, 2015 4:32 PM
To: Pagnard, Jason
Subject: RE: Scans of Compass Reco Map Book (MAG Comments)

Jason,
All three were sent.
Please let me know if they came through, Thanks Marc

-----Original Message-----
From: Marc Pearsall
Sent: Friday, May 08, 2015 4:27 PM
To: 'Pagnard, Jason'
Subject: RE: Scans of Compass Reco Map Book (MAG Comments)

Aha!
I'm gonna bundle them into 3 emails (of 16 megs each) right now...
Here I go!
Thanks
Marc

-----Original Message-----
From: Pagnard, Jason [mailto:jason.pagnard@burgessniple.com]
Sent: Friday, May 08, 2015 4:26 PM
To: Marc Pearsall
Subject: Re: Scans of Compass Reco Map Book (MAG Comments)

Can you post them to the MAG ftp site? We can pull them down from there. Otherwise, I can send you B&N ftp site info on Monday. We also can receive emails up to 20mb.

Sent from my iPhone

On May 8, 2015, at 4:22 PM, Marc Pearsall <MPearsall@azmag.gov<mailto:MPearsall@azmag.gov>> wrote:

Jason,
Hey.
I have the scans of Compass Reco Map Book with my comments.
I scanned 36 pages (48 megs)
Shall I put them on a disc for you?
Or email them over on Monday in six, 8mg blocks?
Thanks
Marc

Marc Pearsall
Transit Planner III ~ Rail
Maricopa Association Of Governments (MAG)
302 North 1st Avenue, Suite 200
Phoenix, AZ. 85003
office: 602 452-5094
main: 602 254-6300
email: mpearsall@azmag.gov<mailto:mpearsall@azmag.gov>

Note:
These electronic documents are provided by Burgess & Niple (B&N) as a convenience to our clients.
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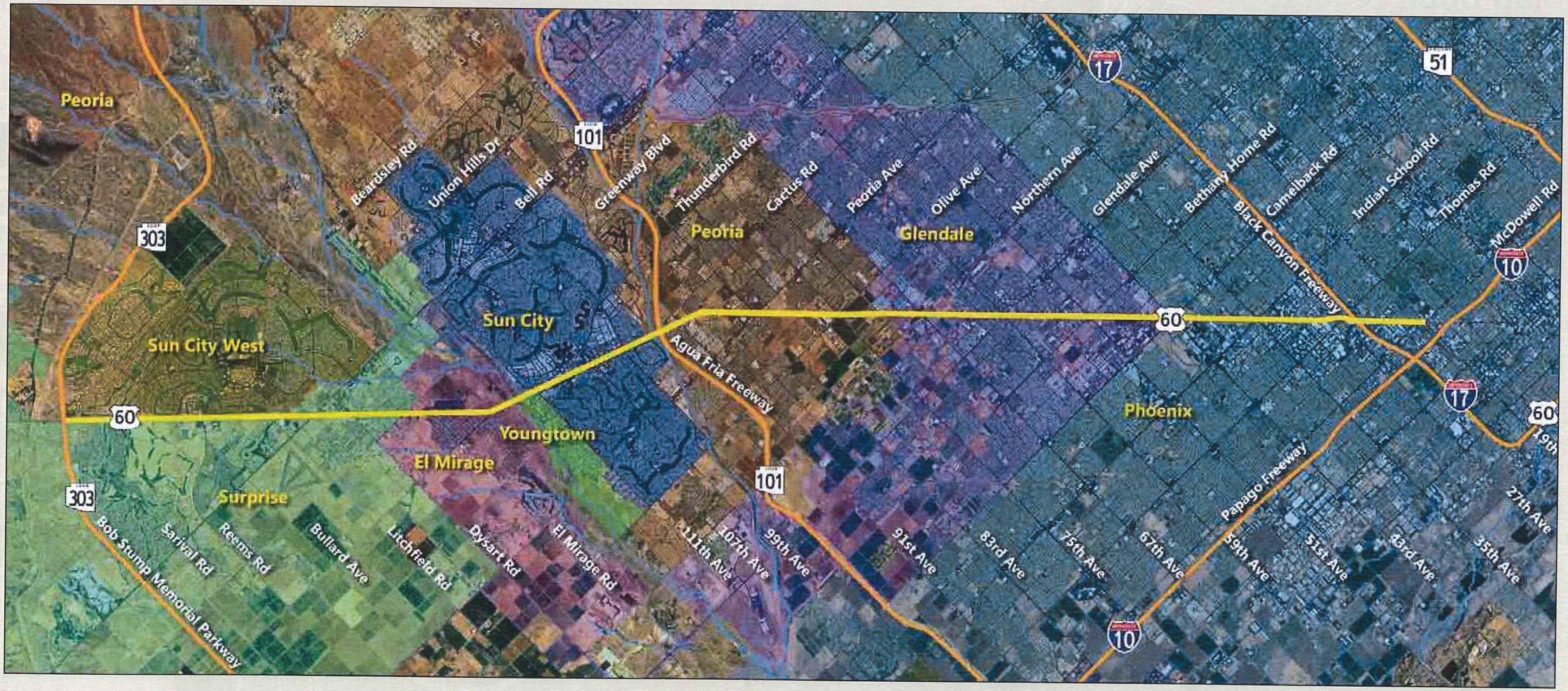
PLEASE SHOW ALL SIDEWALKS ON THE NEW ROADWAY STRUCTURES.
SOME FOLKS HAVE COMMENTED THAT THEY THINK THE NEW GRADE SEPARATIONS HAVE NO ADA COMPLIANCE.
THANKS

4/23/15

Recommendations Map Book



Legend
- US-60/Grand Ave COMPASS Corridor
- Freeway
- Streams/Washes

DRAFT

Julie
Pole - Bridges
Locations
w/ M. Melnychenko

Corridor Optimization and Access Management Plan, and System Study
COMPASS
MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

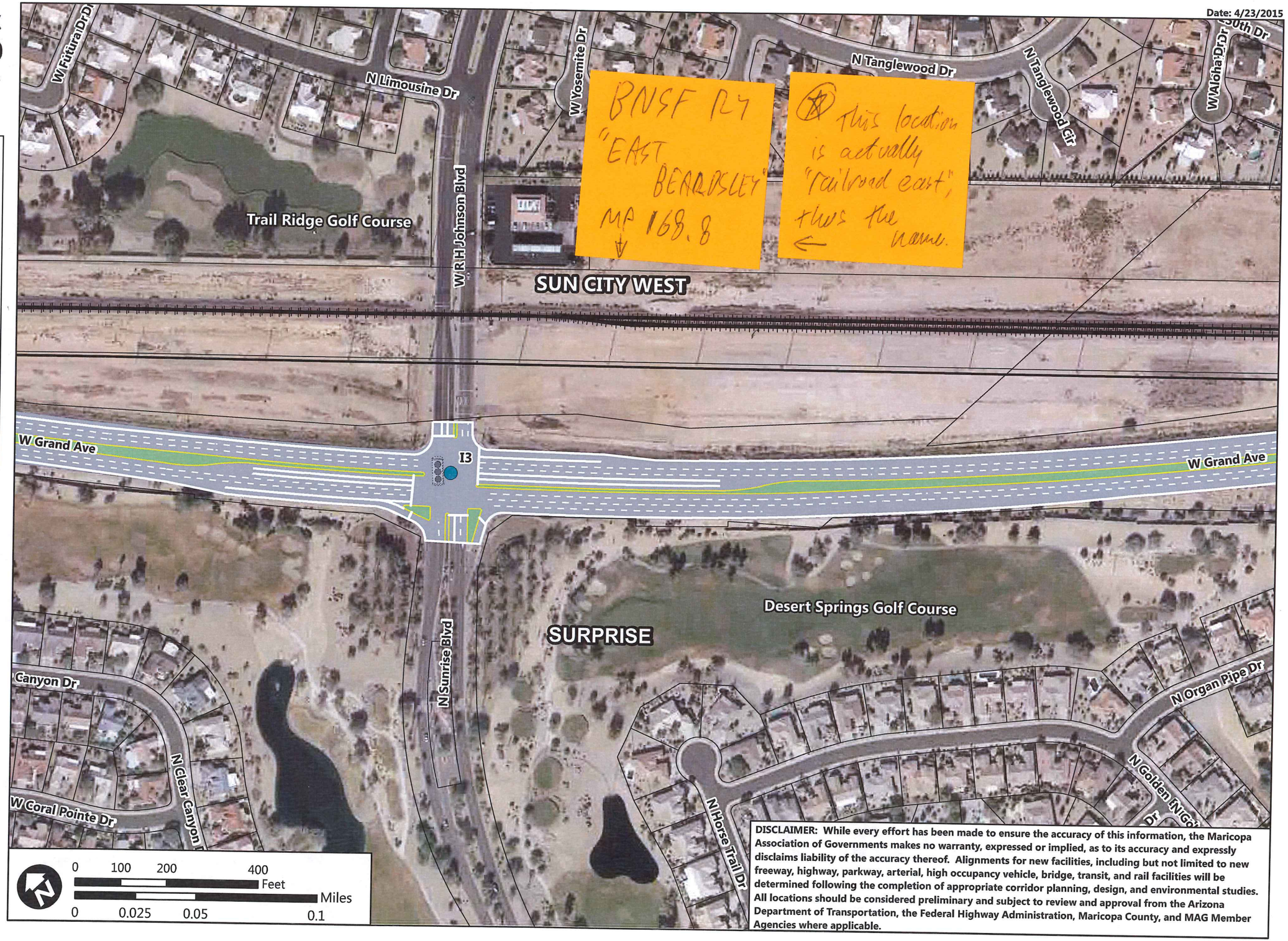
US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access		
Access ID	Access Type	Median Type
I3	F	N

Date: 4/23/2015



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

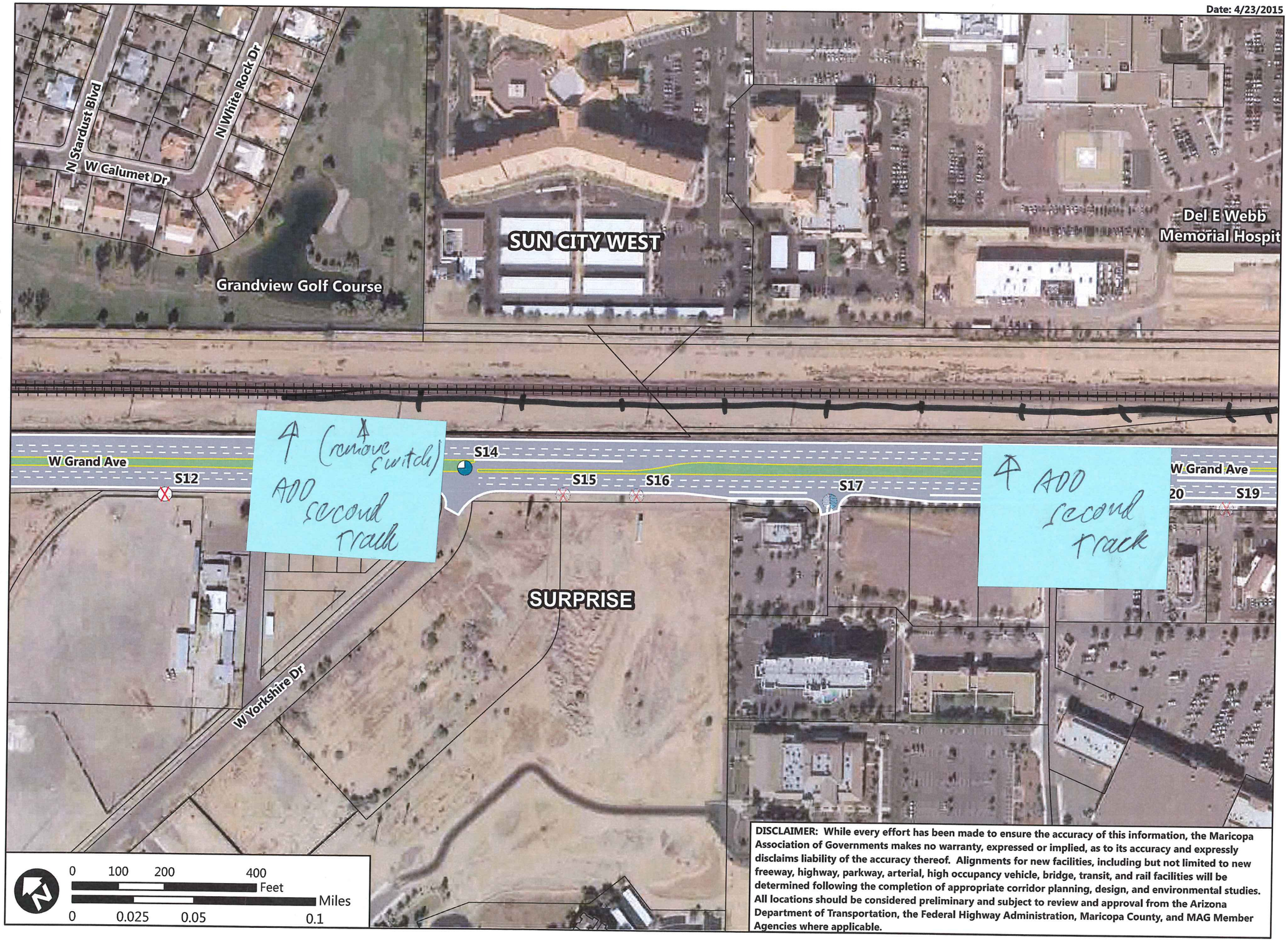
Date: 4/23/2015

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S12	C	R
S13	R	R
S14	T	MB1
S15	C	R
S16	C	R
S17	R	R
S18	R	R
S20	C	R
S19	C	R



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US-60/Grand Avenue: Loop 303 to Interstate 10

(A) This location is actually "railroad west" this is the name.

BNSF Ry "WEST BEARDSLEY" MP. 170.1

Legend

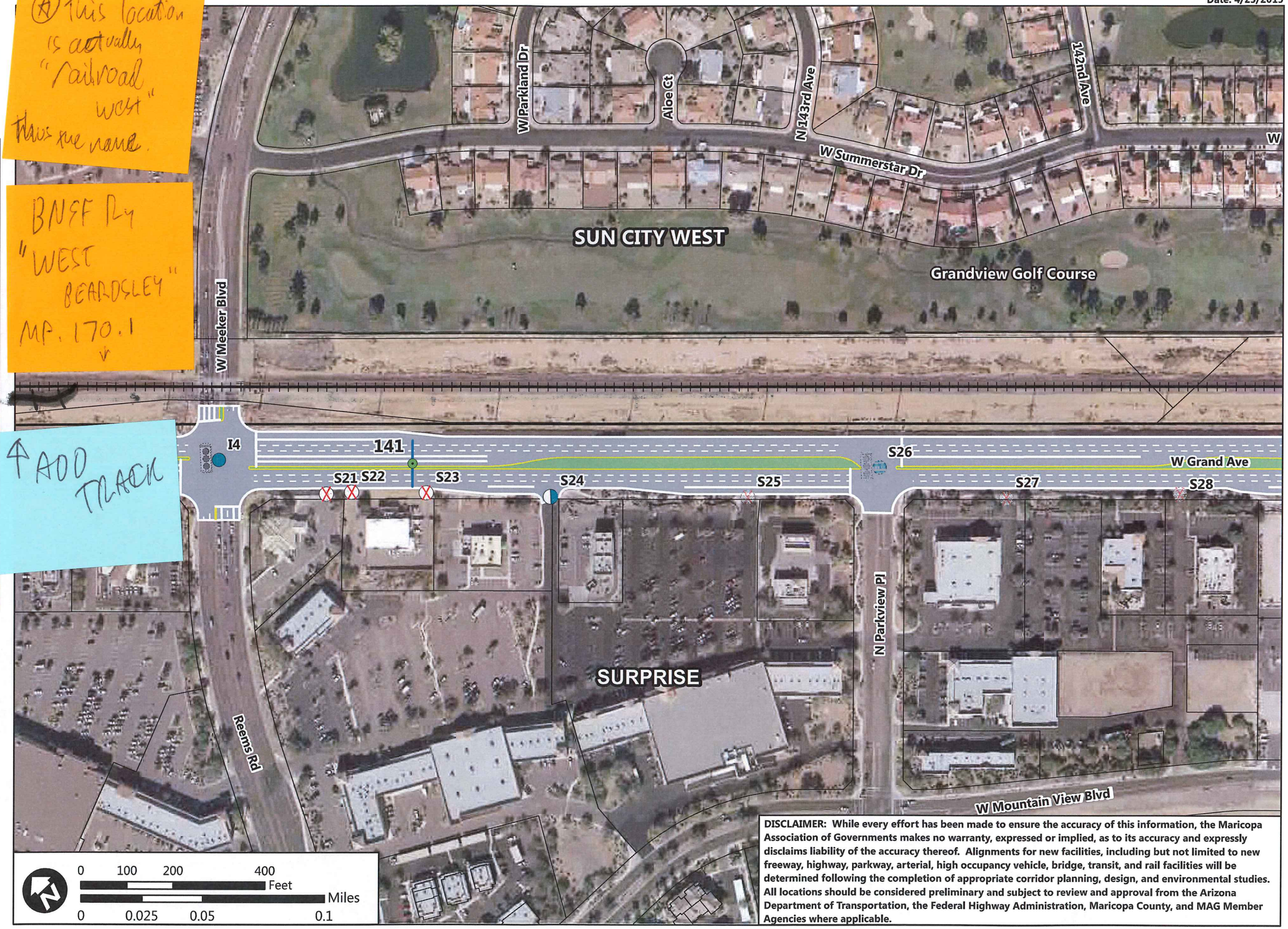
- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Typ
S19	C	R
I4	F	N
S21	C	R
S22	C	R
S23	C	R
S24	R	R
S25	C	R
S26*	F	N
S27	C	R
S28	C	R

*S26 is an existing signalized intersection

ADD TRACK



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

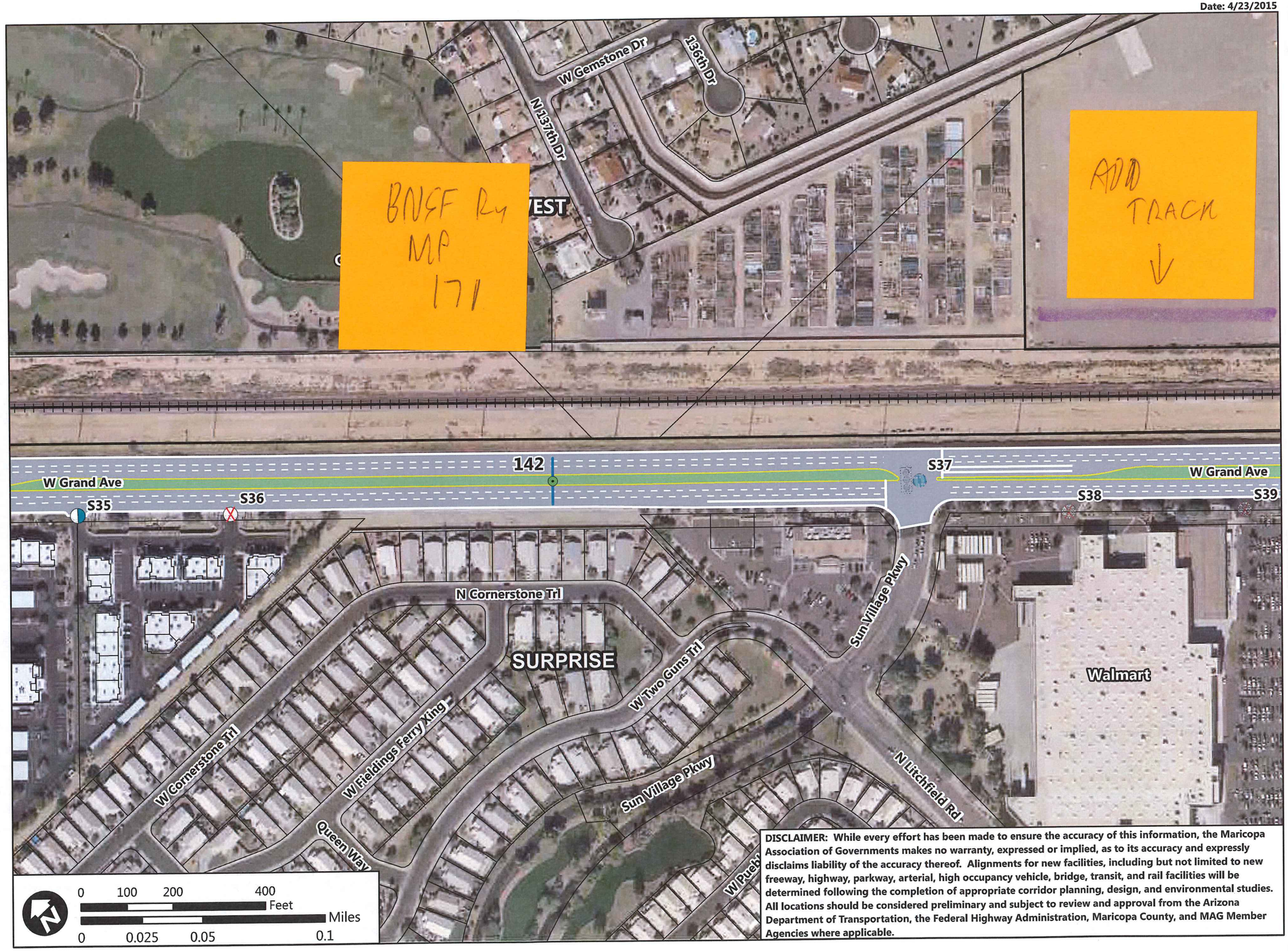
Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S35	R	R
S36	C	R
S37*	F	N
S38	C	R
S39	C	R

*S37 is an existing signalized intersection



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US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S39	C	R
S40*	F	N
S41	R	R
S41.1	OF	R
N0.1	ON	R
I101	F	N
S42	R	DI
I5	C	DI

*S40 is an existing signalized intersection

Date: 4/23/2015

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Legend

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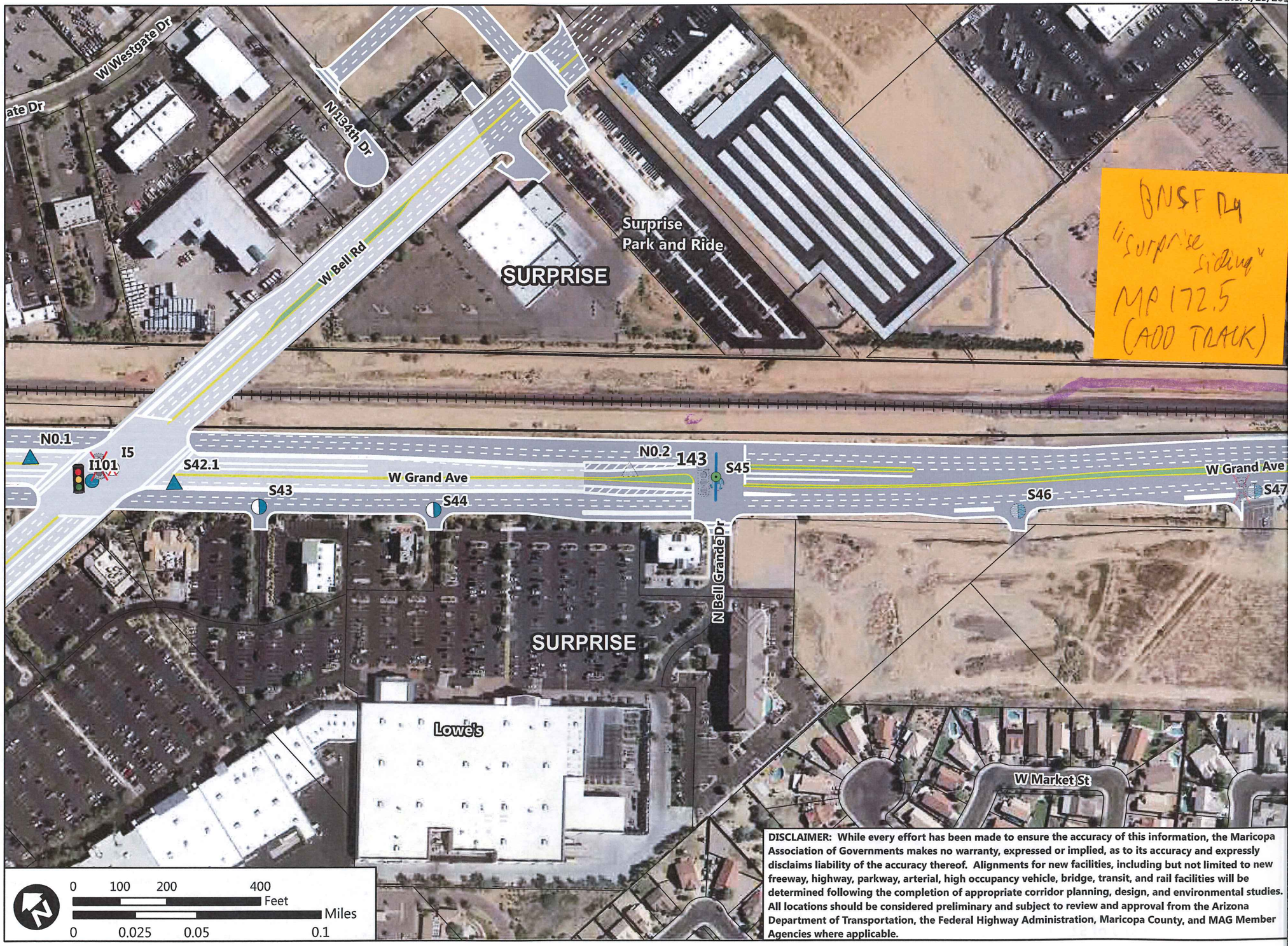
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I5	C	DI
S42.1	ON	R
S43	R	DI
S44	R	DI
N0.2	OF	R
S45	F	N
S46	R	R
S47	R	R



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Date: 4/23/2015

Legend

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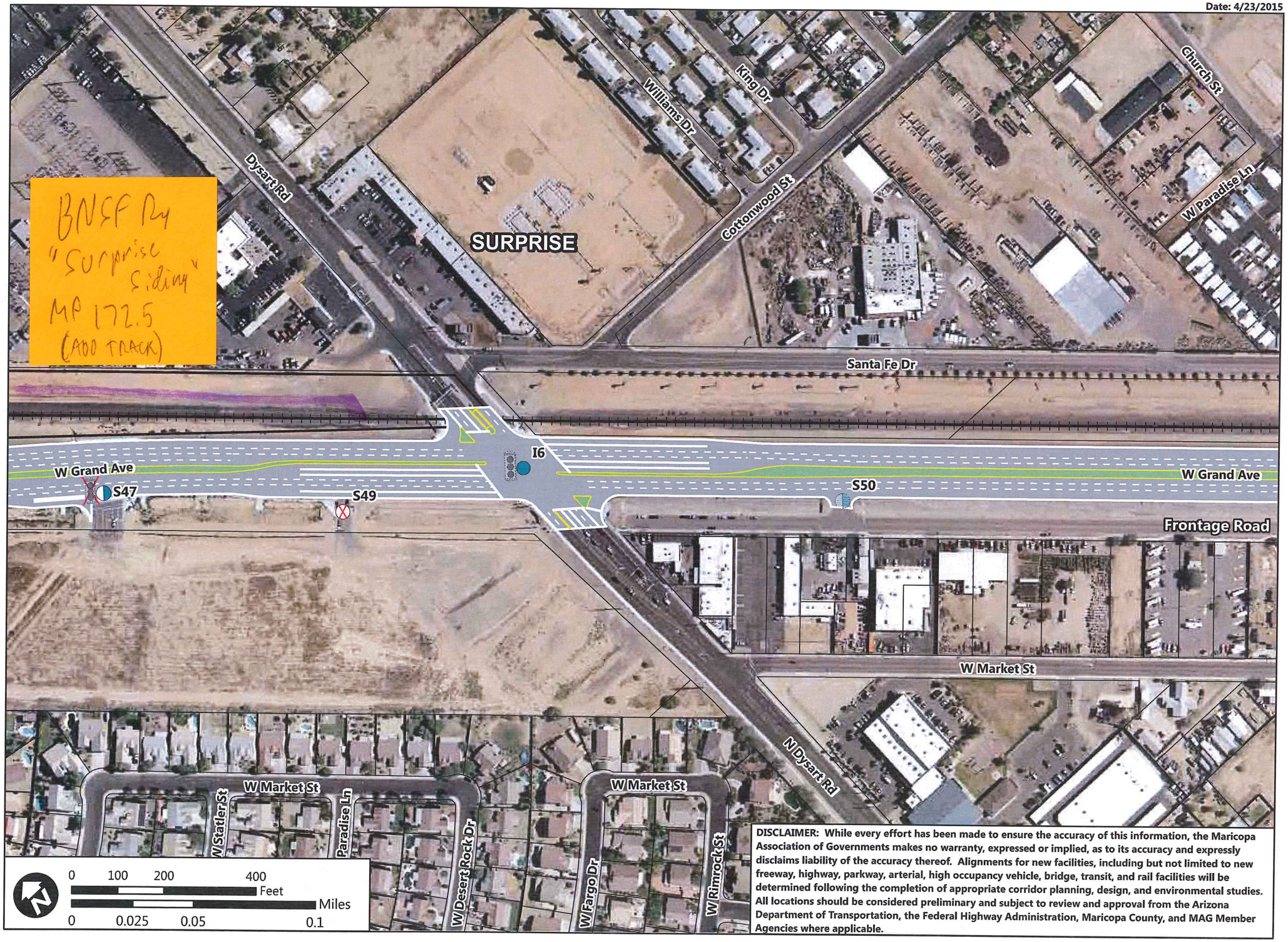
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S47	R	R
S48*	C	R
S49	C	R
I6	F	N
S50	R	R

*S48 deleted in between TM 1 and 6



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US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S51	T	MB1
S52	R	R

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US-60/Grand Avenue: Loop 303 to Interstate 10

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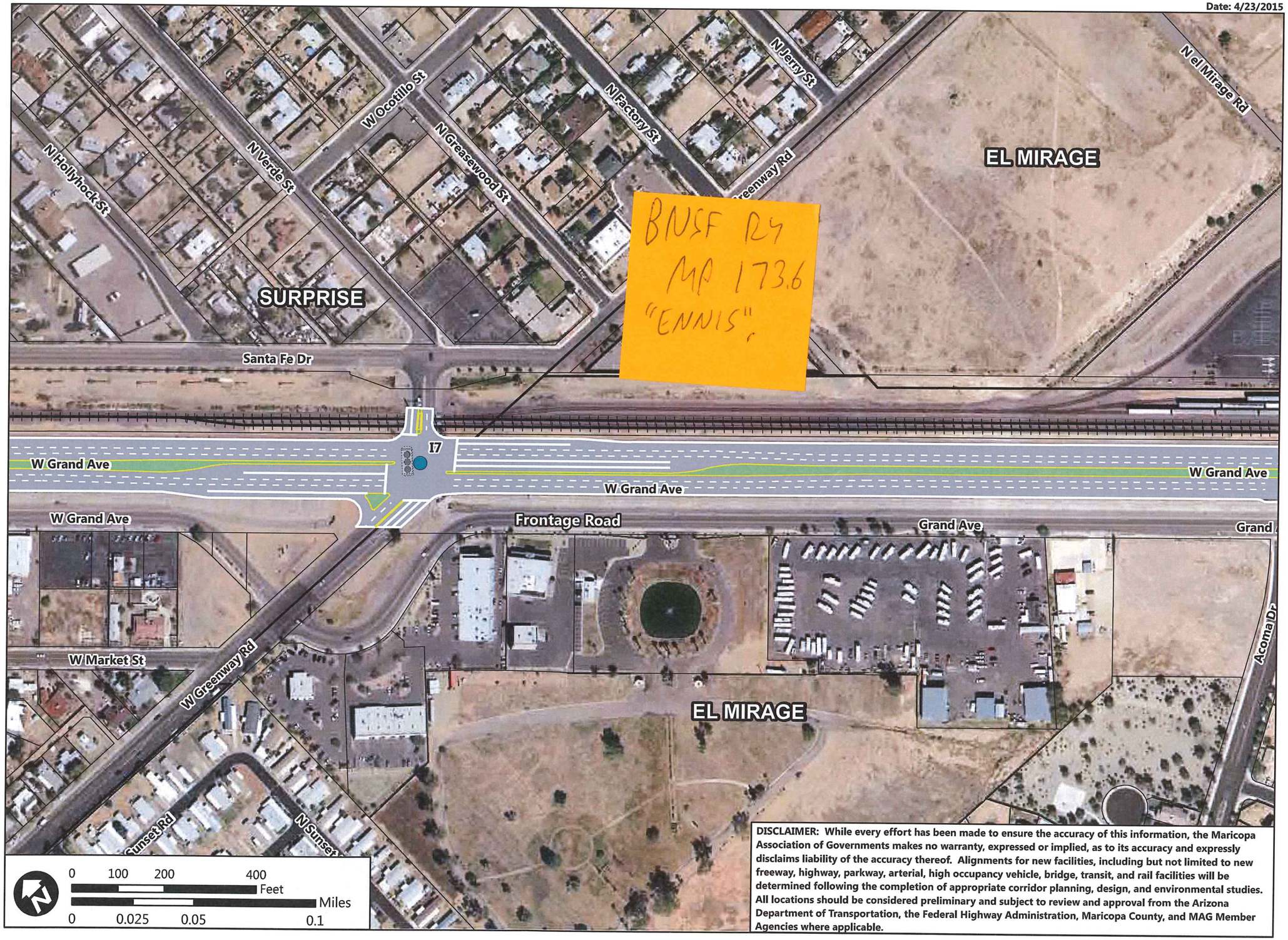
Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I7	F	N



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S52.9	T	MB1
S53	C	R
S54*	F	N

*S54 is 3/4 access - EB traffic cannot go south

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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I8*	F	N

*I8 is an existing signalized intersection that is being reconfigured in place

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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S56	C	R
S58*	F	MB1
S57	R	R
S59	C	R
S60	C	R
S61	C	R
S61.1	C	R
S62	R	R

*S58 is Florida T

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COMPASS

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US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
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- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S60	C	R
S61	C	R
S61.1	C	R
S62	R	R
S63	R	R
I9	C	R
S64	C	R
S65	C	R
S66	R	R

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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Date: 4/23/2015

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S66.1	OF	R
S67	C	DI
S68	C	DI
N0.3	ON	R
S69	C	DI
I10	C	DI
I102	F	N
S69.1	ON	R
S70	C	DI
S72	C	DI
N0.4	OF	R
S71	R	R

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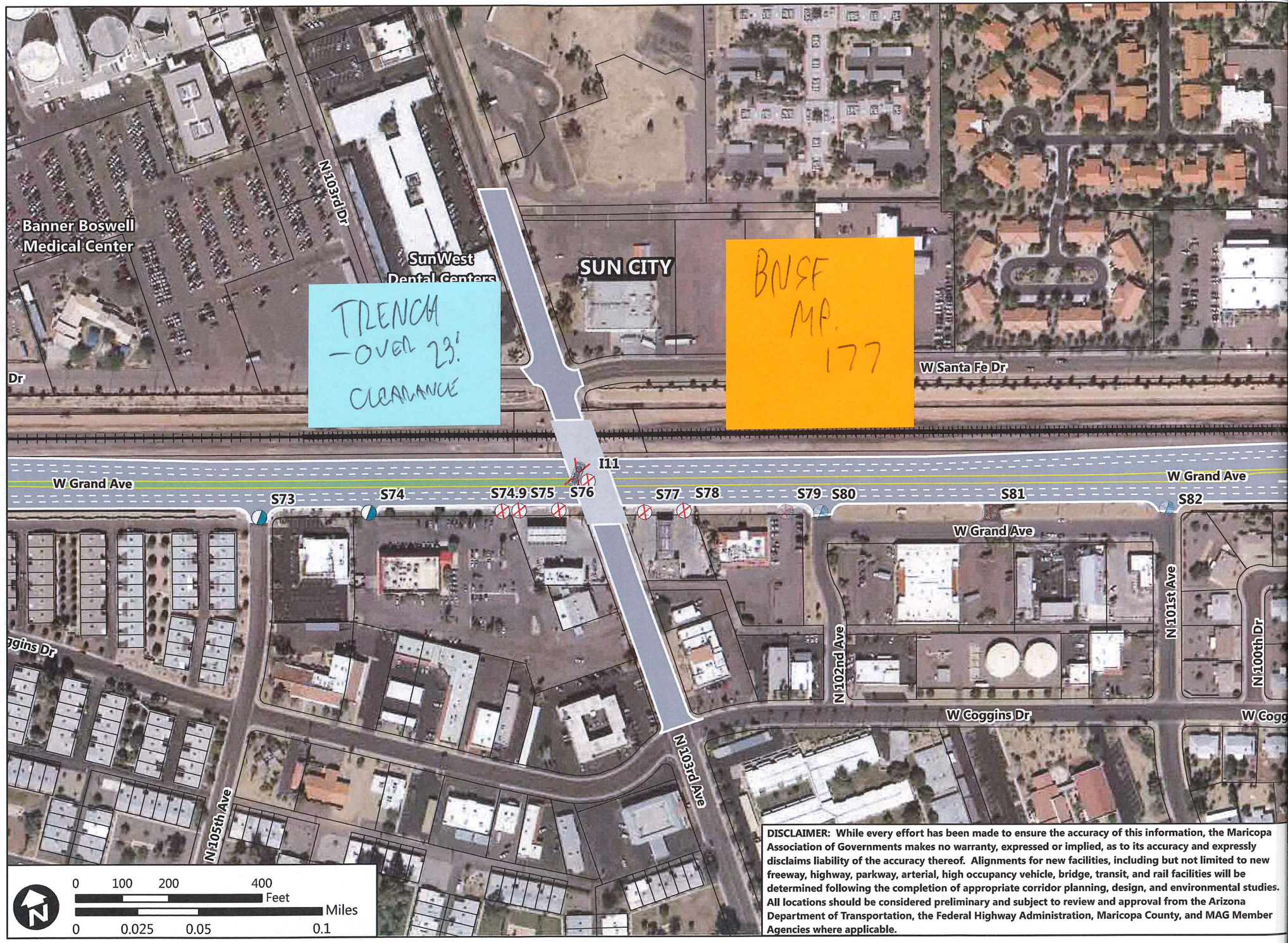
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S73	R	R
S74	R	R
S74.9	C	R
S75	C	R
S76	C	R
I11	C	R
S77	C	R
S78	C	R
S79	C	R
S80	R	R
S81	C	R
S82	R	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Date: 4/23/2015

Legend

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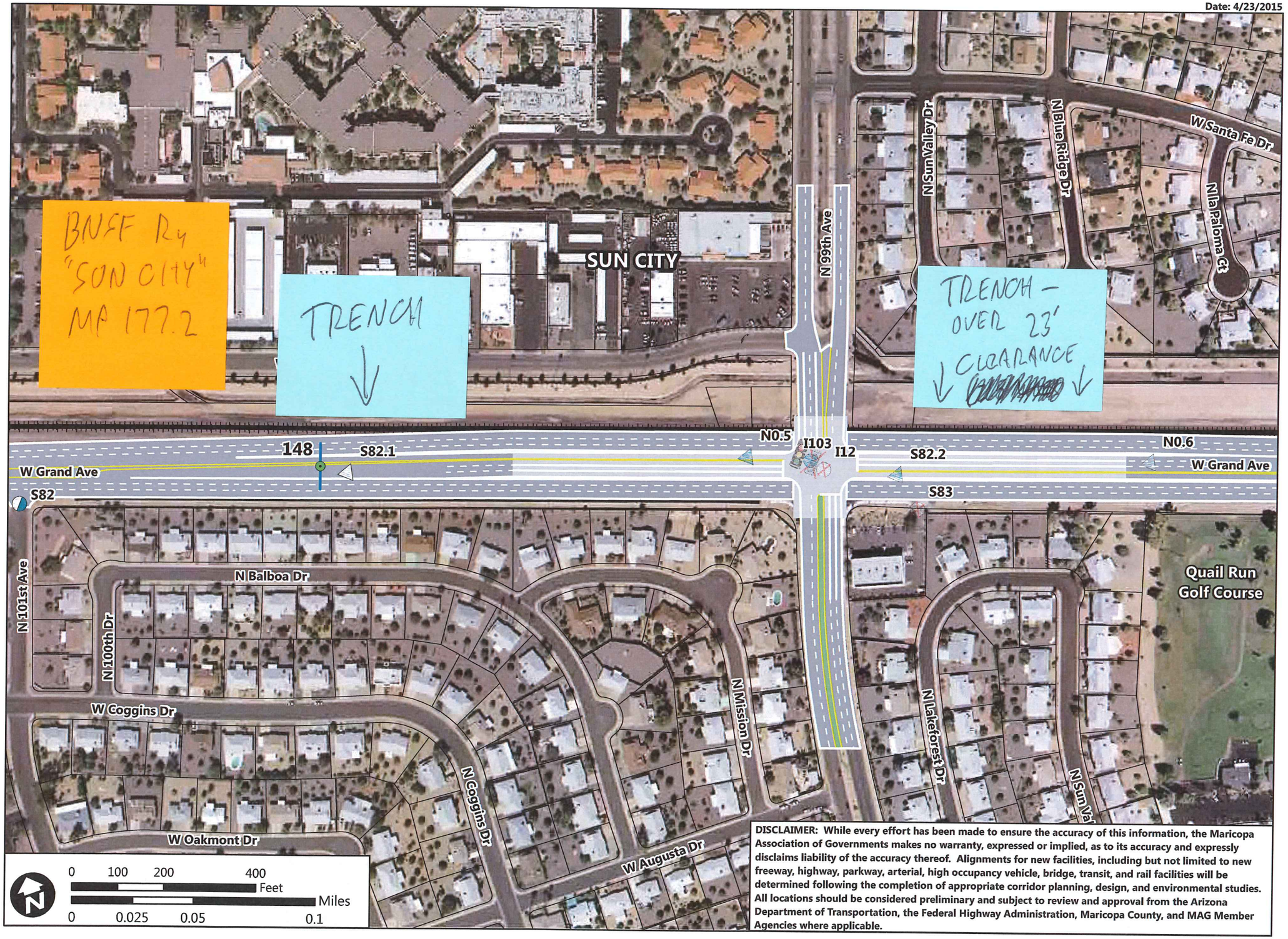
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S82	R	R
S82.1	OF	R
N0.5	ON	R
I12	C	DI
I103	F	N
S82.2	ON	R
S83	C	DI
N0.6	OF	R



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COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

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- City Boundary
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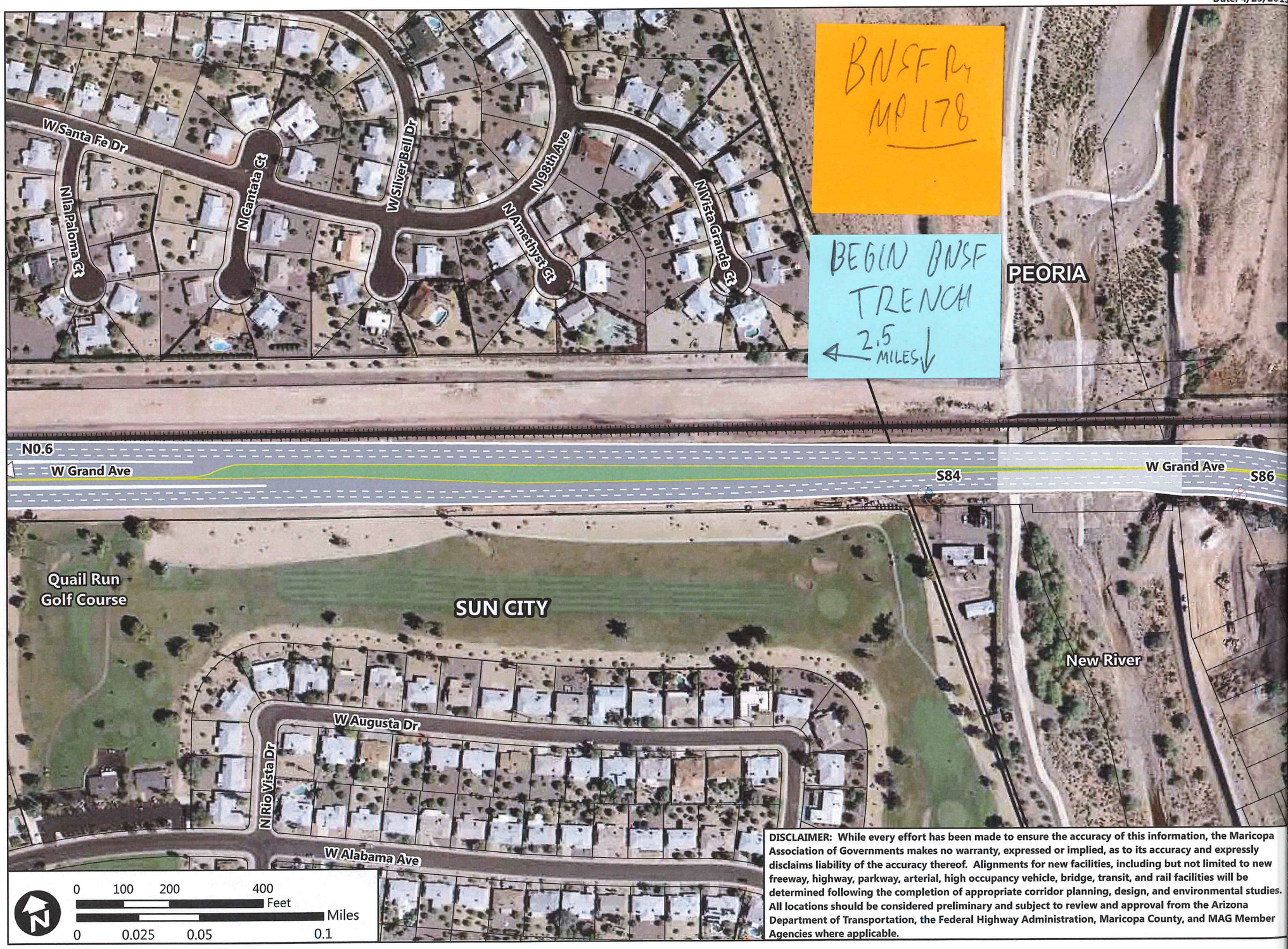
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S84	R	R
S86	C	R



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COMPASS

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US-60/Grand Avenue: Loop 303 to Interstate 10

Date: 4/23/2015

Legend

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- Full Movement Access
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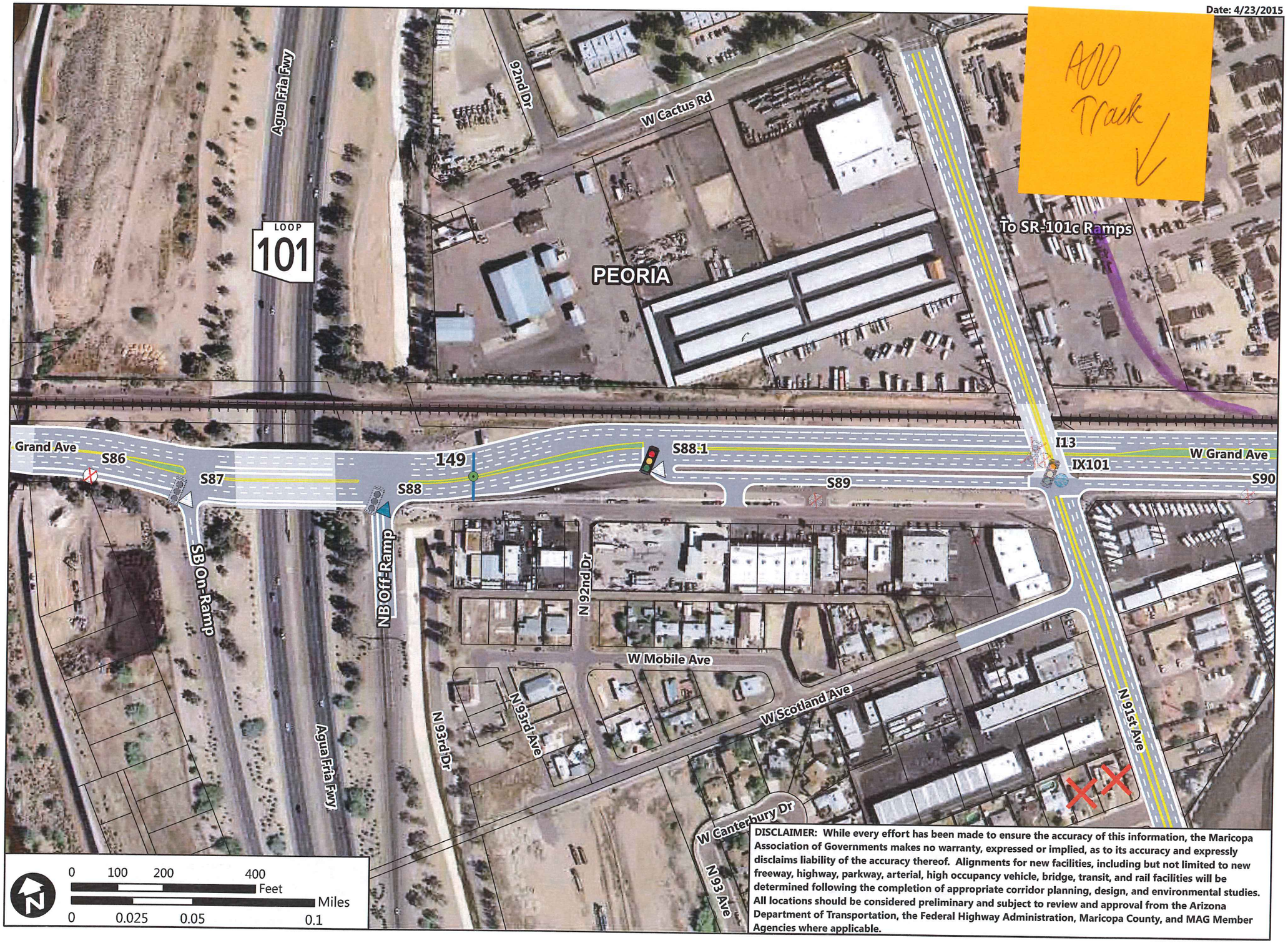
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S86	C	R
S87	OF	N
S88	ON	N
S88.1	OF	N
S89	C	R
I13	C	R
IX101	F	N
S90	C	R



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COMPASS

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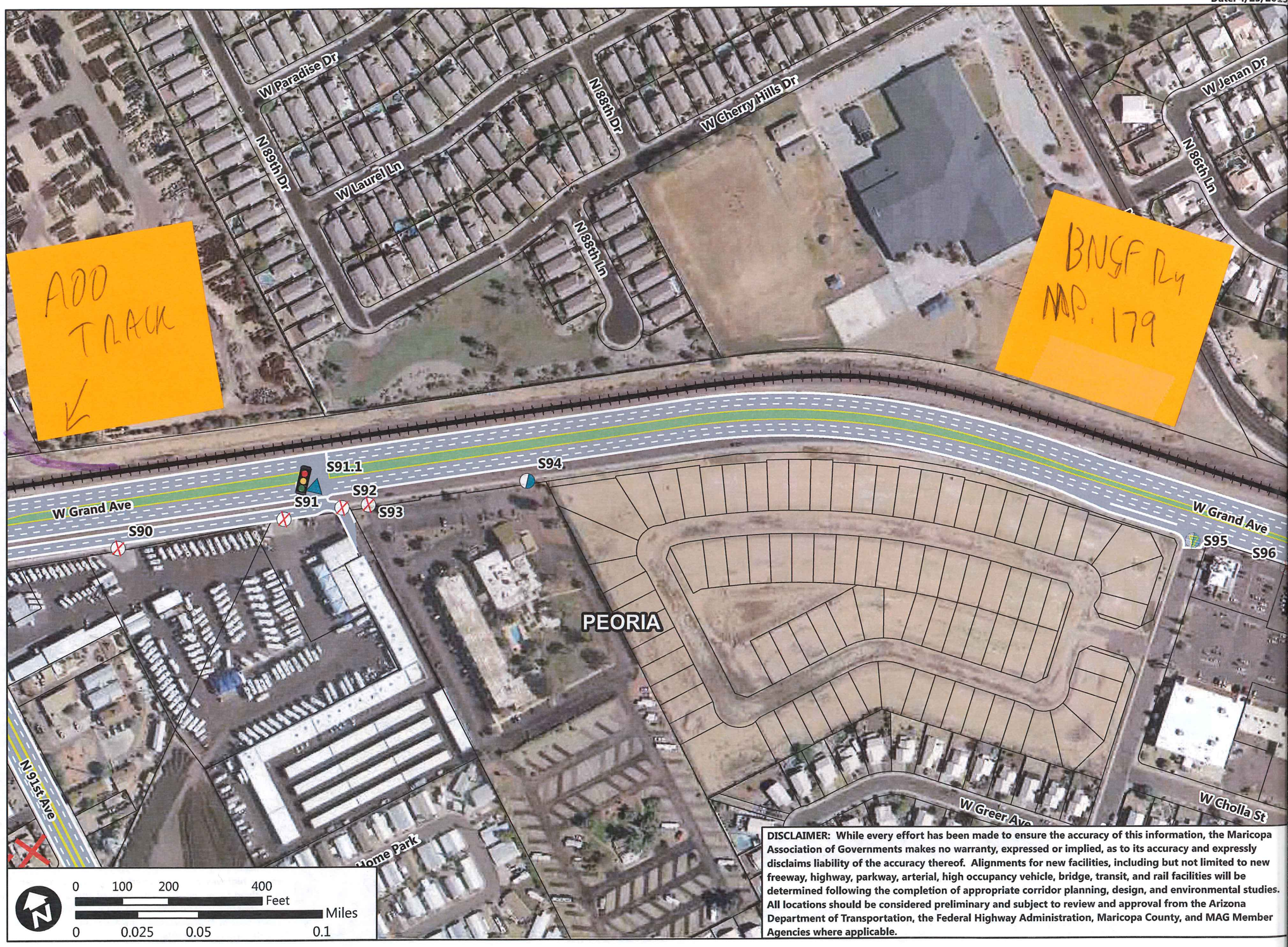
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S90	C	R
S91*	C	R
S91.1	ON	N
S92	C	R
S93	C	R
S94**	R	R
S95	R	R
S96	C	R

*S91 accesses frontage ramp in lieu of Grand
**S94 would require a driveway extension to access Grand



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- Future Signalized Intersection
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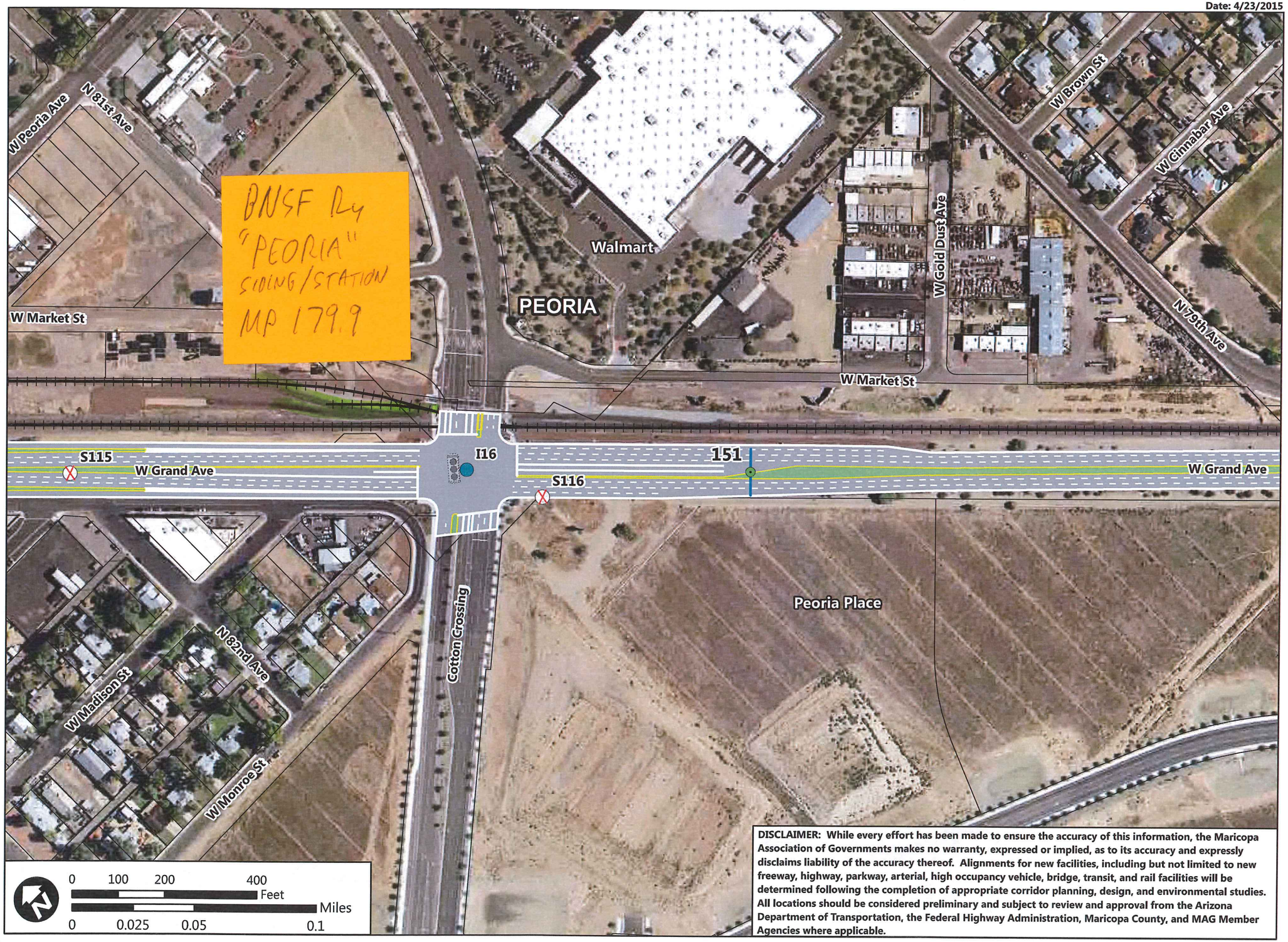
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S115	C	R
I16	F	N
S116	C	R



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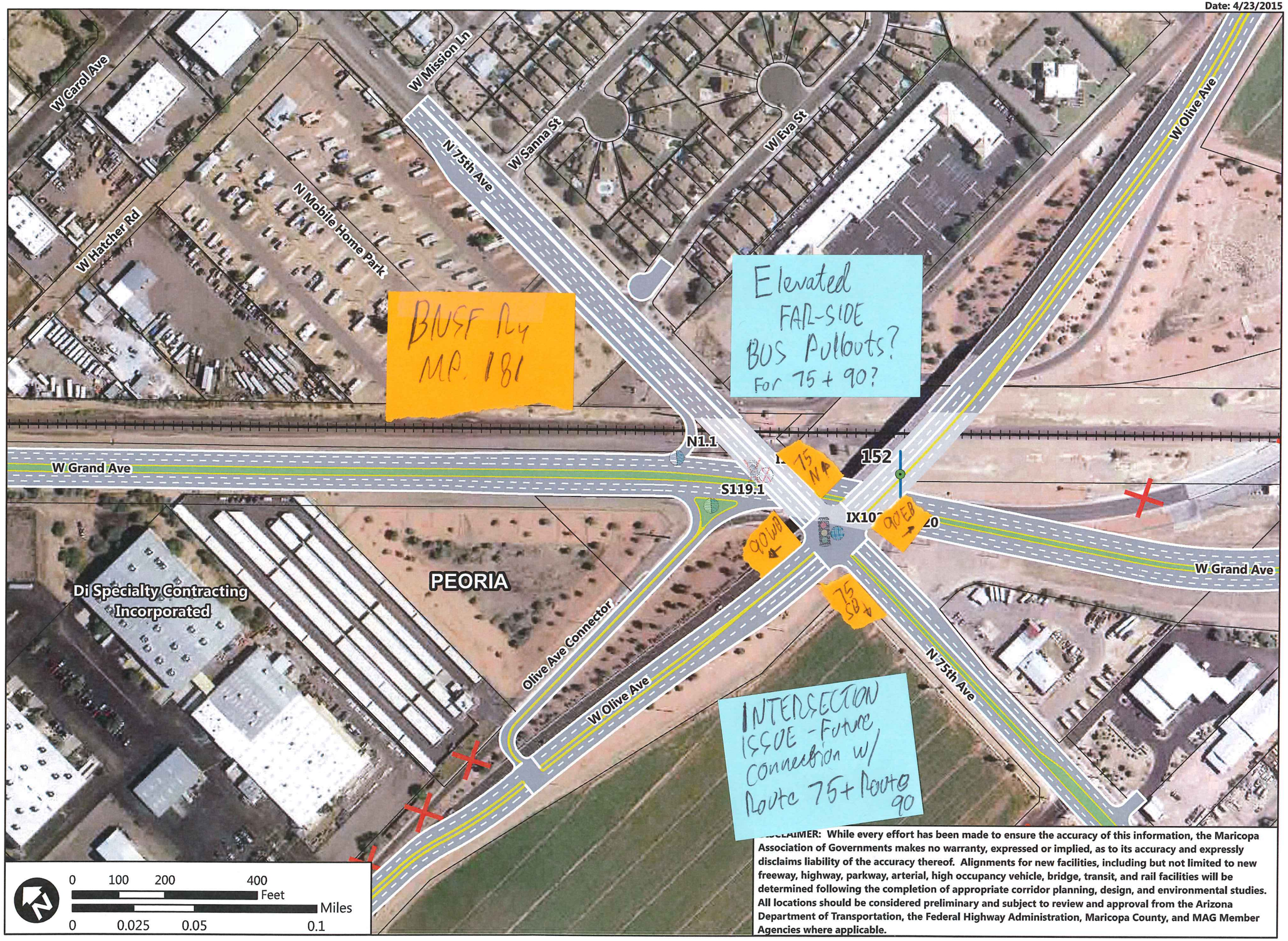
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
I17	C	R
N1.1*	R	R
S119.1	R	R
S120	C	R
IX102**	F	N

*N1.1 is right-on only

**IX102 is Olive and 75th intersection above Grand



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- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N16	C	R
N17	C	R
N18	C	R
N19	C	R
N20	C	R
N21	C	R
N22	C	R
N23	C	R
N24	C	R
N25	C	R
N26	C	R
N27	C	R
N28	C	R
N29	R	R
N30	R	R

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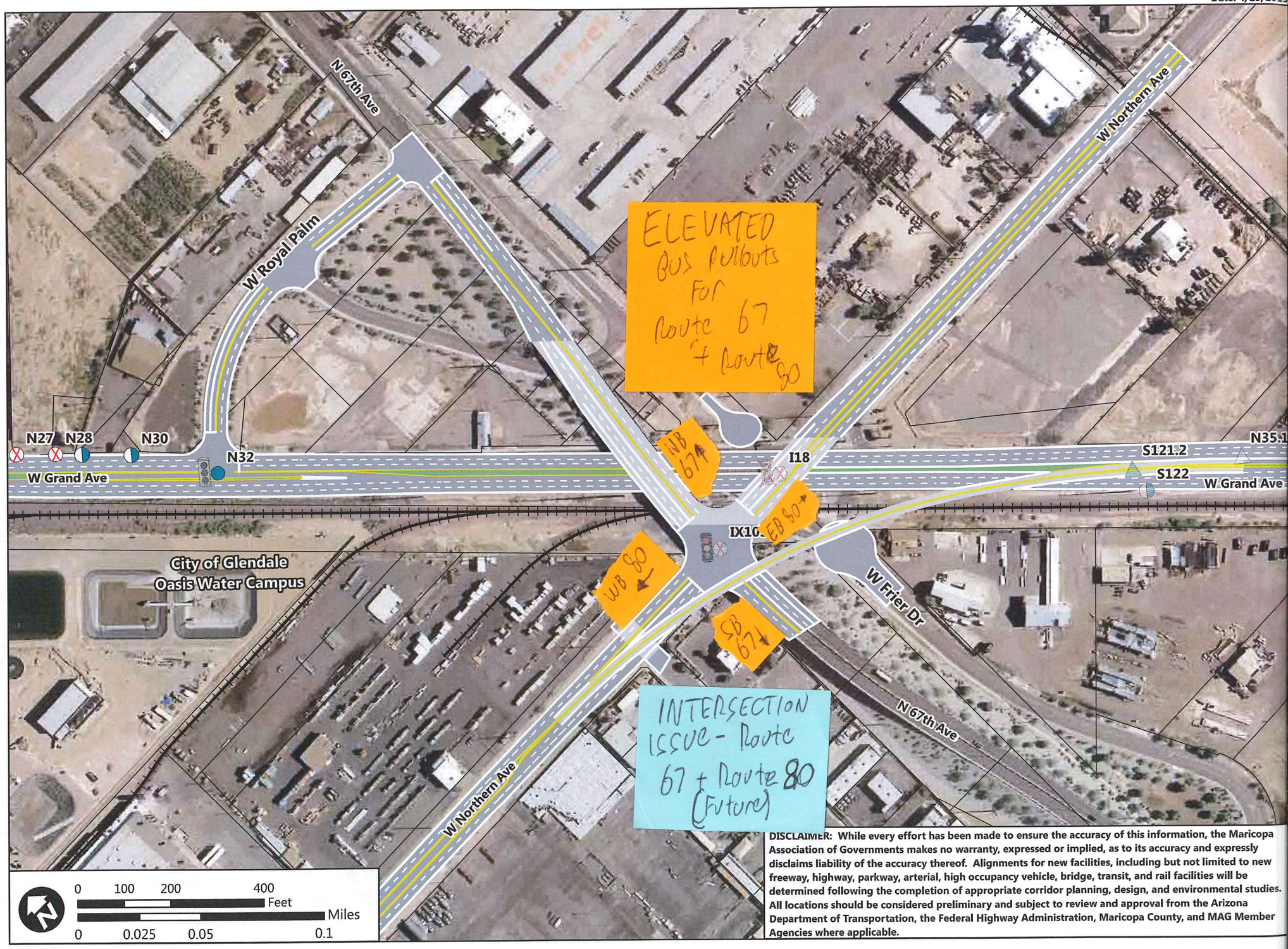
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N27	C	R
N28	C	R
N29	R	R
N30	R	R
N32	F	N
IX103*	C	R
I18	C	R
S122	R	R
N35.1	OF	R
S121.2	ON	R

*IX103 is signal at Northern and 67th



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- On-Ramp Access to US-60
- Future Signalized Intersection
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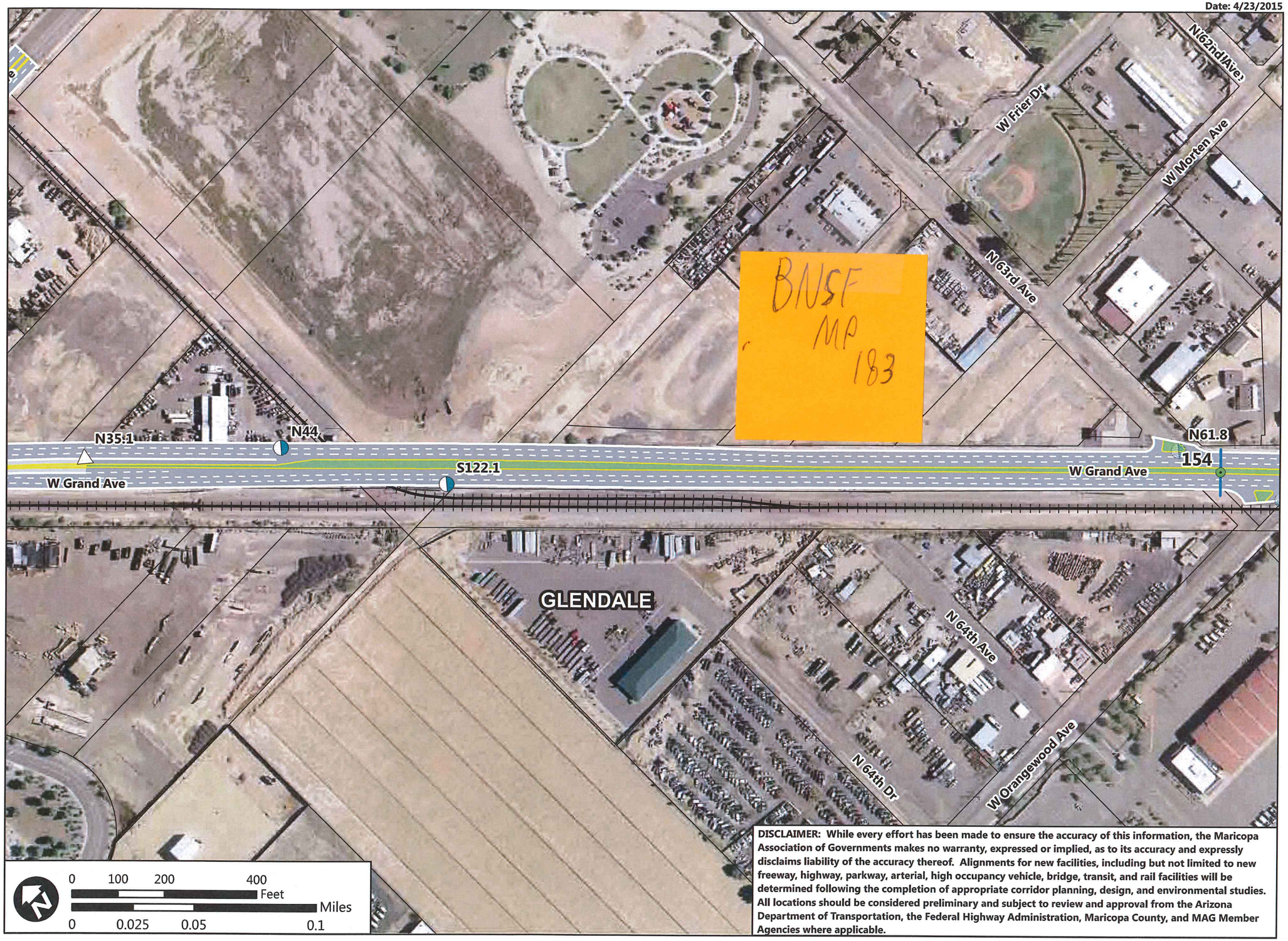
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N44	R	R
S122.1	R	R
N61.8	R	R

Date: 4/23/2015



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US-60/Grand Avenue: Loop 303 to Interstate 10

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- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type

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- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N92*	R	R
N93**	R	R
N94	C	R
N95	R	R
N96	C	R
N97	C	R
N98	R	R
N101	T	MB1
N102	C	R
N103	R	R
N104	C	R
N105	C	R
N106	T	MB1
N107	C	R
N108	C	R
N109	C	R
N110	C	R
N111	C	R
N112	C	R
N113	R	R
N115	C	R

*N92 only provides right turn onto Grand
**N93 only provides right turn off of Grand

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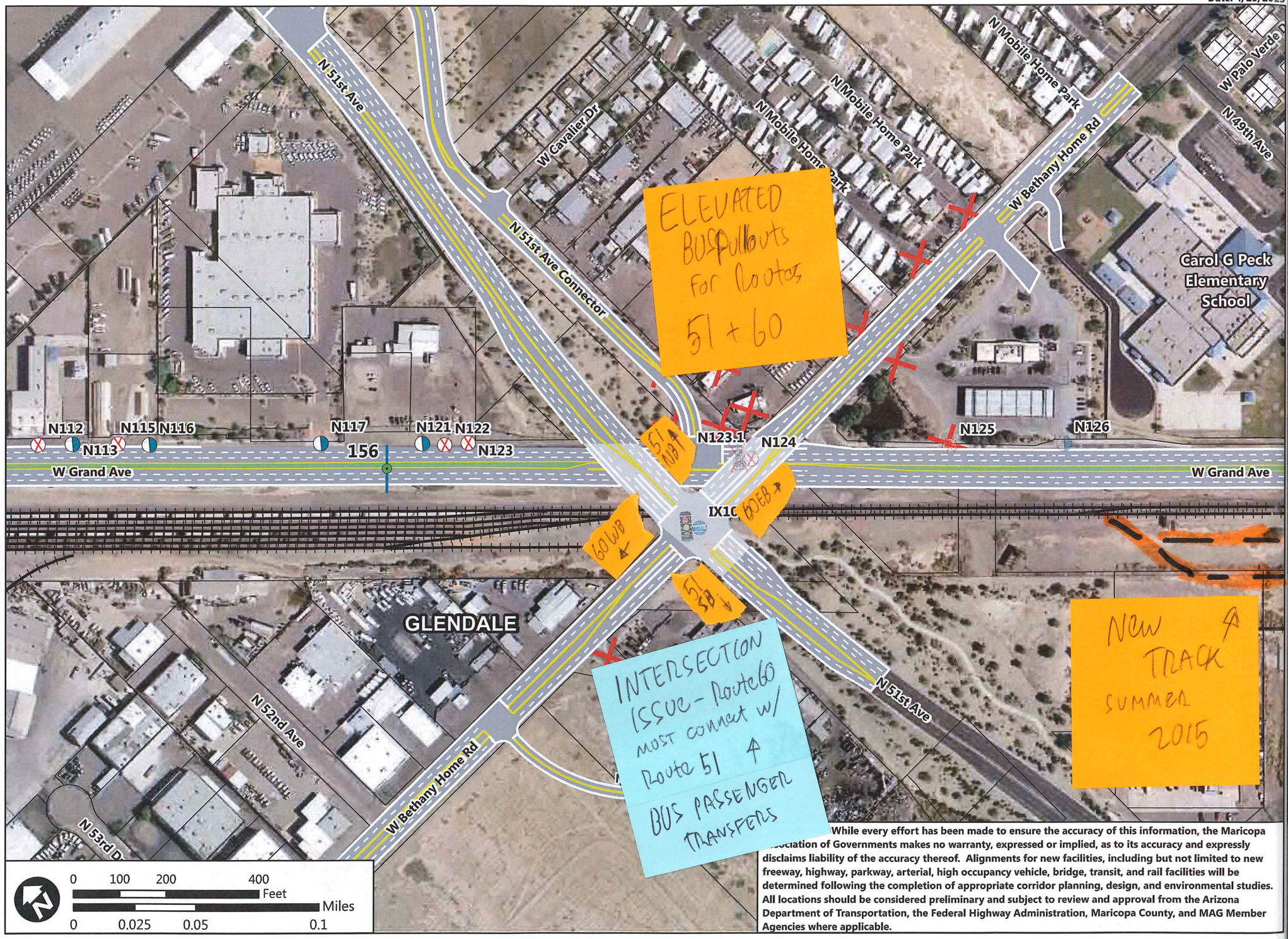
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N112	C	R
N113	R	R
N115	C	R
N116	R	R
N117	R	R
N121	R	R
N122	C	R
N123	C	R
N123.1	F	MB1
N124	C	R
IX104*	F	N
N125	C	R
N126	R	R

*IX104 is full intersection above Grand



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- Close Access
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- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type

THIS YARD Currently being extended in SPRING/summer 2015

BNSF GLENDALE INTERMODAL FACILITY

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- Close Access
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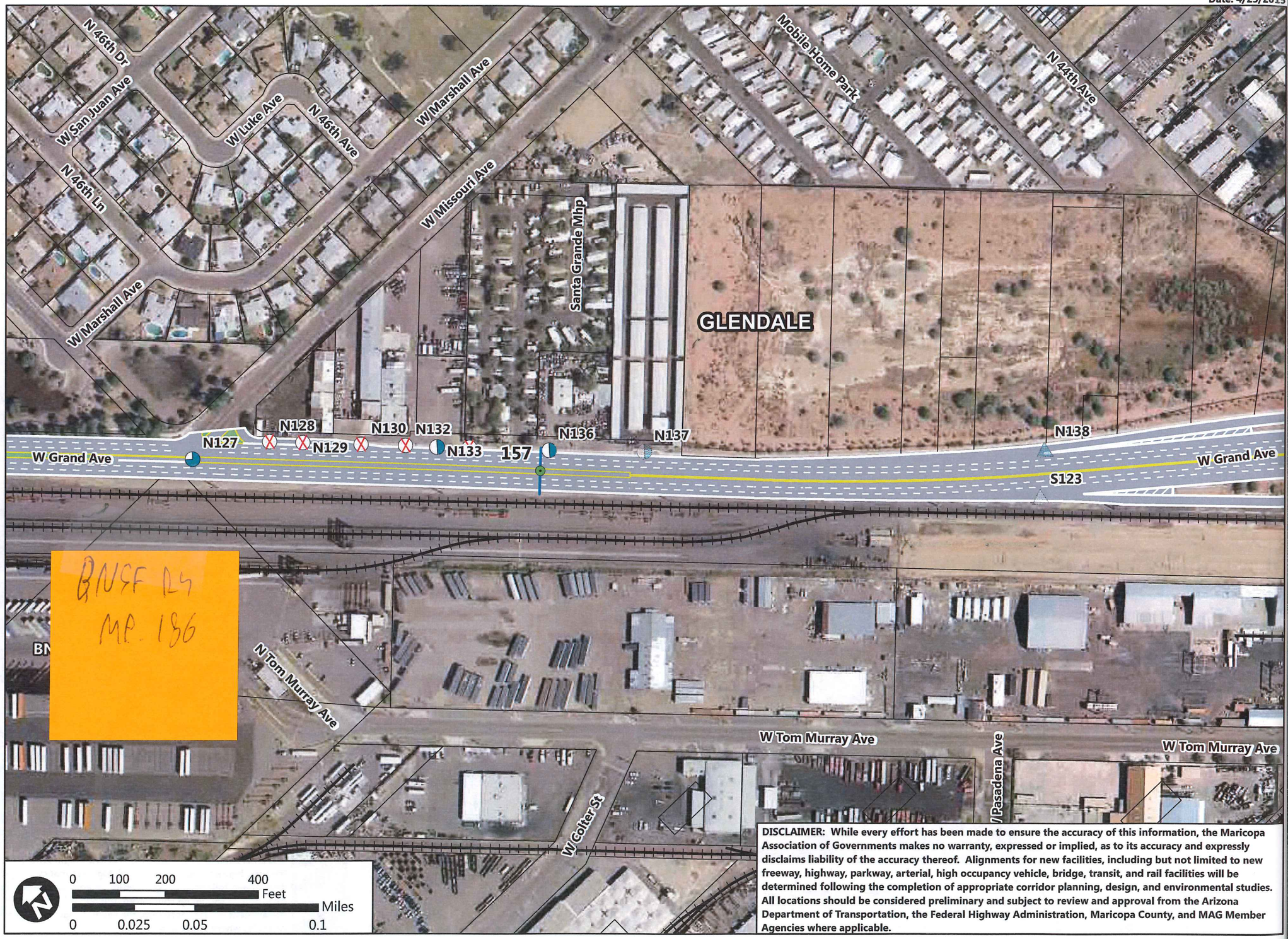
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N127	T	MB1
N128	C	R
N129	C	R
N130	C	R
N132	C	R
N133	R	R
N134	C	R
N136	R	R
N137	R	R
S123	OF	R
N138	ON	R



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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S124	ON	R
N139	OF	R
N140	C	R
N141	R	R
N142	R	R
N143	C	R
N144	R	R
N145	C	R
N146	R	R
N147	C	R
S125	C	R
N148	C	R
N149	R	R
N150	C	R
N151	C	R
N153	C	R

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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

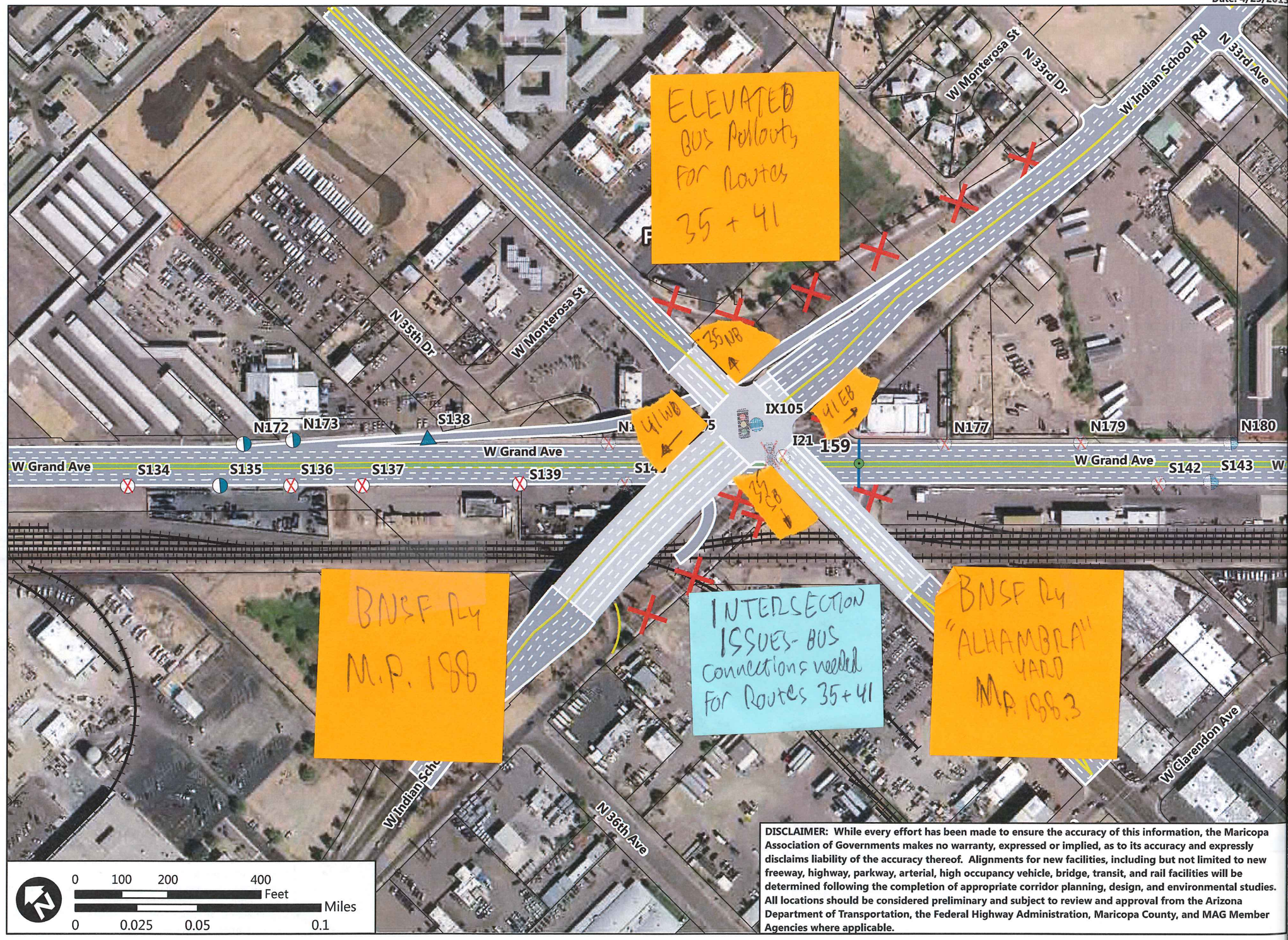
Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S134	C	R
S135	R	R
N172	R	R
S136	C	R
N173	R	R
S137	C	R
S138	ON	R
S139	C	D
N174	C	R
S140	C	R
S140.1	OF	R
N175	R	R
IX105*	F	N
I21	C	R
N177	C	R
N179	C	R
S142	C	R
S143	R	R
N180	R	R

*IX105 is Indian School and 35th above Grand



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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N197	C	R
N198	C	R
I22	R	R
N199	C	R
N200	C	R
N201	C	R
N202	C	R
N203	C	R
S148.5	R	R
N204	R	R
N205	C	R
N206	R	R
N207	R	R
N208	C	R
N209	R	R
N210	C	R
S149	OF	R
N210.5	ON	R

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Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

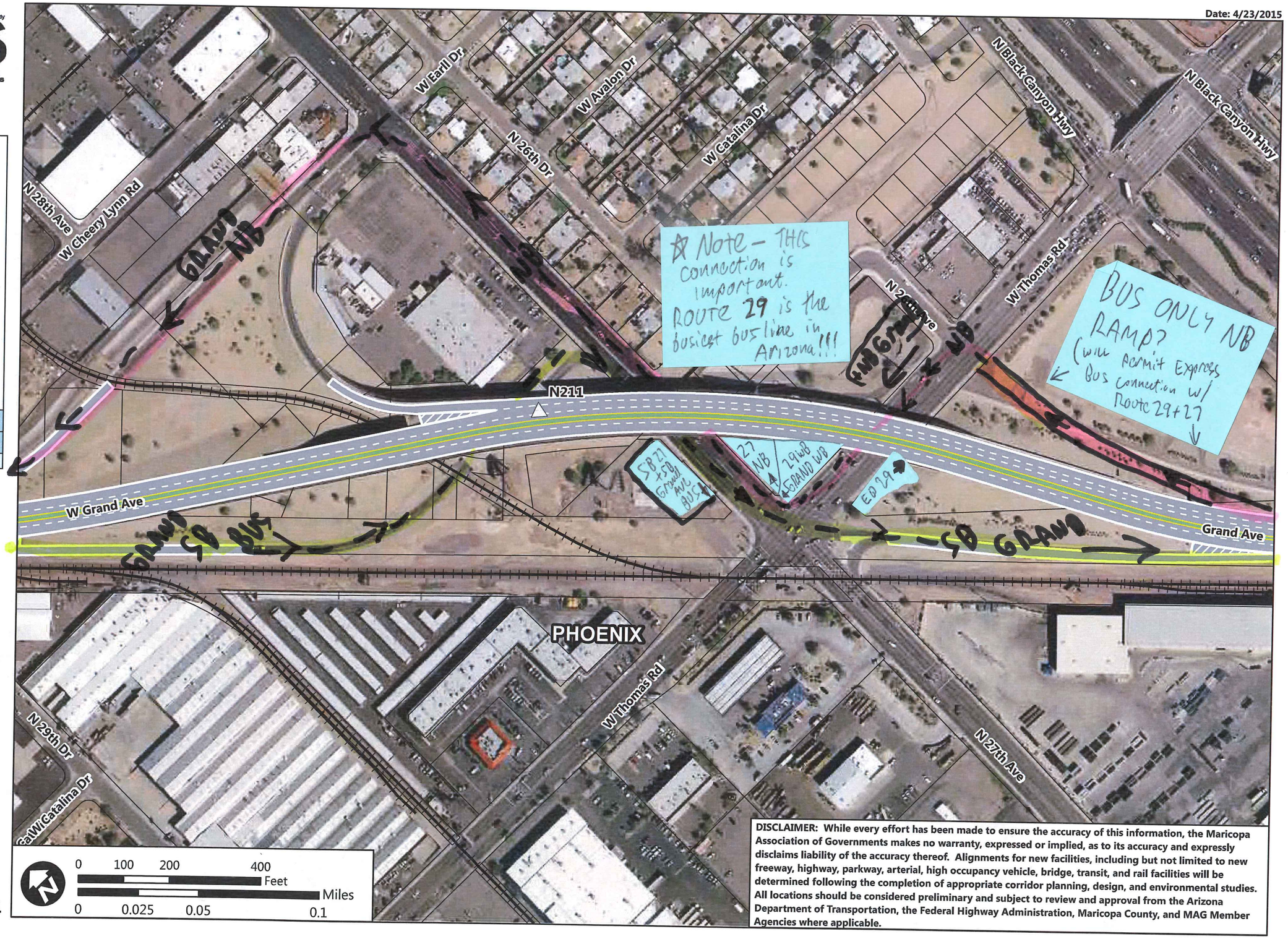
Date: 4/23/2015

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N211	OF	R



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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
S150	ON	R
N211.5*	R	R
N212	R	R
N213	C	R
N214	C	R
N215	C	R
N216	R	R
N217	C	R
N218	R	R
N219	C	R
N220	C	R
N221	C	R
N222	C	R

*N211.5 may provide access to I-17. See Interstate 10/Interstate 17 Corridor Master Plan Study

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Date: 4/23/2015

Corridor Optimization, Access Management Plan, and System Study

COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

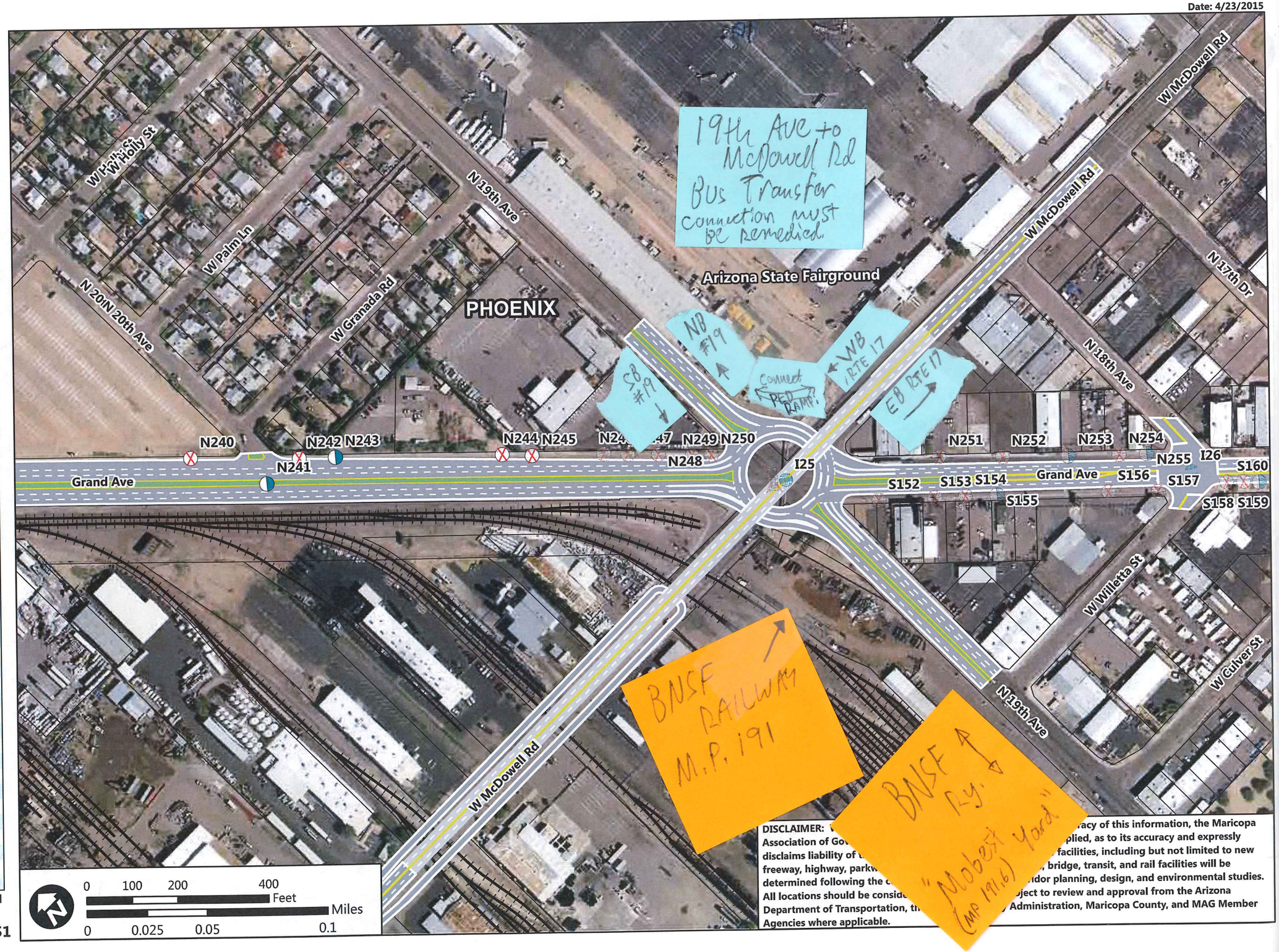
Legend

- Railway
- City Boundary
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal

Recommended Disposition of Access

Access ID	Access Type	Median Type
N240	C	R
N241	R	R
N242	C	R
N243	R	R
N244	C	R
N245	C	R
N246	C	R
N247	C	R
N248	C	R
N249	C	R
N250	C	R
I25*	F	R
S152	C	R
S153	C	R
N251	C	R
S154	C	R
S155	R	N
N252	C	N
N253	R	N
S156	C	D
N254	C	D
N255	R	D
S157	C	D
I26	F	D
S158	C	D
S159	C	D
S160	R	D

*I25 is a roundabout. No access to McDowell



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Pagnard, Jason

From: Pagnard, Jason
Sent: Monday, June 22, 2015 7:30 PM
To: 'Martin Lucero'
Cc: Dana Owsiany; Lloyd Abrams; Bob Hazlett (bhazlett@azmag.gov)
Subject: RE: Draft Compass Comments

Martin,

We appreciate your comments. The Recommendations Map Book was updated to reflect your comments regarding access.

Respectfully,
Jason

From: Martin Lucero [mailto:Martin.Lucero@surpriseaz.gov]
Sent: Wednesday, May 06, 2015 1:57 PM
To: Pagnard, Jason
Cc: Dana Owsiany; Lloyd Abrams
Subject: Draft Compass Comments

Jason,
Thank you for the opportunity to comment on the COMPASS Project Recommendations Map Book. If you have any questions regarding these comments, please contact me at 623-222-3142. Thank you.

Comments Regarding Access:

1. Page 8 of 51, Access ID S38: Recommend keeping this access right-in/right-out for Walmart's deliver trucks' maneuverability and safety.
2. Page 11 of 51, Access ID S47, S49: These two driveways should remain as they currently exist, per previous agreement between the City of Surprise, MAG, and ADOT.

Comments Regarding Technical Issues:

1. Page 5 of 51, Access ID S15, S16, S17, S18, S19, S20: Symbols seem faded. Most likely a GIS/technical issue.
2. Page 6 of 51, Access ID S25, S26, S27, S28: Symbols seem faded. Most likely a GIS/technical issue.
3. Page 7 of 51, Access ID S31, S32, S33, S34, S35: Symbols seem faded. Most likely a GIS/technical issue.
4. Page 8 of 51, Access ID S37, S38, S39: Symbols seem faded. Most likely a GIS/technical issue.
5. Page 9 of 51, Access ID S41, S42, and Bell Road intersection: Symbols seem faded. Most likely a GIS/technical issue.
6. Page 10 of 51, Access ID S45, S46: Symbols seem faded. Most likely a GIS/technical issue.
7. Page 11 of 51, Access ID S50: Symbol seems faded. Most likely a GIS/technical issue.
8. Page 12 of 51, Access ID S52: Symbol seems faded. Most likely a GIS/technical issue.

Martin Lucero
Transportation Planning Manager
City of Surprise | 16000 N. Civic Center Plaza | Surprise, AZ 85374
phone: 623.222.3142 | fax: 623.222.3001

Pagnard, Jason

From: Pagnard, Jason
Sent: Monday, June 22, 2015 7:58 PM
To: 'Jorge Gastelum'
Cc: Bob Hazlett
Subject: RE: US-60/Grand Ave COMPASS - Meeting Agenda Transmittal and Notice of Available Documents

Jorge,

We appreciate your review. The Recommendations Map Book was updated to reflect your comment.

Respectfully,
Jason

From: Jorge Gastelum [mailto:jgastelum@cityofelmirage.org]
Sent: Thursday, April 30, 2015 10:17 AM
To: Bob Hazlett; Pagnard, Jason
Subject: RE: US-60/Grand Ave COMPASS - Meeting Agenda Transmittal and Notice of Available Documents

Thank you Bob,

The only question I have is the "Recommendations Map Book" shows closing the access to Luna Street which is opposite to what it has been discussed with you previously.

We could discuss further this afternoon at the meeting.

Thanks,

Jorge Gastelum, P.E. – Director of Development and Community Services/City Engineer
12145 NW Grand Avenue, El Mirage, AZ 85335
P: 623-876-2976 | M: 623-764-5948 | F: 623-933-8418 | E: jgastelum@cityofelmirage.org

City of EL MIRAGE Arizona
GRAND HERITAGE, BRIGHT FUTURE!

From: Bob Hazlett [mailto:BHazlett@azmag.gov]
Sent: Friday, April 24, 2015 1:37 PM
To: 'Nicole Lance'; Jorge Gastelum; 'Madhu Reddy'; 'Biscan, Dana'; 'ray.dovalina@phoenix.gov'; Amber Wakeman; 'Pagnard, Jason'; 'Townsend, Jim K.'; 'Grant Anderson, Youngtown'; 'leticia.vargas@phoenix.gov'; 'mark.melnychenko@phoenix.gov'; 'Debbie Albert'; 'Tom Remes'; 'eunice.chan@dot.gov'; 'Aryan Lirange'; Chaun Hill; 'Shawn Kreuzwiesner'; 'Audra Koester Thomas'; 'Martin Lucero'; 'stephen.chang@surpriseaz.gov'; 'Philip Demosthenes'; 'Mohammad A. Zaid'; Dana Owsiany; 'Brian Toombs'; Dave Moody; 'Trent Kelso'; 'mzaid@azdot.gov'; Nathan Pryor; 'leticia.vargas@phoenix.gov'; 'Stephen Chang'; 'Denise Lacey - MCDOTX'; 'Brent Cain'; Marc Pearsall; 'Dudley, Matthew'; 'Andy Granger'; 'Jamal Rahimi'; Eric Anderson; 'Steve Thieken'; 'Steve Boschen'; 'Andy Granger'; 'Colbath, Cathy'; 'Suparna Dasgupta - MCDOTX'; 'mark.melnychenko@phoenix.gov'; Beth.Mirka@burgessniple.com
Subject: FW: US-60/Grand Ave COMPASS - Meeting Agenda Transmittal and Notice of Available Documents

Correction . . . Jason Pagnard can be reached at **602 244-8100**, extension **5332**.

Pagnard, Jason

From: Pagnard, Jason
Sent: Monday, June 22, 2015 9:36 PM
To: 'Shawn Kreuzwiesner'; Bob Hazlett (bhazlett@azmag.gov)
Cc: Bill Mattingly; Andy Granger; Jamal Rahimi; Susan Daluddung; Dan Nissen; Lisa Estrada; Stuart Kent; Chris Jacques
Subject: RE: Peoria's Comments on the Grand Ave COMPASS Recommendations
Attachments: 75th Full Interchange-6-19-15...pdf

Shawn,

We appreciate your thorough review. With coordination and approval from Bob Hazlett, your comments were included in Technical Memorandum 6 and the Recommendations Map Book in two ways. First, several key items you point out are stated within the document. Second, your comments and this response are included in the appendix of Technical Memorandum 6 so that they are carried forward with the project, ensuring nothing is missed. Specific responses to your comments are as follows:

General Response: The City's potential hesitation to supporting some of the concepts is recognized; however, note that they are just concepts at this point. The concepts need to go through the ADOT Scoping Phase (Design Concept Report), where the concepts proposed should be one of potentially several other concepts investigated. This COMPASS project requests that during the Scoping Phase, the basic access and traffic operation principals (e.g. reduced signal phases) of the study are incorporated in alternative concepts. This COMPASS project also requests that the concerns stated by its Planning Partners are further investigated during the Scoping Phase. For this reason, the comments you submitted below and this response are included in Technical Memorandum 6. Specific issues, including those you submitted, are also raised in the narrative in Technical Memorandum 6 for each of the major intersections. This will ensure the City's concerns are carried forward in future implementation phases.

Grand Ave Crossing of New River (Pg 22 of 51): The aerial image was not updated (we recognize it is a couple years old); however, a note calling out a "Potential Trail Access" was added to the page to incorporate the basis of your comment.

91st Ave/Grand Intersection(pg 23 of 51): See the General Response above regarding concepts.

This location is probably one of the most challenging locations in the corridor for several reasons, including the railroad, proximity to SR-101L, maintaining local access immediately to the south, limited available right-of-way, and the City's interest to not adversely impact the RV dealership on the south side. The concept, albeit a unique concept for a unique and challenging location, modeled exceptionally well…LOS C and better for the AM and PM peak hours.

The issue with providing a full diamond interchange at SR-101L is the railroad tracks, which you recognize. Adding new at-grade railroad crossings is generally inconsistent with the recommendations of the study, and may adversely impact future funding opportunities with the BNSF Railway for implementing corridor recommendations. Also, most transportation agencies (e.g. ADOT) are generally not in favor of new at-grade railroad crossings.

87th and 85th /Grand Intersections (pg 25 of 51): The Recommendations Map Book was revised to reflect the comment.

Grand/Cotton Crossing (Pg 27 of 51): See the General Response above regarding concepts.

Several concepts were investigated at this location. Similar to eliminating the right-turn movement to Cotton Crossing, if the ramp were brought down in the median, then the left-turn to Cotton would be precluded for the same reason (through traffic mixing with turning traffic in a very short length). Given multiple opportunities to access the area south

of US-60/Grand Avenue in the Old Town area with the grade-separated concept, it appeared prudent to provide the left-turn at Cotton Crossing vs. right-turn.

The complexities at the location and City's concerns are documented and should be investigated in greater detail during ADOT's Scoping Phase (see General Response above).

Grand/75th/Olive Intersection (Pg29 of 51): Sure, see attached.

Please contact Bob Hazlett with further questions.

Respectfully,
Jason

From: Shawn Kreuzwiesner [mailto:Shawn.Kreuzwiesner@peoriaaz.gov]
Sent: Tuesday, May 12, 2015 3:24 PM
To: Bob Hazlett (bhazlett@azmag.gov); Pagnard, Jason
Cc: Bill Mattingly; Andy Granger; Jamal Rahimi; Susan Daluddung; Dan Nissen; Lisa Estrada; Stuart Kent; Chris Jacques
Subject: Peoria's Comments on the Grand Ave COMPASS Recommendations

Bob, Jason,

The Peoria staff has had a chance to review the Recommended Map Book from the US-60/Grand Avenue COMPASS project. In general the report looks good and we do support the goal of improving traffic flow on Grand Avenue. However, we have some concerns about some of the proposed improvement that are summarized below. It may be best if we can set up some time before Jason's contract is over to review the comments/concerns. Without some adjustments, we will have a difficult time supporting the recommendations moving forward.

Grand Ave Crossing of New River (Pg 22 of 51): It would be good to get an updated arterial photo of this area to show the completion of the New River trial. The trail now runs in the river bottom under the BNSF/Grand bridges and then connects to the existing trail on the upper west bank. What accommodations will be made to connect the existing sidewalk on the south side of Grand to this trail link?

91st Ave/Grand Intersection(pg 23 of 51): In the August 2014 project update, the City first saw the option to grade separate 91st Ave from Grand and to add a new frontage road on the north side to allow for North-South traffic movements. The new design shifts the access road to the south side of Grand but appears to retain the same functionally. We are concerned that this may not be the best final solution for this intersection.

Is it not possible to construct more of a full diamond intersection with Grand/101 to allow for full 101SB to Grand and Grand to 101NB movements? We understand that the BNSF tracks are a major impediment in the area. Our heaviest traffic movements in the area are: 101SB to Grand, and Grand to Cactus/101NB. Both of these movements appear to require traffic to pass through two new signals with the proposed option – which is a major concern.

87th and 85th /Grand Intersections (pg 25 of 51): There should be a new traffic signal shown at 87th. The existing signal at 85th Avenue should be shown as being deleted.

Grand/Cotton Crossing (Pg 27 of 51): We are concerned about the loss of the right turn movement from Grand Ave inbound to Cotton Crossing SB. The city constructed Cotton Crossing to be one of your major Arterial connections with Grand Avenue and the loss of any traffic movements is drastic. Did you look into the option of constructing the new access lanes/road from Grand Ave to the new Old Town traffic deck from the inside lanes on Grand, rather than on the outside of the through lanes? We thought that might help reduce the conflict with Cotton Crossing.

Grand/75th/Olive Intersection (Pg29 of 51): Is it possible to get a single drawing of this intersection to show how all the traffic movements will work in the area.

Sincerely,

Shawn V. Kreuzwiesner, PE, MPA | Engineering Planning Manager
623-773-7643 | Shawn.Kreuzwiesner@peoriaaz.gov

Planning and Community Development Department | City of Peoria
9875 N. 85th Ave., Peoria, AZ 85345
Office Hours are Monday to Thursday, 7a.m. till 6p.m.
www.peoriaaz.gov

"The most powerful argument of all for saving open space is economics; in most states, tourism is the number two industry."
Jim Fowler

Date: 6/19/2015

Corridor Optimization, Access Management Plan, and System Study

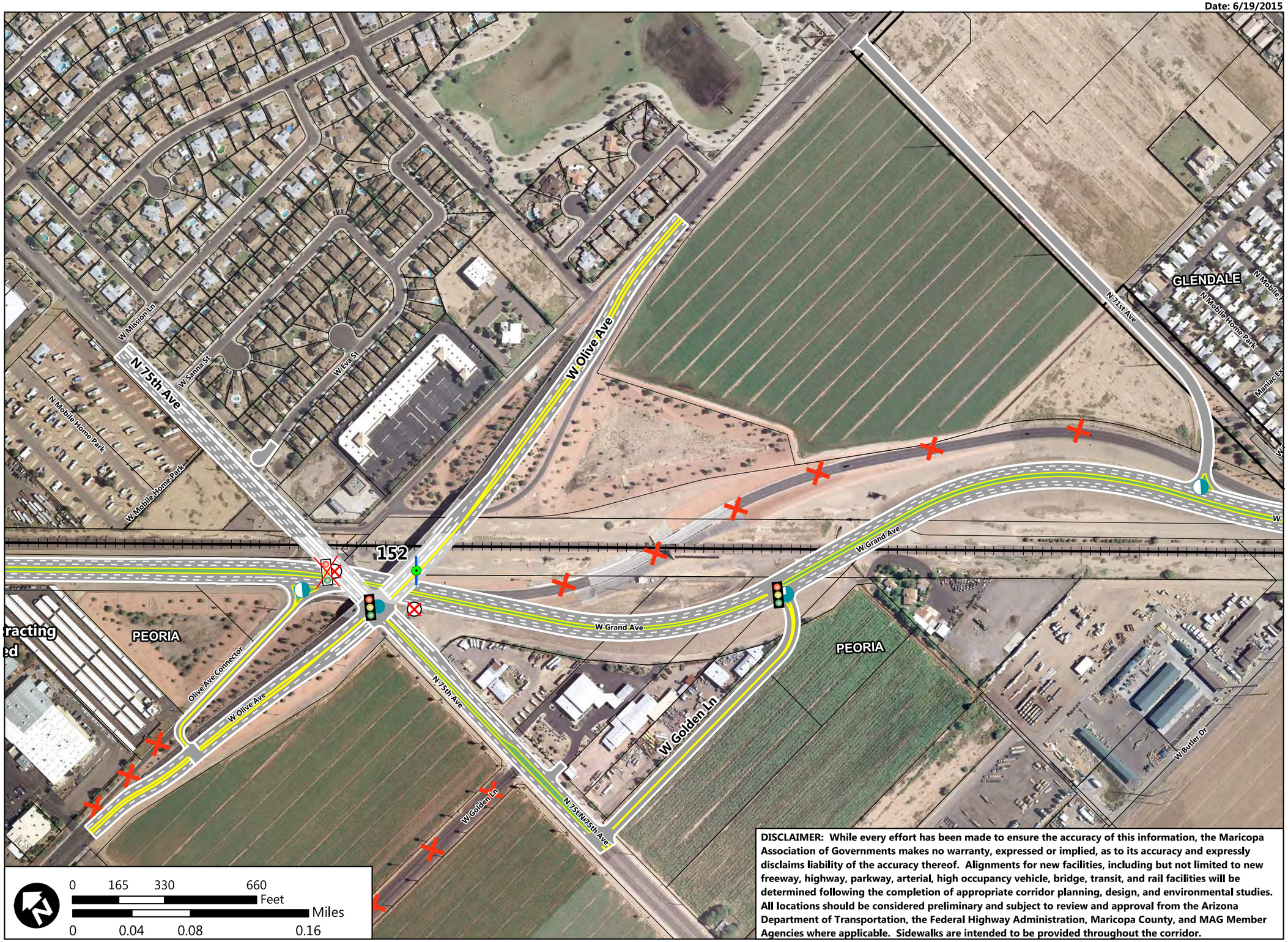
COMPASS

MARICOPA ASSOCIATION of GOVERNMENTS

US-60/Grand Avenue: Loop 303 to Interstate 10

Legend

- Railway
- City Boundary
- ADOT Mile Post
- Full Movement Access
- 3/4 Movement Access
- Right-In Right-Out Access
- Close Access
- Off-Ramp Access from US-60
- On-Ramp Access to US-60
- Future Signalized Intersection
- Existing Signalized Intersection
- Remove Existing Signal



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Pagnard, Jason

From: Pagnard, Jason
Sent: Monday, June 22, 2015 10:04 PM
To: 'Bob Hazlett'
Subject: RE: Comments – DRAFT Recommendation Map Book, COMPASS US-60/Grand Avenue: Loop 303 to Interstate 10
Attachments: Glendale.pdf

Importance: High

Bob, see below and attached (notes refer to the attached PDF) for the response to Glendale's comments. Please forward to the City at your earliest convenience. This e-mail and the attachment will be included in Technical Memorandum 6.

General Note – We appreciate your thorough review. With coordination and approval from Bob Hazlett, your comments were included in Technical Memorandum 6 and the final Recommendations Map Book in two ways. First, several key items you point out are stated within the document. Second, your comments and this response are included in the appendix of Technical Memorandum 6 so that they are carried forward with the project, ensuring nothing is missed.

Note A – Technical Memorandum 6 provides a narrative, graphical representation, and traffic modeling printouts to convey concept recommendations. MAG will be provided electronic files of the documents for its future use in disseminating information.

Note B – Access points that were identified at the study outset and documented in Technical Memorandum 1 were included in the Recommendations Map Book for consistency. This addresses the potential question of missing an access point when comparing the two documents.

Note C – Done. Per follow-up discussion between MAG and City staff, study recommendations for the Myrtle and immediate area were removed from Technical Memorandum 6 narrative and the Recommendations Map Book. A note was added stating "Additional study needed. Subject to final recommendations for potential HCT corridor extension from downtown Glendale to Westgate."

From: Bob Hazlett [mailto:BHazlett@azmag.gov]
Sent: Monday, May 11, 2015 10:13 PM
To: Pagnard, Jason
Subject: Fwd: Comments – DRAFT Recommendation Map Book, COMPASS US-60/Grand Avenue: Loop 303 to Interstate 10

Bob Hazlett
Maricopa Association of Governments
602 254-6300
robhaz@cox.net

---------- Forwarded message ----------
From: "**Sage, Patrick**" <PSage@GLENDALEAZ.COM>
Date: Thu, May 7, 2015 at 9:07 PM -0700
Subject: Comments – DRAFT Recommendation Map Book, COMPASS US-60/Grand Avenue: Loop 303 to Interstate 10
To: "Bob Hazlett" <BHazlett@azmag.gov>
Cc: "Albert, Debbie" <dalbert@glendaleaz.com>, "Stoddard, Brent" <BStoddard@glendaleaz.com>, "Goad, Jenna" <JGoad@GLENDALEAZ.COM>, "Froke, Jon" <JFroke@GLENDALEAZ.com>, "McAlindin, Dave" <DMcalindin@GLENDALEAZ.com>, "Guntupalli, Kiran" <KGuntupalli@GLENDALEAZ.COM>, "PE Peter W. Knudson (peter.knudson@dibblecorp.com)" <peter.knudson@dibblecorp.com>, "Tim Wolfe (tim.wolfe@dibblecorp.com)" <tim.wolfe@dibblecorp.com>

Bob:

Attached find the composite review comments from the City of Glendale staff on the above referenced document. We look forward to further discussions on the recommendation from this study.

Best regards,

Patrick Sage, AICP
City of Glendale
Transportation Planner
623.930.2945 (desk)
937.901.8233 (mobile)

Public Works
Transportation

DATE: May 7, 2015

TO: Bob Hazlett, Maricopa Association of Governments

FROM: Patrick Sage

SUBJECT: Comments – DRAFT Recommendation Map Book
COMPASS - US-60/Grand Avenue: Loop 303 to Interstate 10

City of Glendale staff reviewed the draft document referenced above and provided the following composite comments. Staff focused primarily on the section of Grand Avenue addressed in this COMPASS that is located in or adjacent to the City limits.

General Note – The City requests more discussion on the best way to convey recommendations for the major intersection reconfigurations, particularly where grade separations are under considerations. In the City of Glendale these include the Grand Avenue intersection with Northern Avenue/67th Avenue (page 32), and the Grand Avenue intersection with Bethany Home Road /51st Avenue (page 38). See e-mail response Note A

Page 29-30
Consider providing a description or graphic depiction of how routing/connections are made between Olive Avenue and westbound Grand Avenue (is it via 71st connector?). Also NB 75th to WB Grand (is it via Golden Lane relocated connector?). See e-mail response Note A

Page 31

- Access ID N3.5 – Close access to Grand Avenue. Done
- Access ID N4 – Reconstruct intersection with Grand Avenue to form a 90 degree intersection. Creating a 90 degree intersection would require R/W; the comment is noted for further investigation.
- Access ID N29 – Label missing on map. Done
- Access IDs N3.5, N4, N5, N6, N8 N10, and 13 – No descriptions (Access Type, Median Type) in left legend. Done
- Note – all 18 private access drives identified for closure on this page are currently open. No alternative access for these properties is evident in these recommendations. Is the expectation that alternative access opportunities will be identified as properties redevelop? The Recommendations Map Book was updated to show a potential back access roadway per prior City comment.

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- Note – Access ID N27 and N28 appear on page 31 and are included in the access drive closure count for that page. Area overlaps between pages, but is not double counted.
- Consider adding additional explanation for I18 that the signal removal and access closure coding is related to the grade separation. Comment noted.

Page 33

- Access ID N61.8 – realign N 63rd Avenue to create a 90 degree intersection with Grand Avenue. Creating a 90 degree intersection would require R/W; the comment is noted.
- Remove the "154" label from the 63rd Avenue intersection location or identify what it signifies (mile marker?) in the Legend. Done

Page 34

- Four private access drives identified for closure on this page have already been closed - Access ID N63, N64, N67 and N69. Please remove the "Close Access" symbols from the Map Book for these locations. See e-mail response Note B
- Several significant concerns were raised regarding the proposed reconfiguration of the Myrtle Avenue intersection with Grand Avenue. Therefore, the City requests further discussion on how this intersection is addressed in the recommendations for this COMPASS. See e-mail response Note C
- Lack of right turn lanes on EB Grand Avenue to SB Myrtle, particularly after routing all EB to NB left turns to follow this movement. See e-mail response Note C
- Concerns regarding NB traffic on Myrtle (south of Grand Avenue) queuing beyond the "jug handle" during train events, in turn stopping SB traffic due to desired LTs into the jug handle and eventually backing up and stopping EB traffic on Grand Avenue. See e-mail response Note C
- Improvements at this location will be dependent on the outcome of the West Phoenix/Central Glendale High-Capacity Transit (WPCG-HCT) Study and the resulting locally preferred alternative. See e-mail response Note C

Page 36

- 57th Drive intersection with Grand Avenue – no recommendations are offered for this location. Improvements may be warranted and will depend on the outcome of the WPCG-HCT Study. Comment noted
- 10 private access drives identified for closure on this page have already been closed - Access IDs N76, N77, N79, N80, N83, N86, N88, N89, N90, and N91. Please remove the "Close Access" symbols from the Map Book for these locations. See e-mail response Note B
- Remove "155" label? 155 is a mile post marker

Page 37

- 13 private access drives identified for closure on this page have already been closed - Access IDs N94, N96, N97, N102, N104, N105, N107-112, and N115. Please remove the "Close Access" symbols from the Map Book for these locations. See e-mail response Note B

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- Remove large red "X"s, assuming that these are GIS "orphans" that do not relate to directly to these recommendations. If pertinent to this study provide appropriate explanation in the Legend. Road is marked for removal
- Consider adding additional explanation for N124 that the signal removal and access closure coding is related to the grade separation. Comment noted

Page 40

Five private access drives identified for closure on this page have already been closed - Access IDs N127-130, N132, and N134 (or135). . Please remove the "Close Access" symbols from the Map Book for these locations N127 is Missouri Avenue and is open today; See e-mail response Note B