

## 5.0 ALTERNATIVES ANALYSIS

### 5.1 Introduction

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

### 5.2 Alternatives Analysis

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

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

#### Current Connection Methods

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

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

#### Connection Alternatives

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

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

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

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

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

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

### **Feasibility of Connection Improvements**

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

### **5.2.2 Route Transfer**

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

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

### **5.2.3 Ultimate Concepts**

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

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

### **5.2.4 Grade Separations**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

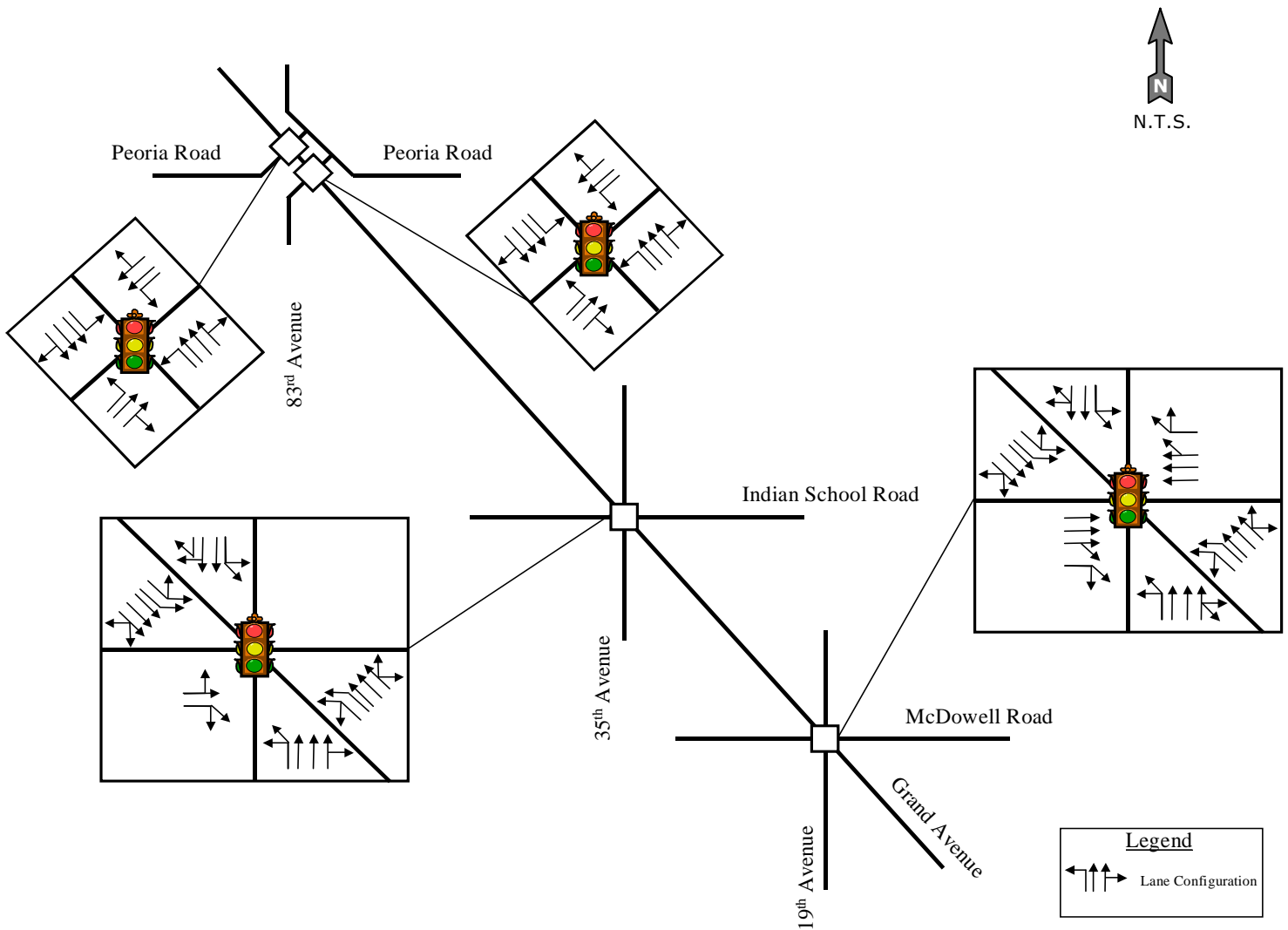
- Grand Avenue is three through lanes per direction (southeast bound and northwest bound) with dual left-turn lanes and free-flow right turn movements.
- McDowell Road is three through lanes per direction (eastbound and westbound). A single eastbound right-turn lane and dual westbound right-turn lanes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

### **Existing Traffic Analysis**

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

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

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



### Exhibit 5.3 Existing Lane Configurations

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

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

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

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

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

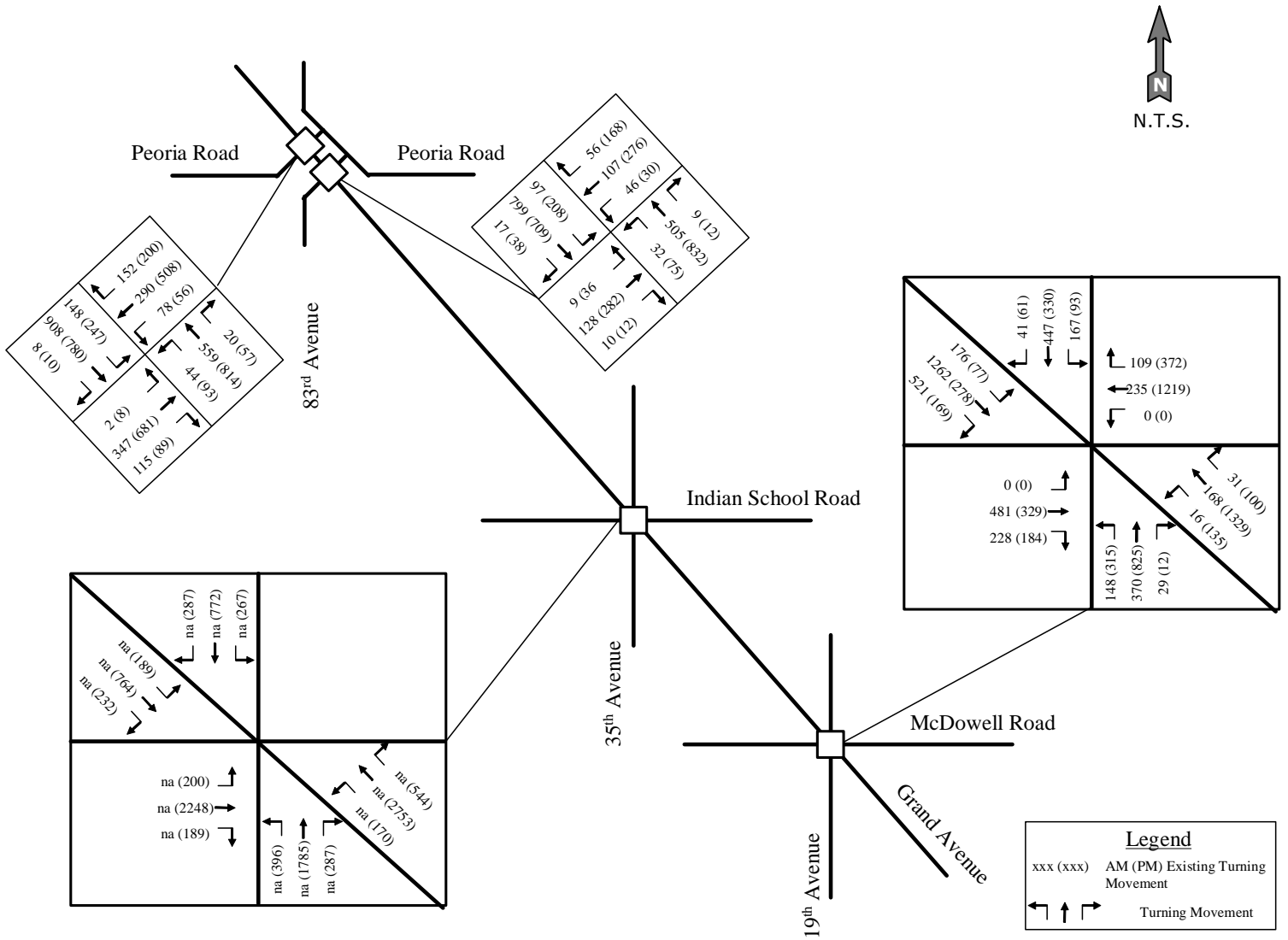
Synchro software was utilized to calculate the level-of-service (LOS) for each existing intersection. The results of this calculation are provided in Appendix E and are summarized in Exhibit 5.4 below.

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

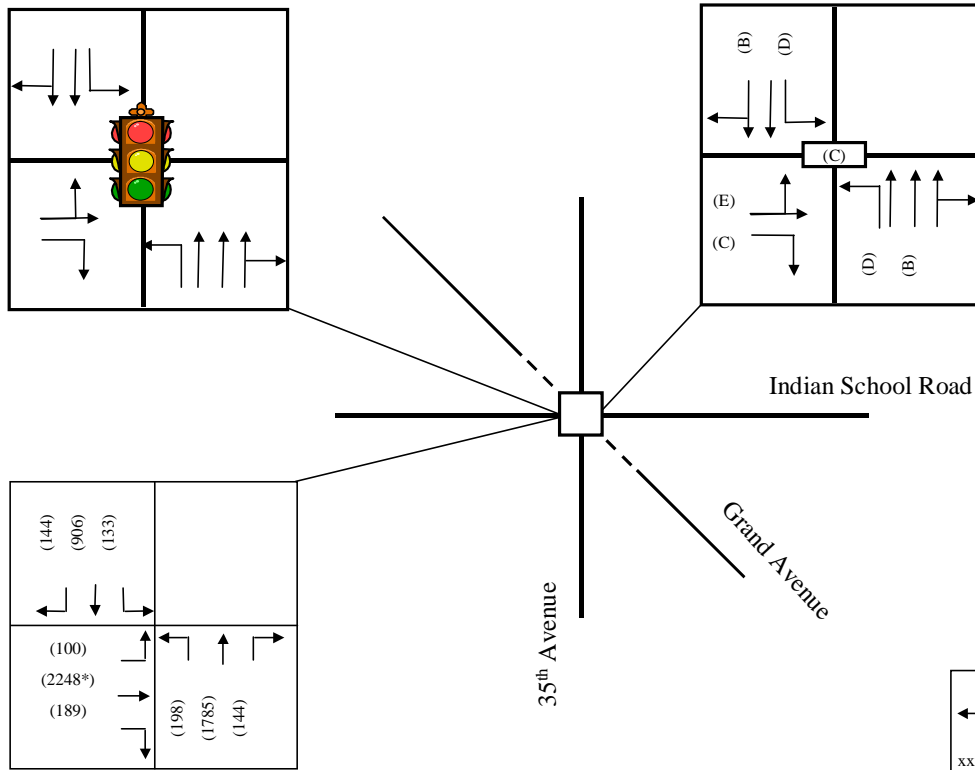
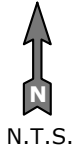
Alternative 2 suggests the through lanes of 35<sup>th</sup> Avenue be depressed under Grand Avenue. Frontage roads along 35<sup>th</sup> Avenue would provide access to the properties along 35<sup>th</sup> Avenue. The frontage roads would also provide access to Indian School Road and Grand Avenue. Indian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

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

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

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

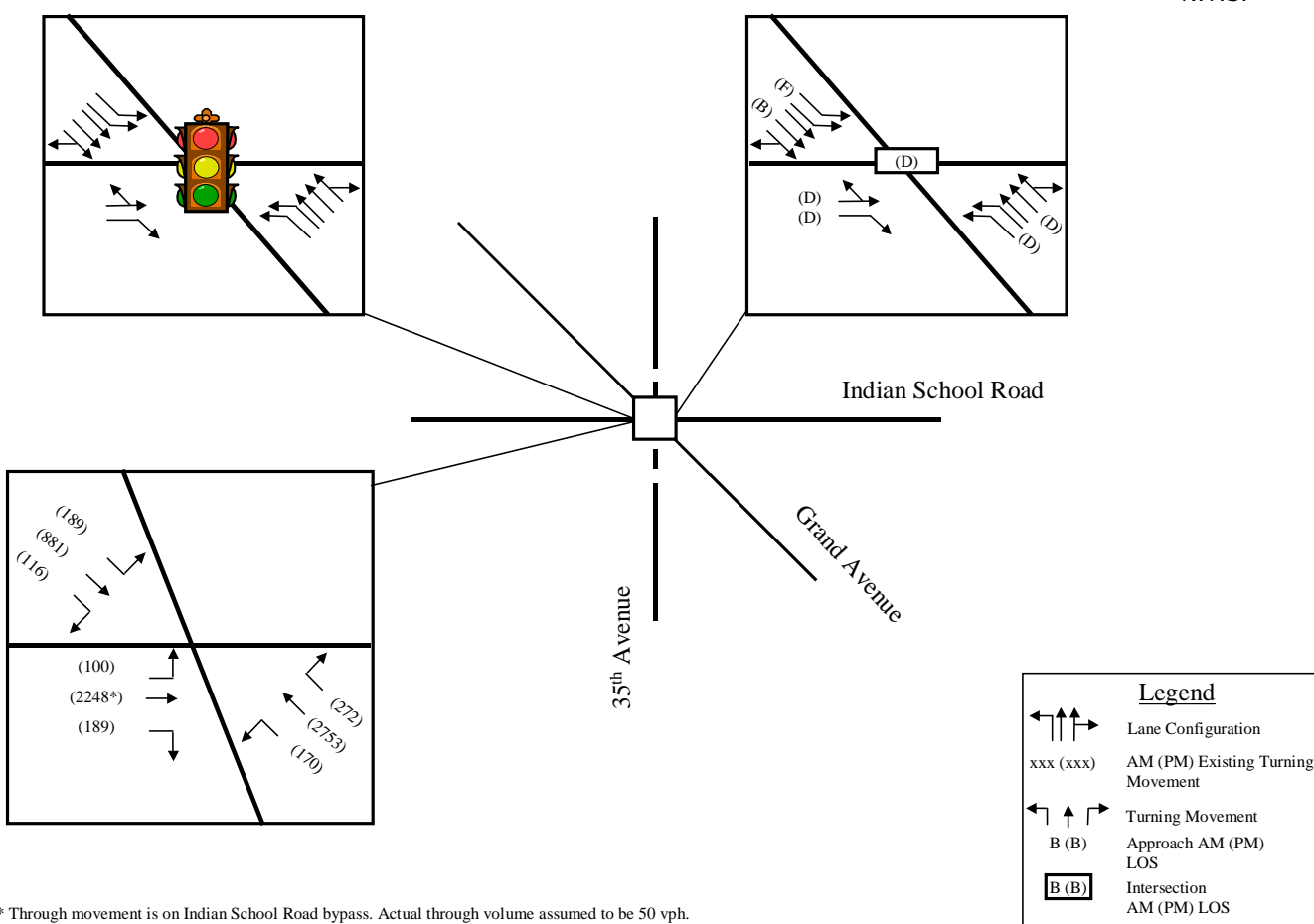
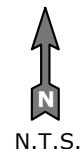
This alternative suggests a flyover for northbound 19<sup>th</sup> Avenue traffic to northwest bound Grand Avenue traffic and for southeast bound Grand Avenue traffic to southbound 19<sup>th</sup> Avenue traffic. The flyover would eliminate one northbound left-turn movement from the six-legged intersection;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



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

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

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



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

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

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

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

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

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

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

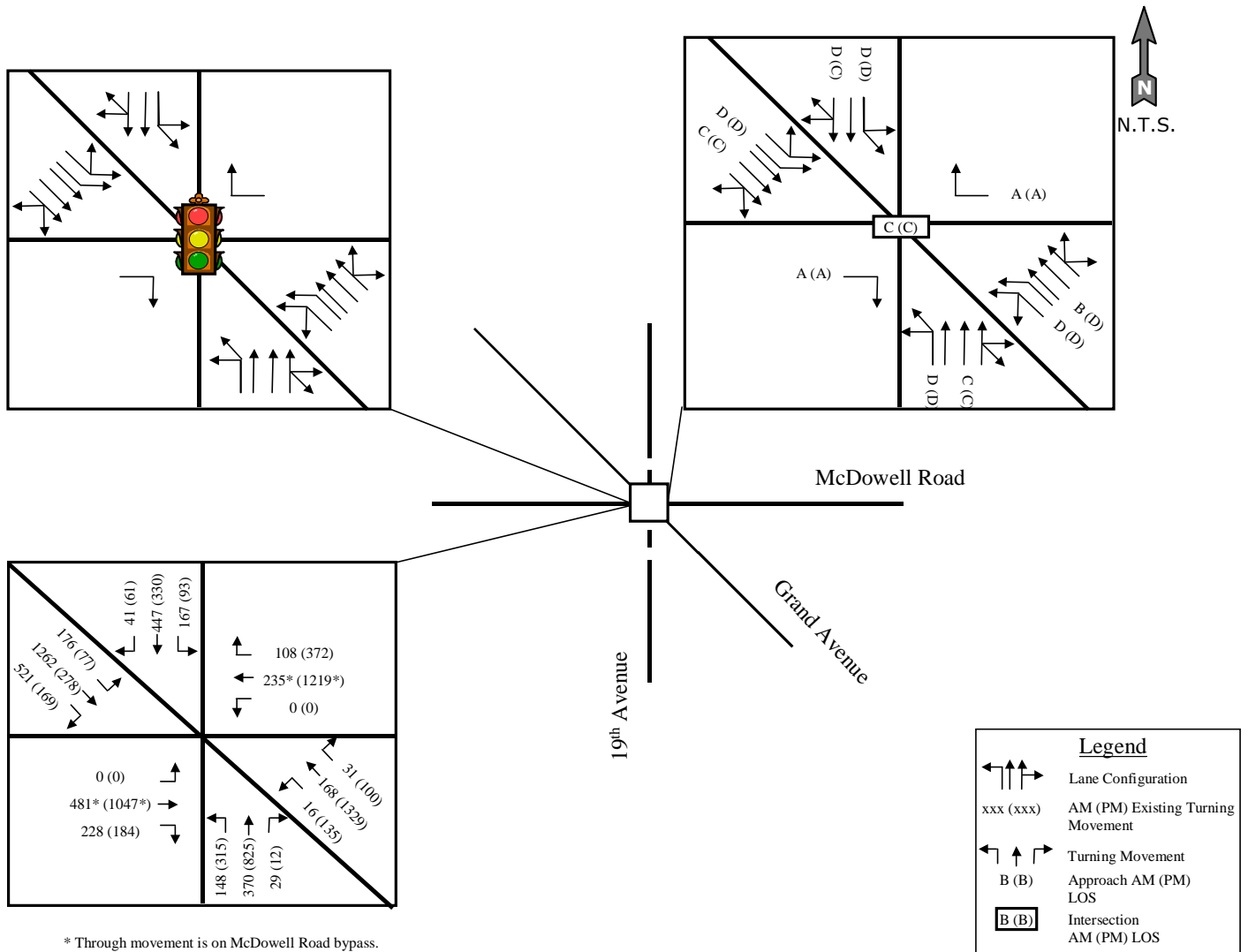
- McDowell Road traffic to northbound 22<sup>nd</sup> Avenue to Grand Avenue.
- Westbound left-turn from McDowell Road at Connector Roadway B/Grand Avenue.

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

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

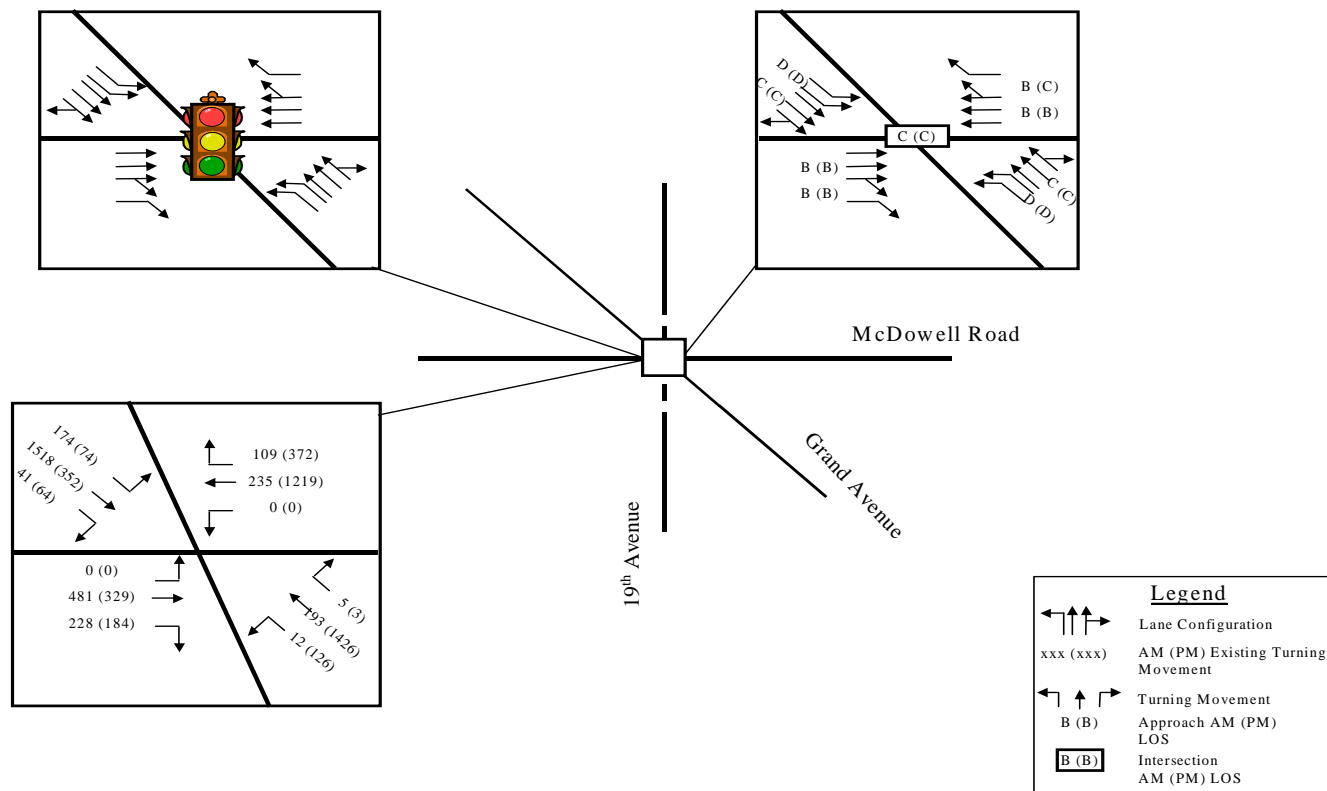
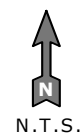
Alternative 3 includes a bypass for through traffic on 19<sup>th</sup> Avenue. This bypass is proposed just west of the existing 19<sup>th</sup> Avenue alignment. This alternative would allow uninterrupted traffic flow for the through traffic on 19<sup>th</sup> Avenue.

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



\* Through movement is on McDowell Road bypass.

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



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

#### Alternative to Existing LOS Comparison

Alternatives at the following intersections were compared to existing conditions.

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

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

## Exhibit 5.11 LOS Comparison - Alternatives to Existing

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

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

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

### Final Evaluation Criteria and Alternative Evaluation

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

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

#### Service

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

## **Impact**

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

## **Implementation**

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

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

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

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

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

## **Findings**

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

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

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

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

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

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

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

### 5.2.5 Intersection Improvements

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

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

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

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

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

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

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

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

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

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

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

The proposed ITS improvements along Grand Avenue include:

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

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

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

### 5.2.7 Bottlenecks

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

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

### 5.2.8 Access Management

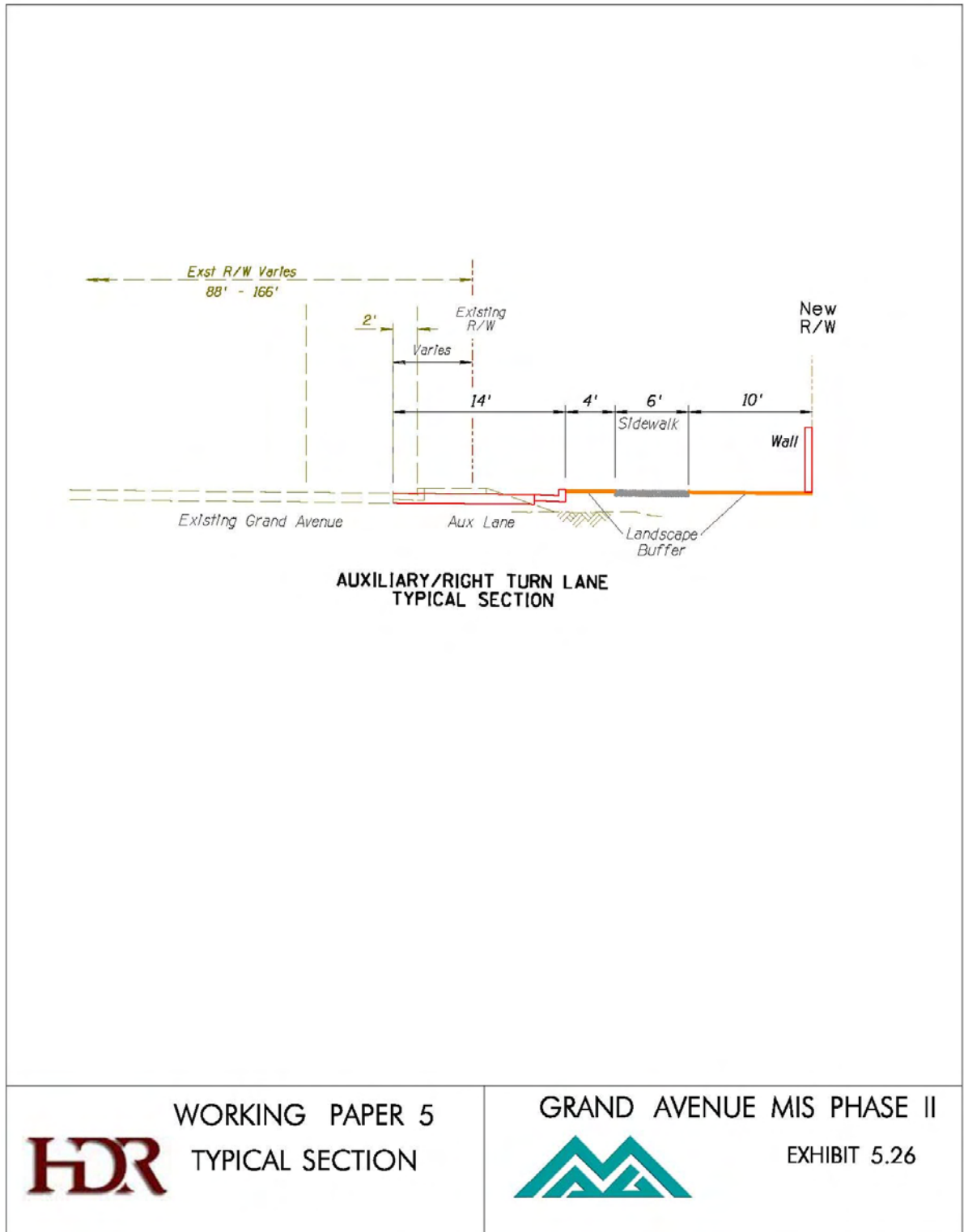
One of the goals of the Agency Steering Group is to build upon the improvements identified in the original *Grand Avenue MIS* and move Grand Avenue toward the status of an Enhanced Arterial/Limited Expressway. The steering group identified access management as the prime method to achieving this goal.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

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

### Median Closures

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

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



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

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

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

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

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

- Butler Drive ([Exhibit 5.30](#))
- Orangewood Avenue ([Exhibit 5.31](#))
- 63<sup>rd</sup> Avenue ([Exhibit 5.31](#))
- 56<sup>th</sup> Avenue ([Exhibit 5.32](#))
- Missouri Avenue ([Exhibit 5.34](#))
- 37<sup>th</sup> Avenue ([Exhibit 5.35](#))
- 24<sup>th</sup> Avenue ([Exhibit 5.37](#))
- Monte Vista Road ([Exhibit 5.38](#))
- 21<sup>st</sup> Avenue ([Exhibit 5.38](#))
- 20<sup>th</sup> Avenue ([Exhibit 5.38](#))

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

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

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

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

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

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

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

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

Proposed locations for exclusive right-turn lanes include:

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

Proposed locations for auxiliary lanes include:

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

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

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

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

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

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

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

### **5.2.9 Safety**

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

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

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

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

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

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

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

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

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

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

## **PURPOSE**

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

## **ISSUES**

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

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

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

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

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

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

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

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

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

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

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

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

### **Intersections**

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

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

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

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

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

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

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

### **Proposed Corridor Facilities**

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

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

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

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

### **5.2.11 Transit Requirements**

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

#### **Characteristics of BRT**

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

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

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

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

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

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

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

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

### **Conceptual BRT Alternatives**

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

#### **Advanced BRT**

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

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

### *Roadway Cross-Section*

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

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

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

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

### *Queue Jumps/Transit Signal Priority*

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

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

### *Operating Characteristics*

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

### **Limited BRT**

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

### *Roadway Cross-Section*

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

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

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

### *Queue Jumps/Transit Signal Priority*

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

### *Operating Characteristics*

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

### **Recommended BRT Alternative**

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

### **BRT Route Description**

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

### *Roadway Cross-Section*

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

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

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

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

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

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

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

### *Downtown Peoria BRT Station*

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

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

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

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

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

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

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

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

#### *Transit Signal Priority*

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

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

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

#### *Operating Characteristics*

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

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

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

#### *BRT Operating Costs*

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

### *BRT Capital Costs*

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

### **Summary**

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

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

### **5.2.12 Goods Movement**

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

### **5.2.13 Community Mitigation**

#### **Purpose**

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

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

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

**Exhibit 5.51 Streetscape Treatment Options**

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

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

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

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

**Corridor Vision**

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

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

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

### **RUTHA Vision**

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

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

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

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

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

### **Adjacent Communities Vision**

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

- Small scale retail and commercial uses
- Human scale, detailed, buildings
- Front doors at right of way
- Durable, indigenous, rich materials
- Grids and rectangles, or curvilinear, informal lines
- Warm and earth colors, extensive materials palette
- Strolling, walking speed
- Fine texture, ornament
- Shade, comfort, multimodal use
- Wayfinding communications, directed at the pedestrian

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

- Focus visual interest to the pedestrian by removing overscale items like the billboards or undergrounding utilities.
- Celebrate building facades by locating them as closely as possible to the right-of-way, with parking or storage behind the building. Buildings should be similar in use and appearance to those in the adjacent downtown areas, including historical references.
- Have corner to front-door access to buildings on the corner. Minimize use of fences or screen walls.
- Design signs, walks, plants, walls, fences, lights, etc. for pedestrian scale, not vehicular.
- Provide shade and comfort facilities at nodes.
- Buffer the pedestrian from vehicular traffic, including trains and noise.

- Screen, beautify or disguise corridor infrastructure elements such as the train tracks, utilities and the road itself.
- Integrate art and graphics that emphasize history and City themes.
- Regulate business sign placement, materials, and size, similar to the requirements in use in the City’s downtown areas.
- Use informal curving lines, geometry is not necessary. Grids to reflect downtown blocks are acceptable.
- Space lights, plants, and street furniture is acceptable informally or formally.
- Use materials with rich textures, finely grained, that match the materials being used in the adjacent downtown areas.
- Use ornament and detail on all surfaces. Use City identities and icons such as city seals, logos, colors or the name to identify the City.
- Require a color palette that is composed of colors such as brick reds, dark greens, earth tones that match colors being used in the adjacent downtown areas.
- Emphasize shade, color and accent interest in both tree and understory plant palette. Plantings should be detailed to pedestrian scale, and should relate to or match the theme materials in the adjacent downtown areas.

## **USING THE ELEMENTS TO EXPRESS THE VISION**

The boundaries or transition areas between the Old Town/Pedestrian Friendly and Railroad/Utility/Transportation/Historically Industrial/Agricultural were defined by the Cities in the Study Area. Examples of applying the vision objectives to individual elements are shown, as well as how the unifying portion of the concept might work in an actual streetscape in each community. ADOT has expressed a desire to design and construct these mitigation features provided the municipalities perform and pay for maintenance activities. Further discussion is needed to develop written maintenance agreements between the agencies prior to construction.

### **Locations**

The Cities in the Study have set the boundaries for the Old Town & Pedestrian Friendly or RUTHA visions. They can be found on Exhibit 5.52.

In addition, the City boundaries could be celebrated at 43<sup>rd</sup> and Camelback and Butler Drive.

## **ELEMENTS - RUTHA AREAS**

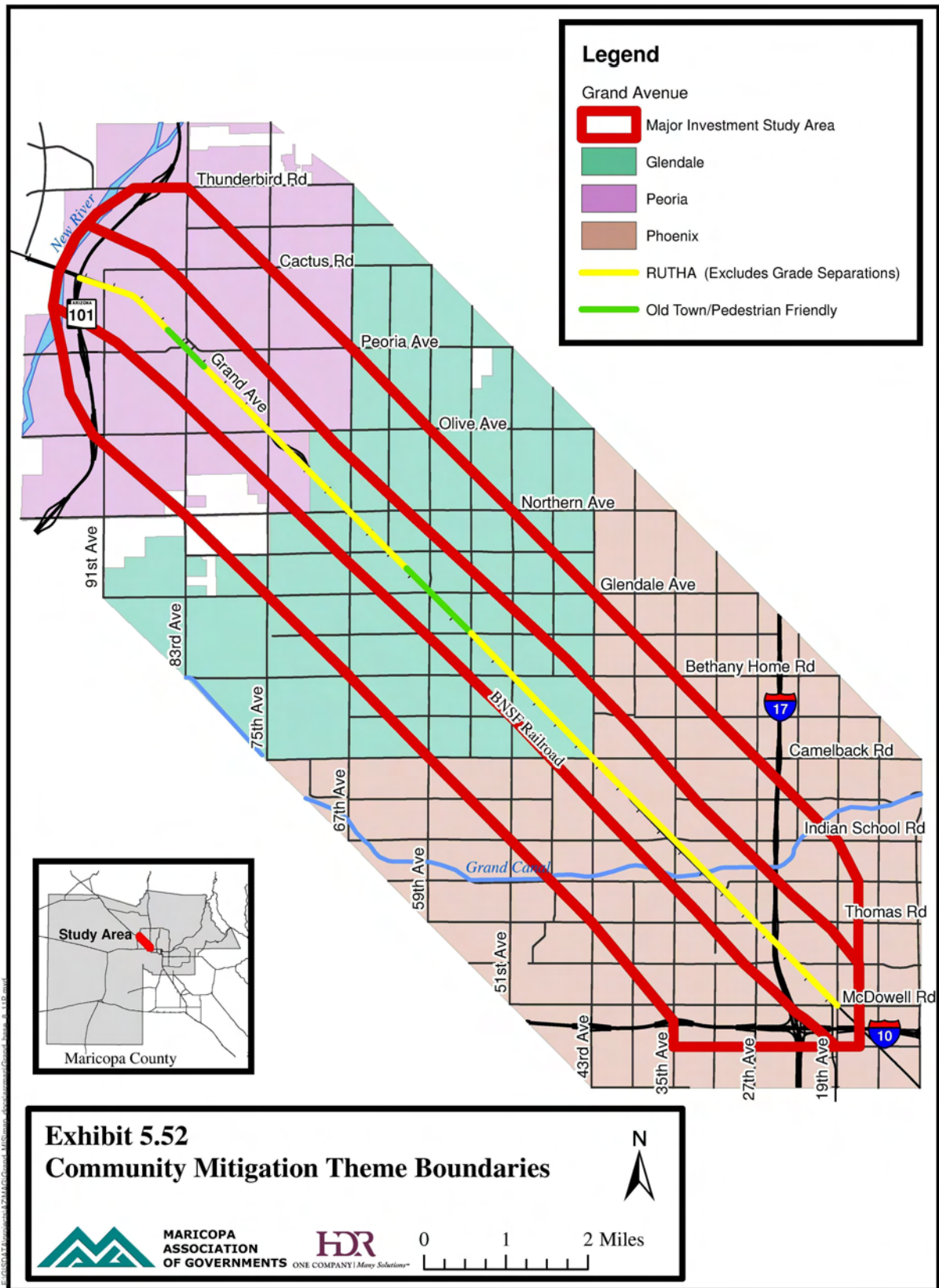
### **Billboards**

Remove when directly affected by proposed improvements along the corridor.

### **Buildings**

If visible, use industrial forms and materials such as metal, brick or block. No ornament or decoration. Limit windows or doors facing Grand Avenue.

Exhibit 5.52 Community Mitigation Theme Boundaries



## **Railroad**

Celebrate on Grand with interpretive signs. Add vertical edge (3' or less in height) at right-of-way to screen view of their right-of-way from Grand Avenue.

## **Image and Character of Adjacent Land Uses**

Screen undesirable views, including parking lots that front onto Grand Avenue, with tall (8'-10') opaque fence or wall. Give visual clues to driveway edge, and allow limited advertising by appropriately visible signs on the wall; restrict colors and locations.

## **Aboveground Utilities**

Underground as needed for continuity. Leave larger utilities visible. There is a potential for interpretives for the utility company.

## **Grade Separation Structures**

Install with clean lines, no rustication needed in view from Grand Avenue. Use standard street identification, limited and simple plant palette.

## **Hardscape (walls, paving, fences)**

Walls and Fences - On the non-railroad side, install uniformly colored (stain or spray-on painting in color palette) and textured walls and/or fences near edge of sidewalk. Preference is for no columns except at driveway entrances. Columns will be 3'-0" or greater diameter metal posts, extending to wall height or 6"-12" taller. Maximum landscape planter area in front of wall should be 10' wide; if under 2' wide, enlarge sidewalk width and have no planter.

On the railroad side, colored (stain or spray-on painting in color palette) Jersey barriers on the railroad right-of-way line. If there is room in the right-of-way, use plant materials on the Grand Avenue side of the barrier that require minimal irrigation. Use swathes of material in 300' lengths if possible.

Paving - On the non-railroad side, install curb and gutter, attached natural color sidewalk, minimum 8' width.

No sidewalk is to be installed on the railroad side.

## **Lighting**

Use custom street lights, with poles, arms and light fixtures painted "safety colors".

## **Signage**

In conjunction with adjacent owners, develop narrowly standardized signage requirements based on acceptable materials, forms, size, placement, and colors. No commercial signs will be allowed in the right of way.

## **Site Furniture, Posts, Poles**

Site furniture should be very limited in this area. Use appropriate size and scale of posts, poles and other uprights. Posts and poles should not interfere with sight visibility.

## **Landscape Areas**

Use a palette of grasses and shrubs. Limit accents of form or color. In the median, keep the double-palms, spacing at the existing spacing (approximately 50'). On the non-railroad side and in the median, use a large (3/4") screened decomposed material. On the railroad side, use a standard screened decomposed granite material.

## **ELEMENTS – OLD TOWN/PEDESTRIAN FRIENDLY AREAS**

For Glendale, the Old Town/Pedestrian Friendly area would extend on Grand Avenue from the 55<sup>th</sup> and Maryland grade separation to Myrtle Avenue. The remainder of the corridor within Glendale would feature RUTHA elements, except the other grade separation structures themselves over Grand Avenue. Here the RUTHA elements will read through on Grand Avenue itself, while the structure celebrates the adjacent City.

In Peoria, the Old Town/Pedestrian Friendly area would extend on Grand Avenue from Monroe Avenue to 87<sup>th</sup> Avenue, including the future pedestrian crossing at 83<sup>rd</sup> and Peoria. The remainder of the corridor within Peoria would feature RUTHA elements, except the grade separation structure itself at 75<sup>th</sup> and Olive. Here the RUTHA elements will read through on Grand Avenue itself, while the structure celebrates the adjacent City.

In Phoenix, the Old Town/Pedestrian Friendly area would be south of McDowell.

## **Billboards**

Should be removed when possible in Old Town/Pedestrian Friendly areas, otherwise consider screening from sidewalk views.

## **Railroad**

Screen visual and noise with short walls or barrier and vegetation when possible.

## **Image and Character of Adjacent Land Uses**

When possible, revise land uses, lot orientation, access, facades, detailing of buildings to meet retail pedestrian friendly criteria.

## **Aboveground Utilities**

Place underground as many utilities as possible including:

- Overhead lighting power in all existing areas to be replaced by underground power for new street lighting,
- 12 kV on the west side from 87<sup>th</sup> Avenue to 86<sup>th</sup> Avenue,
- 12 kV on the west side from 83<sup>rd</sup> Avenue to 82<sup>nd</sup> Avenue,
- 12 kV on the east side from 67<sup>th</sup> Avenue to Palmaire Avenue,
- 12 kV on the east side from 41<sup>st</sup> Avenue to Indian School Road,
- 12 kV on the east side from 35<sup>th</sup> Avenue to 31<sup>st</sup> Avenue,
- 12 kV on the east side from south of Osborn Road to NW bound on-ramp,
- 12 kV on east side from north of Encanto Boulevard to south of Monte Vista Road.

## **Hardscape (walls, paving, fences)**

On both the non-railroad and railroad sides, use Old Town inspired elements such as pavers, brick or stucco walls, natural concrete, low fences, as directed by individual Cities.

## **Lighting**

Continue use of City standard fixtures, or use RUTHA fixtures with City-selected colors.

## **Signage**

City standards for signs will apply. No signs will be allowed in the right of way.

## **Site Furniture, Posts, Poles**

City standards for these items will apply.

## **Landscape Areas**

Continue the attention to detail that current structures have, expressing each City identity. Use palettes from adjacent downtown areas or established redevelopment guidelines. Involve artists as needed.

## **PROPOSED COMMUNITY MITIGATION FEATURES**

The features discussed above to be incorporated into the potential improvements identified in this Study are shown on [Exhibits 5.53 through 5.59](#) and include:

- Landscaping on non-railroad side of Grand Avenue in 4-foot and 10-foot wide buffer areas.
- Sidewalk on non-RR side along entire length of corridor.
- Median landscaping consisting of low-growing plants where median width allows.

- Screen wall or low wall at new right-of-way line on non-railroad side.
- Landscaping/Screen wall or concrete barrier on railroad side depending on available right-of-way.
- Underground utilities including 12 Kv power and power for overhead lighting.
- New street lighting on both sides along the entire corridor.
- Improved intersection aesthetics including brick pavers in sidewalks.

The total estimated cost (2005 \$) of these improvements is \$28,639,679.

Details of specific design features, such as, landscape buffer widths, sidewalk widths, wall heights, etc., will be addressed by ADOT in a future design concept report.

### **5.2.14 Drainage**

The purpose of this evaluation is to identify existing drainage features, discuss the current status of drainage plans and planned facility development by the Flood Control District of Maricopa County (FCDMC) and Cities within the corridor, and evaluate future drainage concerns at the proposed grade separations.

#### **Existing Drainage Features**

Major drainage documents reviewed for the Study area include:

- Maryvale Area Drainage Master Study (ADMS), Floodplain Mitigation Study (November 1997), Hydrology (February 1997, FCD #93-29, Wood, Patel & Associates, Inc.
- Flood Insurance Rate Maps (FIRM), Map Numbers 04013C1630H, 04013C1640F, 04013C1645G, 04013C2110F, and 04013C2130G. Federal Emergency Management Agency (FEMA), September 30, 2005.
- Final Drainage Reports for Intersection Improvements at Camelback Road/43<sup>rd</sup> Avenue, Maryland/55<sup>th</sup> Avenue, Glendale/59<sup>th</sup> Avenue, Northern/67<sup>th</sup> Avenue, and Olive/75<sup>th</sup> Avenue, Arizona Department of Transportation.
- METRO Area Drainage Master Study (ADMS), Hydrology (estimated completion, March 2006), Mitigation Options (estimated completion, August 2007), FCD, EEC, Inc.

Four of the five grade separations identified in this Study are located within the Maryvale Area Drainage Master Study (ADMS), and the remaining southernmost intersection of 19<sup>th</sup> Avenue/McDowell Road is located within the Cave Creek Wash Floodplain. This intersection is included in the METRO ADMS, which is currently being conducted by the FCDMC. These documents along with phone interviews of other designers, City staff, and FCDMC staff were used to develop an understanding of the drainage situation along the corridor.

The overall flow pattern along the corridor is mainly from north to south and from east to west via a surface flow street system, an underground storm drain system, and regional (FCDMC & ADOT) channels. The storm drain systems, mostly designed for the 2-year storm event and

occasionally for the 10-year storm event, are typically located in the one-mile arterial streets and the half-mile collector streets.

Areas along the Grand Avenue corridor are subject to periodic flooding, typically due to ponding upstream of the elevated railroad embankment. The ponding areas, which have depths ranging from one to four feet, are depicted in both the Maryvale ADMS and the FEMA-defined approximate floodplains. These two do not completely match, because the FEMA work was based on ponding as well as riverine-type flooding, and therefore, the FEMA floodplain is generally continuous along the corridor. The Maryvale ADMS identified ponding areas north and south of Peoria Avenue, north and south of Olive Avenue, south of Northern Avenue, north of Bethany Home Road, north of the Grand Canal, and at Thomas Road. The FEMA FIRM also identifies the Cave Creek floodplain as being 2700 feet wide at the McDowell Road/Grand Avenue intersection.

### **Past, Current and Planned Facility Development**

Several drainage structures including detention/retention/surge basins have been constructed or are planned throughout the Grand Avenue corridor and within the drainage basin to help alleviate flooding, see Exhibit 5.60. Entities that have been involved in the planning and construction of these drainage facilities include the FCDMC, ADOT, and the cities of Peoria, Phoenix, and Glendale.

These drainage facilities are being planned, designed and installed based on the mitigation measures recommended by the Maryvale ADMS. Additional mitigation measures for the area east of I-17 will be recommended by the METRO ADMS, which is scheduled for completion in August 2007. Major facilities that are in the process of being completed are the Bethany Home Outfall Channel, the Bethany Home Storm Drain, and the 27<sup>th</sup> Avenue/Thomas Road detention basin. Facilities that have been completed are the Northern-Orangewood detention basin and the ADOT constructed retention/detention basins located at the Grand Avenue intersections of 75<sup>th</sup> Avenue/Olive Avenue, 67<sup>th</sup> Avenue/Northern Avenue, 43<sup>rd</sup> Avenue/Camelback Road, 35<sup>th</sup> Avenue/Indian School Road, and at the I-17/Thomas Road TI. ADOT is currently constructing an intersection improvement at the 59<sup>th</sup>/Glendale/Grand Avenue intersection, which has a major drainage component. It will consist of an elaborate offsite storm drain system to capture the offsite runoff before it enters the depressed Grand Avenue and a pump station to convey the runoff northwest to discharge into the existing Northern-Orangewood detention basin. It will function as a 10-year facility, but become a 50-year facility when additional upstream drainage facilities are installed.

### **Future Drainage Concerns at Proposed Grade Separations**

The FEMA Flood Insurance Rate Maps and the Maryvale ADMS were reviewed to determine the offsite drainage features at the 5 grade separations identified in this Study. The results of this review are tabulated in Exhibit 5.61.

### Exhibit 5.60 Flood Mitigation Measures, Current and Future

Location		Facility Type	Agency	Status	Type of Protection	Design Year
75th Avenue / Olive Avenue	Grand Avenue intersection	Detention Basin	ADOT	Constructed	Offsite Runoff	100-Year
67th Avenue / Northern Avenue	Grand Avenue intersection	2 Retention Basins	ADOT	Constructed	Onsite Runoff	100-Year, 2-Hour Volume
Northern-Orangewood Detention Basin	65th to 65 <sup>th</sup> Avenue, South side of Northern Avenue	Detention Basin	FCDMC	Constructed	Offsite Runoff	100-Year
59th Avenue / Glendale Avenue	Grand Avenue intersection	Offsite Storm Drain System & Pump Station	ADOT	Under Construction, 2004-2005	Offsite Runoff	Current 10-Year and Future 50-Year Runoff
43rd Avenue / Camelback Road	Grand Avenue intersection	Retention Basins	ADOT	Constructed	On-Site Runoff	100-Year, 2-Hour Volume
35th Avenue / Indian School Road	Grand Avenue intersection	Detention Basin	ADOT	Constructed	Offsite Runoff	unknown
I-17 / Thomas Road TI	I-17 TI	Detention Basin	ADOT	Constructed	Offsite Runoff	Inadequate for 100-Year Event
Thomas Road North & South	26th Avenue / Verde Lane & 27th Avenue / Grand Avenue	Detention Basin	COP	Bid Advertisement-Fall 2005	Offsite Runoff	100-Year
Bethany Home Road Storm Drain	83rd to 75 <sup>th</sup> Avenue	Storm Drain	FCDMC	Bid Advertisement-September 2005	Offsite Runoff	10-Year
Bethany Home Road Storm Drain	75th to 51 <sup>st</sup> Avenue (Grand Avenue intersection)	Storm Drain	Glendale	10-Year CIP	Offsite Runoff	10-Year
Bethany Home Outfall Channel	New River to 83rd Avenue	Channel	FCDMC & ADOT	Constructed	Offsite Runoff	100-Year
Bethany Home Outfall Channel	83rd to 75 <sup>th</sup> Avenue	Channel	FCDMC	Construction in the near future	Offsite Runoff	100-Year
METRO ADMS	I-17 TO 64th St & Salt River to Arizona Canal	to be determined	FCDMC & COP	Complete August 2007	Offsite Runoff	100-Year

## Exhibit 5.61 Offsite Drainage Features at Proposed Grade Separations

Grand Avenue Intersection	FEMA Floodplain	Maryvale ADMS	
		Ponding Area	Major Offsite Flows
83rd Avenue / Peoria Avenue	No	Yes	Yes
67th Avenue / Northern Avenue	Yes	Yes	Yes
51st Avenue / Bethany Home Road	Yes	Yes	Yes
35th Avenue / Indian School Road	No	No	Yes
19th Avenue / McDowell Road	Yes	NA	Yes

All five intersections have major drainage concerns; three have FEMA regulated floodplains and the Maryvale ADMS shows three have ponding and all five have major offsite flows. Improvements that impact FEMA regulated floodplains would require evaluation with a hydraulic model and the potential preparation of a CLOMR (Conditional Letter of Map Revision) for coordination with FEMA. Improvements that include the construction of depressed roadways would require the installation of an elaborate storm collection system for offsite flows, a pump station, and an outfall facility, such as a retention basin and/or an outfall storm drain. Existing storm drain systems would need to be incorporated into the intersection improvement. All intersections would require retention/detention basins sized for onsite runoff. A detailed evaluation of the offsite drainage at each site should be prepared in the future to identify potential cost-sharing opportunities with FCDMC or local municipalities.

### 5.3 Traffic Analysis

MAG has provided a series of model runs to be used as the basis for the traffic analysis. The data used in this report are for the year 2002, which is used to represent the “existing year”, and the year 2030 forecast. The year 2002 volume data was distributed to the existing roadway network. Year 2030 forecasts were developed for two networks, a 2030 Base Network, which includes all projects in the adopted 2003 Regional Transportation Plan except the Northern Avenue “superstreet” and Grand Avenue improvements beyond those currently programmed; and a 2030 Plan Network, which includes the Northern Avenue and Grand Avenue improvements. A comparison of 2002, 2030 Base, and 2030 Plan volumes on Grand Avenue is shown in Exhibit 5.62. The Base network layout is shown in Exhibit 5.63. The Plan Network layout, shown in Exhibit 5.64, includes additional grade separations at Grand Avenue intersection with Northern Avenue, Bethany Home Road, Indian School Road, and 19<sup>th</sup> Avenue. For modeling purposes, the following grade separation assumptions were made in the Plan network: Northern Avenue west connected to Grand Avenue south; Bethany Home Road separated through the intersection; Grand Avenue separated at the Indian School Road intersection; and 19<sup>th</sup> separated through the intersection.

### 5.3.1 Existing and Future Travel Demand and Operations

In this section we will review the existing and future travel demand along Grand Avenue and the major intersecting cross streets. Exhibits 5.65 and 5.66 show the forecast traffic volumes for Grand Avenue and the cross streets for the Base and Plan networks, respectively. In addition, Exhibits 5.65 and 5.66 show intersection level of service along Grand Avenue.

#### Exhibit 5.62 Grand Avenue - Traffic Volumes (Two-Way ADT)

Section	2002 ADT	2030 Base ADT	2030 Plan ADT
SR 101L – 91 <sup>st</sup> Ave	24,600	43,100	43,500
91 <sup>st</sup> Ave – 83 <sup>rd</sup> Ave	23,000	35,700	35,500
83 <sup>rd</sup> Ave – 75 <sup>th</sup> Ave	21,000	45,300	45,700
75 <sup>th</sup> Ave – 67 <sup>th</sup> Ave	23,000	44,400	41,100
67 <sup>th</sup> Ave – 59 <sup>th</sup> Ave	24,000	48,300	60,100
59 <sup>th</sup> Ave – 51 <sup>st</sup> Ave	26,000	48,500	58,700
51 <sup>st</sup> Ave – 43 <sup>rd</sup> Ave	22,300	46,400	55,800
43 <sup>rd</sup> Ave – 35 <sup>th</sup> Ave	29,000	57,500	66,500
35 <sup>th</sup> Ave – 27 <sup>th</sup> Ave	32,900	51,400	61,400
27 <sup>th</sup> Ave – 19 <sup>th</sup> Ave	21,700	31,700	38,900

Under the Base 2030 conditions, vehicle-miles of travel on Grand Avenue is forecast to increase 83% from 2002 travel, with volumes increasing from the 20,000 to 30,000 vehicles per day (vpd) range in 2002 to the 45,000 to 50,000 vpd range in 2030. The upgrading of Northern Avenue provided for in the Regional Transportation Plan will result in an additional 12% increase in Grand Avenue travel with volumes in the 55,000 to 65,000 range south of Northern Avenue. North of Northern Avenue, volumes on Grand Avenue are the same in the Base and Plan scenarios.

Exhibits 5.67 and 5.68 show the afternoon and evening peak period arterial street intersections levels of service (as determined by the MAG model which uses a planning level analysis technique) along Grand Avenue. The intersecting streets where the through movement is not provided for via a grade separation is included in the tables.

Exhibit 5.63 2030 Base Network

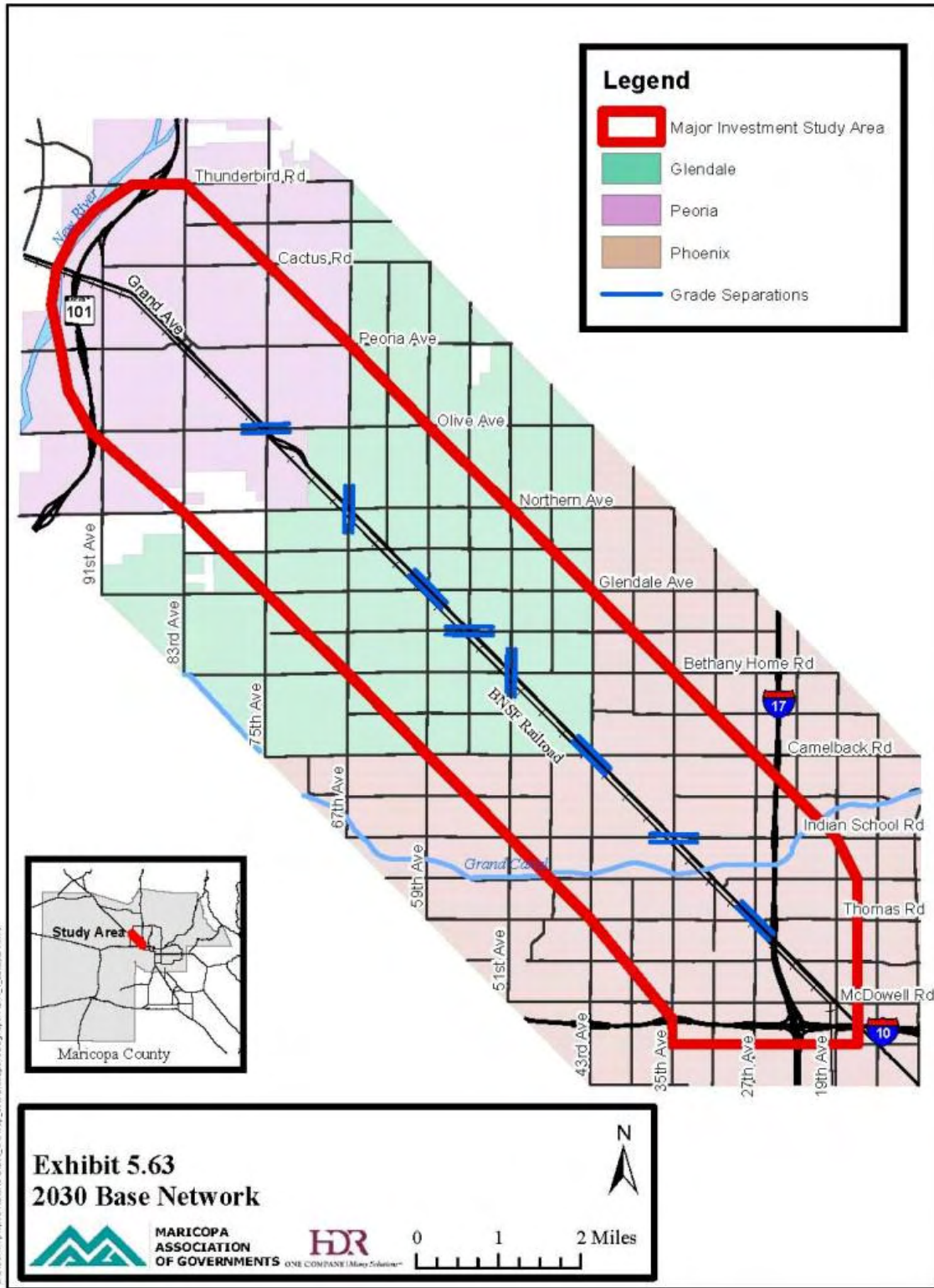
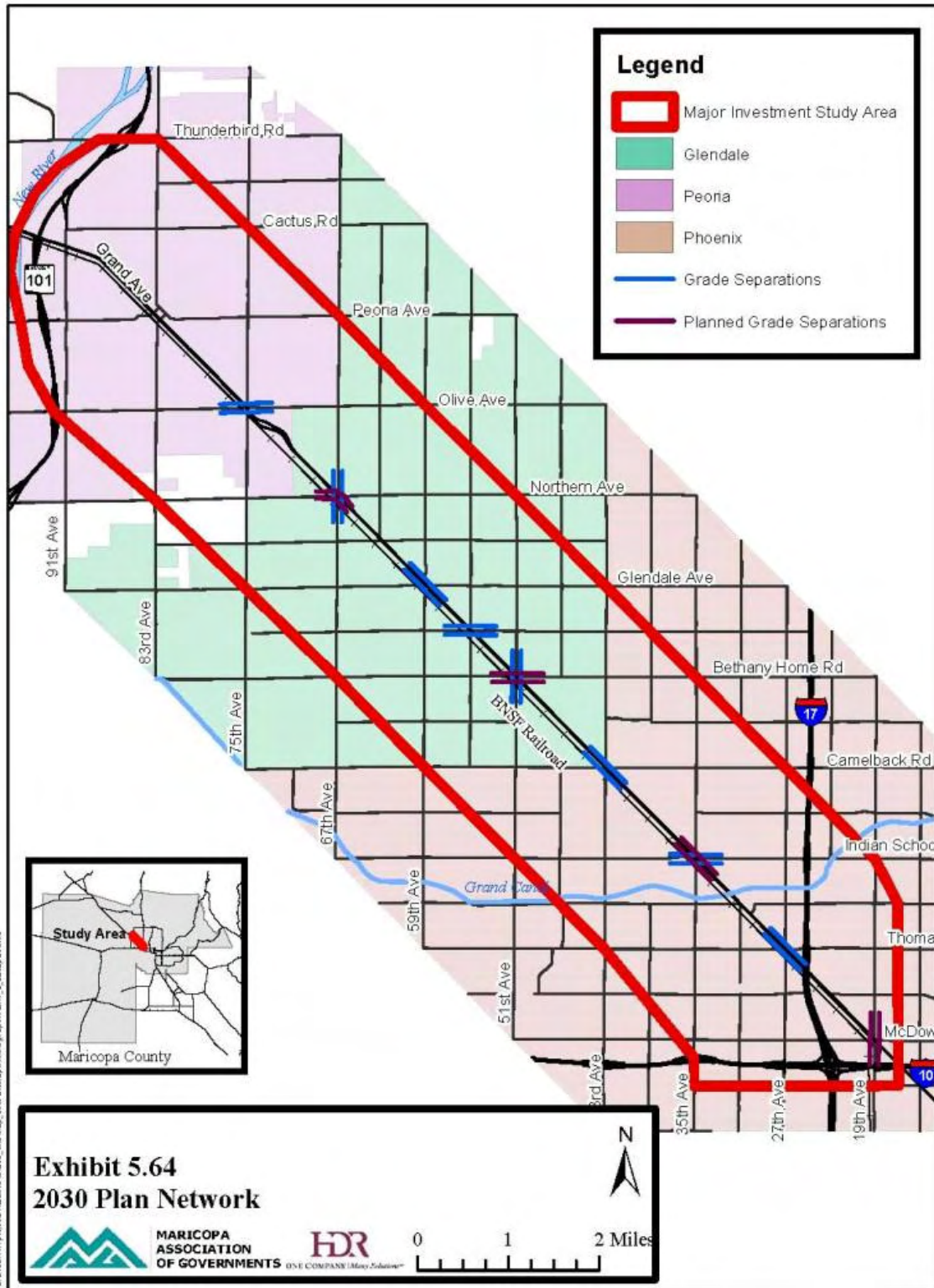


Exhibit 5.64 2030 Plan Network







### Exhibit 5.67 Morning Peak Period Level of Service

2002		2030 Base		2030 Plan	
Streets*	AM LOS	Streets*	AM LOS	Streets*	AM LOS
Grand/7th/Van Buren	D	Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F
Grand/19th/McDowell	C	Grand/19th/McDowell	E - F	Grand/McDowell	D
27th/Thomas	C	27th/Thomas	E - F	Grand.27th/Thomas	E - F
Grand/35th	D	Grand/35th	E - F	-	B
Grand/43rd/Camelback	D	43rd/Camelback	E - F	43rd/Camelback	E - F
Grand/51st/Bethany Home	E - F	Grand/Bethany Home	E - F	-	D
Grand/59th/Glendale	D	59th/Glendale	E - F	59th/Glendale	E - F
Grand/67th/Northern	-	Grand/Northern	E - F	Grand/Northern	E - F
Grand/75th/Olive	D	Grand/75th	E - F	Grand/75th	E - F
Grand/83rd/Peoria	C	Grand/83rd/Peoria	C	Grand/83rd/Peoria	C
Grand/91st	B	Grand/91st	D	Grand/91st	D

\*Streets listed are those that do not provide for grade-separated through movements

### Exhibit 5.68 Afternoon Peak Period Level of Service

2002		2030 Base		2030 Plan	
Streets	PM LOS	Streets	PM LOS	Streets	PM LOS
Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F	Grand/7th/Van Buren	E - F
Grand/19th/McDowell	E - F	Grand/19th/McDowell	E - F	Grand/McDowell	E - F
27th/Thomas	C	27th/Thomas	E - F	Grand.27th/Thomas	E - F
Grand/35th	E - F	Grand/35th	E - F	-	C
Grand/43rd/Camelback	E - F	43rd/Camelback	E - F	43rd/Camelback	E - F
Grand/51st/Bethany Home	E - F	Grand/Bethany Home	E - F	-	E - F
Grand/59th/Glendale	E - F	59th/Glendale	E - F	59th/Glendale	E - F
Grand/67th/Northern	C	Grand/Northern	E - F	Grand/Northern	E - F
Grand/75th/Olive	E - F	Grand/75th	E - F	Grand/75th	E - F
Grand/83rd/Peoria	D	Grand/83rd/Peoria	E - F	Grand/83rd/Peoria	D
Grand/91st	C	Grand/91st	E - F	Grand/91st	E - F

\*Streets listed are those that do not provide for grade-separated through movements