



GRAND AVENUE

MAJOR INVESTMENT STUDY

Final Report

September 1999



URS Greiner Woodward Clyde



in association with

BRW

***Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.***

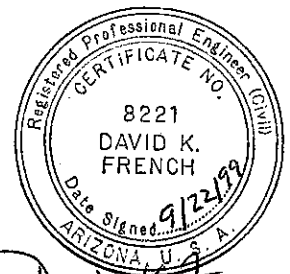
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Prepared for:



September, 1999



David K. French

Prepared by:

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TABLE OF CONTENTS

1.0	INTRODUCTION	1-1
1.0	Overview.....	1-1
1.1	Study Area.....	1-1
1.2	Study Background	1-4
1.3	Study Process.....	1-5
1.4	Report Content	1-7
1.5	Review of Related Studies and Plans.....	1-8
2.0	STUDY PURPOSE AND OBJECTIVES	2-1
2.0	Overview.....	2-1
2.1	Purpose and Need.....	2-1
2.2	Study Goals and Objectives	2-3
3.0	TRANSPORTATION CONDITIONS	3-1
3.0	Summary	3-1
3.1	Existing Roadway Infrastructure	3-2
3.2	Existing and Historical Traffic	3-9
	3.2.1 Data Collection.....	3-9
	3.2.2 Average Weekday Daily Traffic Volumes.....	3-10
	3.2.3 Peak Hour Traffic Volumes and Turning Movement Counts.....	3-13
3.3	Existing Traffic Operating Conditions	3-17
	3.3.1 Congestion and Level of Service	3-17
	3.3.2 Travel Time and Speed.....	3-20
	3.3.3 Stopped Delay	3-23
	3.3.4 Train Delay.....	3-26
	3.3.5 Accidents	3-26
3.4	Existing and Planned Multi-Modal Facilities and Usage	3-31
	3.4.1 Public Transit Service	3-31
	3.4.2 Non-Motorized Transportation Facilities	3-38
	3.4.3 Pedestrian Facilities and Restrictions	3-43
	3.4.4 Rail Facilities and Services	3-45
3.5	Intelligent Transportation Systems	3-46
3.6	Property Boundaries.....	3-47
3.7	Future Conditions	3-47
	3.7.1 Future Volumes.....	3-47
	3.7.2 Future Level of Service	3-49

TABLE OF CONTENTS (continued)

4.0	SOCIO-ECONOMIC CONDITIONS.....	4-1
4.0	Summary	4-1
4.1	Existing Land Use.....	4-2
4.2	General Plan.....	4-13
4.3	Business Types	4-17
4.4	Existing and Projected Population	4-29
4.5	Labor Force / Employment	4-33
4.6	Title VI Environmental Justice	4-36
	4.6.1 Minority Populations.....	4-36
	4.6.2 Elderly Populations	4-39
	4.6.3 Low Income Populations.....	4-40
	4.6.4 Mobility Disability Populations.....	4-43
	4.6.5 Female Head of Household	4-48
	4.6.6 Educational Attainment	4-48
	4.6.7 Automobile Ownership.....	4-53
4.7	Socio-Economic Concerns	4-56
	4.7.1 Residential Concerns.....	4-56
	4.7.2 Business Concerns	4-56
5.0	ENVIRONMENTAL CONDITIONS.....	5-1
5.0	Summary	5-1
5.1	Physical and Natural Environmental Considerations Summary.....	5-1
5.2	Cultural Resources Considerations Summary	5-2
5.3	Section 4(f)/6(f) Properties Considerations Summary	5-2
6.0	ROADWAY OPTIONS.....	6-1
6.0	Summary	6-1
6.1	Development of Options	6-3
6.2	Design Considerations and Standards	6-4
	6.2.1 Design Criteria	6-4
	6.2.2 Standard Cross-Sections	6-4
	6.2.3 Overpass Alignment.....	6-9
	6.2.4 Drainage Considerations	6-11
	6.2.5 Utility Considerations	6-11
6.3	Option 4 — Alternating Grade Separations	6-15
	6.3.1 Overview	6-15
	6.3.2 27 th Avenue / Thomas Road	6-20
	6.3.3 43 rd Avenue / Camelback Road	6-22
	6.3.4 51 st Avenue / Bethany Home Road.....	6-24

TABLE OF CONTENTS (continued)

	6.3.5 55 th Avenue / Maryland Avenue	6-26
	6.3.6 59 th Avenue / Glendale Avenue	6-28
	6.3.7 67 th Avenue / Northern Avenue.....	6-30
	6.3.8 75 th Avenue / Olive Avenue.....	6-32
	6.3.9 Loop 101	6-34
6.4	Option 5 — Limited Expressway.....	6-34
	6.4.1 Overview	6-34
	6.4.2 27 th Avenue / Thomas Road	6-40
	6.4.3 43 rd Avenue / Camelback Road	6-42
	6.4.4 51 st Avenue / Bethany Home Road.....	6-44
	6.4.5 55 th Avenue / Maryland Avenue	6-46
	6.4.6 59 th Avenue / Glendale Avenue	6-48
	6.4.7 67 th Avenue / Northern Avenue.....	6-50
	6.4.8 75 th Avenue / Olive Avenue.....	6-52
	6.4.9 Loop 101	6-54
6.5	Future Expressway	6-54
7.0	MULTI-MODAL ELEMENTS.....	7-1
	7.0 Summary	7-1
	7.1 Local Bus Service Impacts	7-2
	7.2 Express Bus Service.....	7-5
	7.3 Express / Local Bus Interaction	7-6
	7.4 Consideration of Express Bus HOV Lane Concept	7-6
	7.5 Bicycle and Pedestrian Impacts.....	7-7
	7.6 Proposed Grand Avenue Bikeway	7-9
	7.7 LRT Alignment Options, Downtown Glendale to Downtown Peoria.....	7-12
	7.7.1 LRT Alignment Alternatives Under Option 4	7-14
	7.7.2 LRT Alignment Alternatives Under Option 5	7-19
8.0	EVALUATION OF OPTIONS	8-1
	8.0 Summary	8-1
	8.1 Evaluation Process	8-5
	8.2 Service Evaluation	8-6
	8.2.1 Eliminate Six-Legged Intersections.....	8-6
	8.2.2 Eliminate Railroad Crossings	8-11

TABLE OF CONTENTS (continued)

8.2.3	Improve Regional Mobility and Serve Statewide Function	8-12
8.2.4	Promote Development Opportunities	8-16
8.2.5	Improve Aesthetics of the Corridor	8-21
8.2.6	Promote Multi-Modal Uses in the Corridor	8-23
8.2.7	Accommodate Projected Travel Demand in the Corridor.....	8-27
8.2.8	Summary of Service Evaluation.....	8-34
8.3	Impact Evaluation	8-35
8.3.1	Residences Taken	8-35
8.3.2	Businesses Taken.....	8-37
8.3.3	Neighborhoods Impacted.....	8-41
8.3.4	Hazardous Materials	8-50
8.3.5	100-Year Flood Plain	8-50
8.3.6	Cultural Resources	8-51
8.3.7	Section 4(f) Properties	8-51
8.3.8	Acreage Needed for Right-of-Way.....	8-53
8.3.9	Summary of Impact Evaluation	8-54
8.4	Implementation Criteria.....	8-54
8.4.1	Cost of Construction and Right-of-Way	8-55
8.4.2	Engineering Issues and Uncertainties.....	8-55
8.4.3	Phased Construction Opportunities	8-60
8.4.4	Future Expansion Potential.....	8-60
8.4.5	Summary of Implementation Evaluation	8-63
8.5	Funding Availability.....	8-64
8.6	Summary of Evaluation.....	8-65
9.0	PREFERRED OPTION.....	9-1
9.0	Overview.....	9-1
9.1	Public and Agency Opinions.....	9-2
9.2	Steering Committee Recommendation.....	9-2
9.3	Description of Recommended Concept at Each Location	9-3
9.4	Implementation Strategy.....	9-17

TABLE OF CONTENTS (continued)

10.0	PUBLIC INVOLVEMENT	10-1
10.0	Overview	10-1
10.1	Public Involvement Process.....	10-1
	10.1.1 Project Steering Committee	10-1
	10.1.2 Agency Coordination.....	10-2
	10.1.3 Stakeholder Meetings	10-2
	10.1.4 Public Information Meetings.....	10-3
	10.1.5 Public Outreach Program.....	10-3
10.2	Summation of Questionnaire	10-4

APPENDIX METHODOLOGIES, ASSUMPTIONS AND CALCULATIONS

LIST OF EXHIBITS

Exhibit No.	Exhibit Title	
1.1	Vicinity Map	1-2
1.2	Study Area	1-3
1.3	Regional Freeway System	1-6
1.4	Related Studies and Plans	1-9
3.1	Roadway Infrastructure – Peoria Section	3-4
3.2	Roadway Infrastructure – Glendale Section	3-5
3.3	Roadway Infrastructure – Phoenix Section.....	3-6
3.4	Existing Number of Lanes.....	3-7
3.5	Traffic Signal Locations	3-8
3.6	Weekday Daily Traffic Volumes.....	3-11
3.7	Change in Daily Volume 1985 to 1998	3-12
3.8	Change in Traffic Volume on Grand Avenue 1985 to 1998	3-13
3.9	Volume Comparison 1998 Model Versus 1998 Actual	3-14
3.10	Peak Hour Traffic Volumes.....	3-15
3.11	P.M. Peak Hour Volume Comparison.....	3-18
3.12	1998 Intersection Level of Service.....	3-19
3.13	Travel Time, Speed and Delay Diagram.....	3-21
3.14	Average Non-Peak Hour Spot Speeds	3-23
3.15	A.M. Peak Hour Stopped Delay at Six-Legged Intersections	3-24
3.16	P.M. Peak Hour Stopped Delay at Six-Legged Intersection	3-25
3.17	Delay Due to the Train.....	3-27
3.18	Delay Due to the Train.....	3-28
3.19	Accidents by Severity on Grand at Six-Legged Intersections	3-29
3.20	Accidents by Severity on Grand Between Six-Legged Intersections	3-30
3.21	Existing Valley Metro Bus Routes.....	3-32
3.22	Bus Routes	3-33
3.23	Bus Route Ridership by Community	3-34
3.24	Paratransit Systems Serving Grand Avenue Corridor	3-35
3.25	Park-and-Ride Lots.....	3-36
3.26	Planned Transit Operating Improvements: FY 1999-2003	3-37
3.27	Existing Bikeways and Trails	3-39
3.28	Programmed Bicycle / Pedestrian Improvements, 1999-2003.....	3-39
3.29	Planned Bikeways and Trails.....	3-40

LIST OF EXHIBITS (continued)

Exhibit No.	Exhibit Title	
3.30	Bike Routes	3-41
3.31	Existing Impediments to Non-Motorized Travel	3-43
3.32	Predicted Traffic Volume Change on Grand with Current Plan	3-48
3.33	Adjusted Daily Weekday Traffic Volumes for 2020 Along Grand	3-49
3.34	2020 Traffic Volumes – Base Conditions	3-50
3.35	2020 Traffic Volumes – Option 4	3-51
3.36	2020 Traffic Volumes – Option 5	3-52
3.37	Adjusted Daily Weekday Traffic Volumes on Overpasses in Option 4	3-53
3.38	Adjusted Daily Weekday Traffic Volumes on Overpasses in Option 5	3-53
3.39	2020 Intersection LOS – Base Case	3-54
3.40	2020 Intersection LOS – Option 4	3-55
3.41	2020 Intersection LOS – Option 5	3-56
4.1	Land Use Definitions	4-4
4.2	Existing Land Use Summary	4-6
4.3A	Existing Land Use (Peoria Section)	4-7
4.3B	Existing Land Use (Glendale Section)	4-9
4.3C	Existing Land Use (Phoenix Section)	4-11
4.4	General Plan Land Use Summary	4-13
4.5	General Plan Designated Land Use	4-15
4.6	Business Type Definitions	4-18
4.7	Business Type Summary	4-21
4.8A	Business Types (Peoria)	4-23
4.8B	Business Types (Glendale)	4-25
4.8C	Business Types (Phoenix Section)	4-27
4.9	TAZ Boundaries	4-30
4.10	Existing and Projected Population	4-31
4.11	1995 Population Density	4-32
4.12	Existing and Projected Employment	4-34
4.13	1995 Employment Density	4-35
4.14	Minority Populations Summary	4-37
4.15	Minority Population	4-38
4.16	Elderly Populations Summary	4-41
4.17	Elderly Population	4-42
4.18	Low Income Populations Summary	4-44
4.19	Poverty Income	4-45

LIST OF EXHIBITS (continued)

Exhibit No.	Exhibit Title	
4.20	Mobility Disability Populations Summary	4-46
4.21	Mobility Disability	4-47
4.22	Female Head of Household Summary.....	4-49
4.23	Female Head of Household.....	4-50
4.24	Education Attainment Summary	4-51
4.25	Education Attainment	4-52
4.26	Auto Ownership Summary.....	4-54
4.27	Auto Ownership	4-55
4.28	Socio-Economic Concerns	4-57
6.1	Design Standards	6-5
6.2	Typical Sections.....	6-6
6.3	Typical Sections.....	6-7
6.4	Underpass Typical Sections at Glendale Avenue / 59 th Avenue.....	6-8
6.5	Bridge Typical Sections	6-10
6.6	Existing Ponding Areas and Proposed Drainage Basins	6-13
6.7	Option 4, Alternating Grade Separations.....	6-17
6.8	Option 4, Thomas Road / 27 th Avenue	6-21
6.9	Option 4, Camelback Road / 43 rd Avenue	6-23
6.10	Option 4, Bethany Home Road / 51 st Avenue.....	6-25
6.11	Option 4, Maryland Avenue / 55 th Avenue	6-27
6.12	Option 4, Glendale Avenue / 59 th Avenue	6-29
6.13	Option 4, Northern Avenue / 67 th Avenue.....	6-31
6.14	Option 4, Olive Avenue / 75 th Avenue.....	6-33
6.15	Option 4, Loop 101 Connection.....	6-35
6.16	Option 5, Limited Expressway	6-32
6.17	Option 5, Thomas Road / 27 th Avenue	6-35
6.18	Option 5, Camelback Road / 43 rd Avenue	6-37
6.19	Option 5, Bethany Home Road / 51 st Avenue.....	6-39
6.20	Option 5, Maryland Avenue / 55 th Avenue	6-41
6.21	Option 5, Glendale Avenue / 59 th Avenue	6-43
6.22	Option 5, Northern Avenue / 67 th Avenue.....	6-45
6.23	Option 5, Olive Avenue / 75 th Avenue.....	6-47
6.24	Option 5, Loop 101 Connection.....	6-49

LIST OF EXHIBITS (continued)

Exhibit No.	Exhibit Title	
7.1	Existing Local Bus Transfers Impeded by Options 4 and 5	7-4
7.2	Future Local Bus Transfers Impeded by Options 4 and 5	7-4
7.3	Potential Impacts of Option 4 on Non-Motorized Facilities	7-8
7.4	Potential Impacts of Option 5 on Non-Motorized Facilities	7-9
7.5	Typical Dimensions of LRT Lines	7-13
7.6	Option 4 – Alternating Grade Separations Potential LRT Corridor	7-15
7.7	Option 4 – Alternative Cross-Sections with LRT	7-16
7.8	Option 4 – Alternative Cross-Sections with LRT	7-17
7.9	LRT Alignment Alternatives Evaluation (Option 4).....	7-18
7.10	LRT Alignment Alternatives Description (Option 5)	7-20
7.11	Option 5 – Limited Expressway LRT Alignment Alternatives	7-21
7.12	LRT Alignment Alternatives Evaluation (Option 5).....	7-23
8.1	Service Evaluation Summary.....	8-2
8.2	Impacts Evaluation Summary	8-3
8.3	Implementation Evaluation Summary	8-4
8.4	Service Criteria and Measures	8-7
8.5	Intersection Complexity	8-9
8.6	Change in Number of Traffic Signals.....	8-10
8.7	Number of Grade Separations Over Railroad Tracks.....	8-12
8.8	Traffic Signals on Grand Avenue.....	8-13
8.9	P.M. Peak Hour Travel Time	8-15
8.10	Access Control.....	8-16
8.11	Street Frontage (in Linear Feet)	8-18
8.12	Redevelopable Property	8-19
8.13	Land Accessibility	8-20
8.14	Aesthetics	8-22
8.15	Promotion of Local Bus Service.....	8-24
8.16	Promotion of Express Bus Service	8-25
8.17	Promotion of Non-Motorized Travel.....	8-26
8.18	LRT Compatibility	8-28
8.19	2020 P.M. Peak Hour Intersection Level of Service	8-30
8.20	2020 P.M. Peak Hour Total Delay	8-31
8.21	2020 Daily Traffic Volumes on Grade Separations.....	8-32
8.22	2020 Daily Weekday Traffic Volumes on Grand Avenue.....	8-33
8.23	Impact Criteria and Measures.....	8-35
8.24	Number of Residential Units Taken.....	8-37

LIST OF EXHIBITS (continued)

Exhibit No.	Exhibit Title	
8.25	Number of Commercial Businesses Taken	8-38
8.26	Number of Industrial Businesses Taken	8-40
8.27	View Impacts to Neighborhoods	8-42
8.28	Air Quality Impacts to Neighborhoods	8-44
8.29	Community Services Taken	8-46
8.30	Impacts on Accessibility to Neighborhoods	8-47
8.31	Neighborhood Traffic Volume Impacts	8-49
8.32	Hazardous Materials	8-50
8.33	100-Year Floodplain	8-51
8.34	Listed, Eligible / Potentially Eligible Sites for NRHP	8-52
8.35	Section 4(f) Properties	8-52
8.36	Acreage Needed for Right-of-Way	8-53
8.37	Service Criteria and Measures	8-55
8.38	Cost Estimate Summary	8-57
8.39	Uncertainties that Could Increase Cost or Affect Schedule	8-58
8.40	Phased Construction	8-61
8.41	Future Expansion Opportunities	8-63
9.1	Priority Guidelines for Implementation	9-3
9.2	Preferred Option, Alternating Grade Separations	9-5
10.1	Sample Questionnaire	10-5
10.2	Summary of Questionnaire	10-7

Chapter 1.0 INTRODUCTION

1.0 OVERVIEW

Grand Avenue was initially constructed in 1888 as a major roadway to link the farming centers of Glendale and Peoria to downtown Phoenix. Later, the railroad was built adjacent to Grand Avenue and the rail activity helped develop the West Valley into an industrial as well as an agricultural center. As urbanization replaced the farms and traffic volumes increased dramatically, the problems with the diagonal orientation of Grand Avenue and the railroad became very apparent.

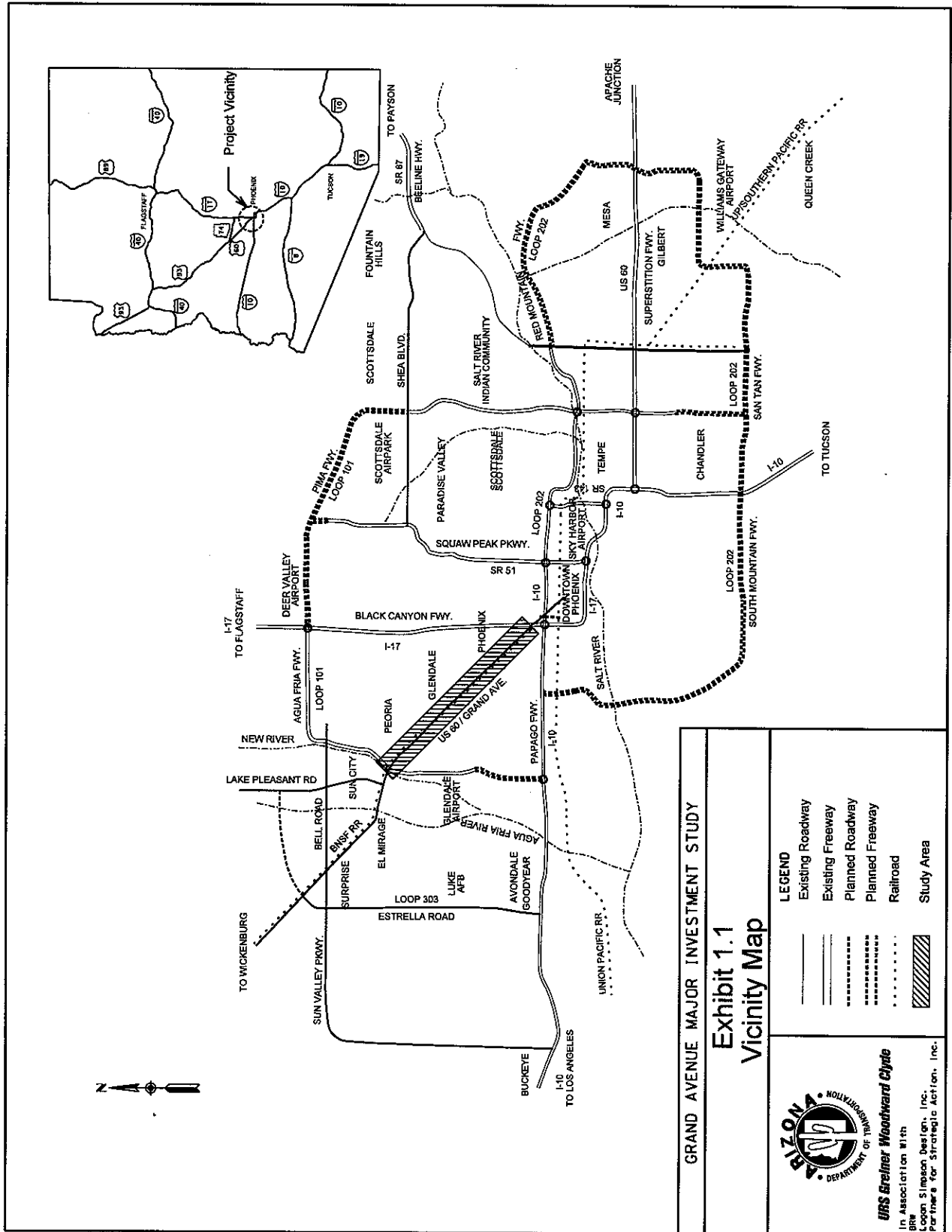
Grand Avenue and the adjacent Burlington Northern Santa Fe Railroad (BNSF) cut diagonally through the West Valley creating a major blockage to east-west and north-south travel. The six-legged intersections formed by Grand Avenue and the north-south and east-west grid of arterial streets from 27th Avenue / Thomas Road to 75th Avenue / Olive Avenue have traffic signal cycle lengths over three minutes which create long delays for motorists. The congestion is amplified by additional delays due to train activity on the BNSF. The delays are a major source of driver irritation and a blockage to emergency vehicle passage.

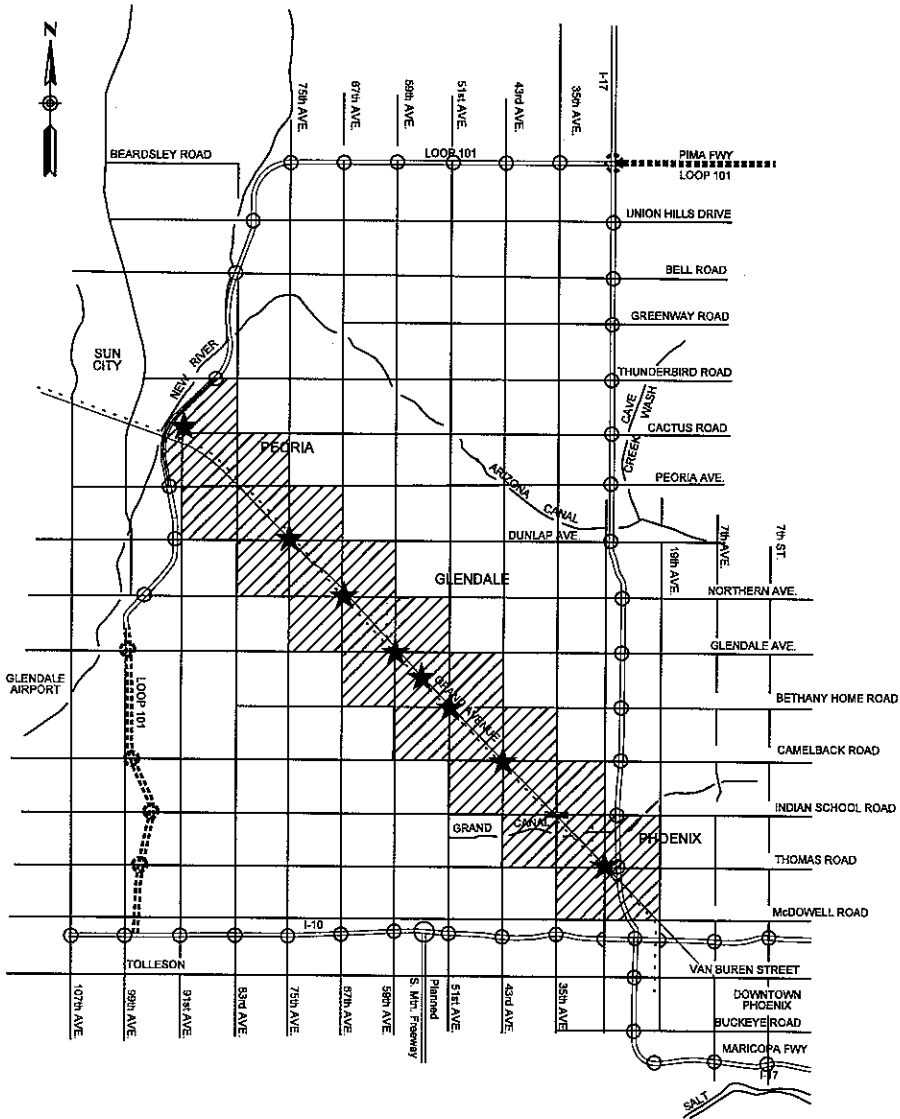
The historical advantages of Grand Avenue and the railroad that led to the development of the West Valley cities have become a detriment to the further development or redevelopment in the past few decades. There are many very viable businesses and industries along Grand Avenue today that provide a solid tax base and employment opportunities. However, as compared to the rest of the metropolitan area, growth along the corridor has lagged.

There is general agreement that significant improvements are needed for the Grand Avenue Corridor. Identified transportation funds provide an opportunity to develop a more modern transportation corridor along Grand Avenue that would directly serve the central business districts of Phoenix, Glendale, and Peoria. Better highway service, more transit, improved aesthetics, and economic development are goals that are often expressed by stakeholders and the general public concerning the Grand Avenue Corridor. This Grand Avenue Major Investment Study (MIS) addresses these concerns by developing, evaluating and recommending transportation investment options for the Grand Avenue Corridor.

1.1 STUDY AREA

The Grand Avenue Corridor is located in Maricopa County, Arizona and passes through the cities of Phoenix, Glendale, and Peoria (see Exhibit 1.1). For this MIS, the study area extends along Grand Avenue (US 60) from I-17 to Loop 101 (Agua Fria Freeway) — a distance of approximately 12 miles. The study area extends approximately one mile on either side of Grand Avenue and is illustrated in Exhibit 1.2.





GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 1.2
Study Area



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LEGEND



Study Area



Project Locations

Source: URS Greiner Woodward Clyde (1999)

The MIS studied eight project locations along the corridor. Seven of these locations are at six-legged intersections formed by the intersection of two major arterial streets with Grand Avenue. The eighth involves a connection to Loop 101 from 91st Avenue. Through the remainder of this MIS report, the six-legged intersections will be identified by the north-south street first then the east-west street without the words "Avenue" or "Road". For example, 27th Avenue / Thomas Road / Grand Avenue intersection will be identified as 27th / Thomas. The eight project locations are shown in Exhibit 1.2 and listed below:

- 27th / Thomas
- 43rd / Camelback
- 51st / Bethany Home
- 55th / Maryland
- 59th / Glendale
- 67th / Northern
- 75th / Olive
- 91st / Loop 101

1.2 STUDY BACKGROUND

In 1985, the Maricopa Association of Governments (MAG) completed the *West Area Transportation Analyses*. An analysis of Grand Avenue was contained in this report and the recommendations included either building a freeway along the corridor or building more grade separations such as the one at Indian School Road which was completed by the City of Phoenix in the late 1970's.

The Arizona Department of Transportation (ADOT) followed with a *Grand Avenue Corridor Study* which developed concepts for a "High Expressway" and a "Low Expressway" which were distinguished by design speed and traffic service. The expressway concepts extended the full 26 miles of Grand Avenue from Beardsley Canal to 7th Avenue. The "High Expressway" was favored, and ADOT launched a preliminary engineering study that revised the concept to a "viaduct" concept. This idea was not favored by the local jurisdictions so the original "High Expressway" concept prevailed.

The Grand Avenue Expressway was included in the urban freeway program to be funded by a combination of federal and local half-cent sales tax funds. In 1994, the Governor of Arizona eliminated the Grand Avenue Expressway and some other routes from the program in order to bring program costs in line with expected revenues. This was followed by action in the MAG Regional Council that removed Grand Avenue from the Regional Freeway Plan.

With the completion of I-10 to I-17 in 1990, the traffic patterns in the West Valley changed. Much of the traffic that moved east-west across Grand Avenue now moved north-south to I-10 and used this much faster route into central Phoenix. This rerouting reduced some of the pressure on Grand Avenue. However, the traffic problems associated with this diagonal road still remain.

Grand Avenue historically has served as a major route for statewide and interstate travel. I-10 and I-17 have replaced much of this function. Grand Avenue is still designated as US 60 and does

connect Wickenburg to the Phoenix metropolitan area. More importantly, US 93, which begins in Wickenburg and extends northward to I-40, Kingman, and connects to I-15 in Las Vegas, has been designated as part of the CANAMEX corridor for NAFTA. The continuation of the corridor from Wickenburg to the metropolitan area is via US 60. The exact routing within the metropolitan area to connect to the Interstate System has not been determined. The eventual determination could impact Grand Avenue.

In addition to the traffic problems associated with Grand Avenue, the visual character of the corridor is generally unattractive and dominated by the railroad and by older marginal commercial establishments. Development within the corridor has suffered and lagged behind other areas of the Phoenix metropolitan area. There is interest in changes to Grand Avenue to renew and upgrade the development opportunities in the corridor.

Given the foregoing setting, MAG initiated the *Grand Avenue Corridor Study* in 1996. URS Greiner was selected as the consultant to prepare this study in conjunction with MAG, ADOT, Maricopa County and the West Valley cities. The corridor study provided an examination of 14 options for the corridor and the further development and refinement of three of those options. Integration of transit into the corridor and the impact on development along the corridor were parts of the process. The results of the study indicate that there was considerable interest in pursuing major improvements to the Grand Avenue Corridor. However, there was no clear-cut consensus at the time as to what is the best option for the corridor. Opinions appeared to be somewhat polarized between those that want the maximum improvement, i.e., a full expressway or freeway with transit, and those that want to disrupt the least number of existing businesses but still eliminate the six-legged intersections. An alternating grade separation concept would meet the needs of this second group.

The *Grand Avenue Corridor Study* recommended that the next step in the process of developing the Grand Avenue Corridor be to prepare a Major Investment Study (MIS). The MIS would continue to refine the roadway and transit alternatives, and incorporate community development or redevelopment planning efforts.

In May 1999, the Governor and State Legislature accelerated completion of the MAG Regional Freeway and Expressway System. Included as part of this plan is \$160 million to fund improvements to eight intersections along Grand Avenue by 2007. The FY2000-2007 ADOT program includes the following items for the Grand Avenue Corridor shown in Exhibit 1.3.

1.3 STUDY PROCESS

The Grand Avenue MIS was initiated by ADOT in January 1999. A steering committee was formed to guide the study process and to review the study products. The committee met periodically throughout the MIS. Committee membership included representation from ADOT, City of Glendale, City of Peoria, City of Phoenix, Maricopa Association of Governments, Maricopa County, Regional

**Exhibit 1.3
Programmed Funds for Grand Avenue Corridor**

FY	Location	Type of Work	Program Budget (\$000)	Funding
2000	Grand Avenue Corridor	Right-of-way acquisition reprogram	\$143	RARF
2000	Thomas / 27 th Avenue Structure	Design structure	3,490	RARF
2000	City of Glendale	Landscape and irrigation	60	State
2000	Thomas / 27 th Avenue Structure	Right-of-way acquisition	9,974	RARF
2002	Jct. I-17 to Jct. SR 101L	Design roadway / right-of-way	10,000	STP
2002	Thomas / 27 th Avenue Structure	Construct structure	46,536	RARF
2003	Camelback / 43 rd Structure	Design structure	3,490	RARF
2003	Camelback / 43 rd Avenue Structure	Right-of-way acquisition	25,924	RARF
2003	51 st Avenue to 75 th Avenue	Design drainage	350	State
2004	Jct. I-17 to Jct. SR 101L	Construction roadway improvements	30,000	STP
2004	Camelback / 43 rd Avenue Structure	Construct structure	31,750	RARF

Source: ADOT Five-Year Highway Construction Program FY2000-04 and MAG Life Cycle Program 2000-2007.

Public Transportation Authority (RPTA), WESTMARC (a private association for business and development in the West Valley) and BNSF. The Steering Committee directed that two options from the *Grand Avenue Corridor Study* be refined and evaluated in the MIS. The two options were Option 4 – Alternating Grade Separations, and Option 5 – Limited Expressway, and that the study focus on identification of improvements at the eight locations listed in Section 1.1.

The MIS began with the development of a public involvement plan to ensure public input into the MIS. The public involvement plan was documented in *Working Paper No. 1 – Public Involvement Plan* and updated several times to include public comments on the MIS. The public involvement plan identified all project stakeholders, individuals and agencies that had an interest in being involved with the MIS and identified means to contact and solicit information, opinions and concerns from them. The plan included public meetings, stakeholder meetings and a public outreach program.

The next step in the MIS was to review existing plans and studies prepared on Grand Avenue and meet with public agencies concerning land use, transportation and environmental issues within the corridor. The review of studies and plans was documented in *Working Paper No. 2 – Related Studies and Plans*. The reviewed studies and plans are included in Section 1.5. Existing Conditions within the corridor were next analyzed and documented in three working papers: *Working Paper No. 3 – Transportation Conditions*, *Working Paper No. 4 – Environmental Overview*, and *Working Paper No. 5 – Socio-economic Conditions*. During this time, roadway and transit alternatives for the two options were being developed for eight project locations along Grand Avenue.

A public meeting was held on April 14, 1999, to introduce the MIS, present preliminary concepts for the two options, and provide opportunity for public input into the designs. Based on the steering committee review and public input, the options were modified and presented in *Working Paper No. 6 – Roadway Options*. Supplementary transit, bicycle, and pedestrian alternatives were also modified and presented in *Working Paper No. 7 – Multi-Modal Elements*.

The two options were taken through an evaluation process that evaluated how well the options met the objectives of the MIS (presented in Chapter 2), and identified the impacts and costs associated with each option. The evaluation methodology and results were documented in *Working Paper No. 8 – Evaluation of Options*. A second public meeting was held on July 14, 1999, to present the evaluation of the two options and receive input on the preferred option. Following that meeting, the steering committee selected a preferred option. Next, additional refinements were made to the preferred option and this final report was prepared.

1.4 REPORT CONTENT

The report is divided into ten chapters and is a compilation of the eight draft working papers completed during the study. Chapter 1 provides an introduction to the Grand Avenue MIS and describes the process followed during the study. Chapter 2 identifies the major issues within the corridor and presents the objectives of the MIS. Chapters 3-5 describe the existing transportation, socio-economic and environmental conditions of the corridor, respectively. The two proposed roadway options are presented in Chapter 6, while Chapter 7 introduces the proposed transit

alternatives that supplement the roadway options. The evaluation of the two options is presented in Chapter 8. The preferred option for each project location is presented in Chapter 9. A set of 1 inch = 200 feet scale plan and profile drawings for the recommended concept at each project location is bound under a separate cover. Results from the public involvement process of the MIS are summarized in the last chapter, Chapter 10. An appendix contains supporting material. An Environmental Overview and a Public Involvement Report for the Grand Avenue MIS are also bound under separate cover.

1.5 REVIEW OF RELATED STUDIES AND PLANS

A total of 70 documents relating to the Grand Avenue Corridor dating back to 1985 were identified and reviewed. Working Paper No. 2 provides a brief summary of each of these documents. Many of the documents are closely related to one another and represent multiple products of a single study effort just as this MIS results in four major final products. This working paper is included in the project files. A listing of the reports is provided in Exhibit 1.4.

Exhibit 1.4

Related Studies and Plans

Previous Grand Avenue Studies

1. **Grand–27th Avenue Thomas Road, Grade Separation Feasibility Study**; Parsons Brinckerhoff Quade & Douglas, Inc (PBQD); February 1985.
2. **West Area Transportation Analysis**; PBQD; June 1985.
3. **Grand Avenue Corridor Study, Final Report**; PBQD; September 1986.
- 3a. **Grand Avenue Corridor Study, Cultural Resource Study**; Janus Associates Incorporated; June 1986.
- 3b. **Grand Avenue Corridor Study, Environmental Assessment**; PBQD; July 1986.
- 3c. **Grand Avenue Corridor Study, Executive Summary**; PBQD; September 1986.
4. **Review of Grand Avenue Corridor Study**; Tudor Engineering Company (Tudor); September 1987.
- 4a. **Grand Avenue Freeway Study, Concept Report**; Tudor; December 1987.
- 4b. **Grand Viaduct Concept**; Tudor; October 1988.
- 4c. **Grand Avenue Viaduct Concept, Drainage Analysis**; Tudor; February 1989.
- 4d. **Grand Avenue Viaduct Concept, Environmental Impact Statement, Draft**.
- 4e. **Parsons Brinckerhoff Quade & Douglas Freeway Concept, Right-of-Way Impacts & Cost Analysis**; Tudor; February 1989.
- 4f. **Grand Freeway, Drainage Analysis**; Tudor; May 1989.
- 4g. **Grand Avenue, Project Hydrology Report, Volume 1: Existing Conditions**; Tudor; August 1989.
- 4h. **Corridor Volume & Capacity Analysis – Grand Avenue**; Tudor; September 1988.
- 4i. **Grand Freeway, Concept Finalization Report**; Tudor; August 1989.
- 4j. **Grand Freeway, Right-of-Way Acquisition Data**; Tudor; August 1989.
- 4k. **Grand Freeway, Right-of-Way Impacts & Cost Analysis**; Tudor; August 1989.
- 4l. **Existing Right-of-Way Inventory Data**; Tudor; August 1989.
- 4m. **Grand Avenue, Existing Utility Summary**; Tudor; August 1989.
5. **Railroad Relocation Evaluation of the Grand Avenue Corridor**; PBQD; February 1988.
6. **I-10 to Van Buren – Recommendation for Alignment Selection**; Tudor; September 1988.
7. **Indian School Road Crossing Study**; Tudor; November 1988.
8. **Grand Avenue Transportation System Management Study, Proposed Interim Improvements**; Tudor; February 1989.
- 8a. **Grand Avenue Transportation System Management Study, Executive Summary**; Tudor; February 1989.
- 8b. **Grand Avenue Transportation System Management Study, Appendices**; Tudor; February 1989.
- 8c. **Grand Avenue Task Force For Transportation System Management Improvements Project Manual and Meeting Minutes**; Tudor.

Exhibit 1.4
Related Studies and Plans (continued)

Previous Grand Avenue Studies

9. **Grand Avenue Traffic Projection, Final Report**; Howard Needles Tammen & Bergendoff (HNTB); June 1989.
- 9a. **Grand Avenue Traffic Projections, Appendices**; HNTB; May 1989.
10. **Camelback Traffic Interchange, Design Concept Report**; Tudor; August 1989.
- 10a. **Camelback Traffic Interchange, Concept Drainage Analysis**; Tudor; August 1989.
- 10b. **Camelback T.I. – Traffic Analysis Report**; Tudor; September 1988.
11. **Thunderbird at Grand Avenue, Level of Service Analysis**; Kimley-Horn and Associates (KHA), Inc.; January 1990.
12. **Grand Avenue Widening, Beardsley Canal to Thunderbird Road, Cost Estimate and Calculations for Horizontal and Vertical Alignment**; KHA; January 1990.
13. **Grand Avenue, Left Turn Study**; Tudor; March 1991.
14. **Agua Fria River Bridge, Design Concept Report, Draft**; Michael Baker Jr., Inc.; March 1990.
- 14a. **Agua Fria River Bridge Drainage Alternative Concepts and Recommendation**; Michael Baker Jr., Inc.; May 1991.
- 14b. **Agua Fria River Bridge, Alignment Study Report**; Michael Baker Jr., Inc.; June 1989.
- 14c. **Addendum to the Agua Fria River Bridge Alignment Study Report**; KHA; September 1989.
- 14d. **Agua Fria River Bridge, Final Drainage Report**; Michael Baker Jr., Inc.; November 1991.
- 14e. **Agua Fria River Bridge, Final Design Analysis**; Bruflat Engineering Company; August 1992.
15. **Grand Avenue Corridor Study, Beardsley Canal to 7th Avenue / Van Buren**; URS Greiner; May 1998.

Cultural Resource Documents

1. **Grand Avenue Corridor Study, Cultural Resource Survey**; Janus Associates, Inc.; June 1986.
2. **Survey of 6.07 Miles Along US 60 Near Wickenburg**; Bradford & Lyle Stone; June 1992.
3. **Grand Avenue Alignment Historic Building Survey**; Woodward Architects; February 1993.
4. **7.07 Mile Segment, US 60 ROW, Vicinity of Morristown and Wittmann**; Scott Kwiatkowski; March 1993.

Exhibit 1.4
Related Studies and Plans (continued)

Multi-Modal Studies And Programs

1. **Camelback Rapid Transit Corridor Study Phase 3 Final Report**; BRW, Inc., April 1989.
2. **Arizona Rail Passenger Feasibility Study Final Report**; KHA; November 1993.
- 2a. **Arizona Rail Passenger Feasibility Continuation Study Project Planning**; KHA, June 1994.
3. **1993 Study of Travel Speed and Delay in the MAG Region**; Lee Engineering; March 1995.
4. **MAG Long-Range Transportation Plan Summary and 1997 Update**; MAG, September 1997.
- 4b. **MAG Long-Range Transportation Plan Summary and 1999 Update, Executive Summary, Draft**; MAG, February 1999.
5. **Bikeways in the Metropolitan Phoenix Area**; MAG, 1997.
7. **Maricopa County 2020 Eye to the Future Transportation System Plan**; December 1997.
8. **"Glendale Bicycle Map"**; City of Glendale, 1997.
9. **Short Range Transit Plan Fiscal Year 1999 through 2003**; Valley Metro.
10. **Grand Avenue Corridor Study**; URS Greiner, May 1998.
11. **Transportation Improvement Program FY 1999-2003**; MAG, August 1998.
12. **Phoenix / Glendale Major Investment Study Report, Draft**; PBQD; November 1998.
13. **Bicycle Transportation System Plan**; Maricopa County Department of Transportation, January 1999 (Final Draft).
14. **MAG Regional Bicycle Plan**; MAG, revised January 1999.
15. **BusBook**; Valley Metro, February 1999.
16. **"Trails Master Plan"**; City of Peoria, no date.
17. **Northwest Valley Transportation Study**; BRW, Inc., ongoing.

Land Use And Community Plans

1. **General Plan for Phoenix: 1985-2000**; October 1985
2. **Glendale General Plan – Development Guide**; January 1989.
3. **Glendale Downtown Redevelopment Plan**; Supplement to the City of Glendale General Plan; January 1989.
4. **Phoenix Area Economic Base Study: Maricopa County, Arizona**; Data Report; December 1996.
5. **Peoria Comprehensive Master Plan (Volume II)**; April 1997.
6. **Peoria Downtown Redevelopment Plan**; Design Workshop; 1999 (Work in Progress).



Chapter 2.0

STUDY PURPOSE AND OBJECTIVES

2.0 OVERVIEW

This chapter presents the purpose and need for making major improvements in the Grand Avenue Corridor and a list of objectives for the Grand Avenue MIS. The proposed options are evaluated against these objectives in Chapter 8 – Evaluation of Options, to assist in developing a consensus on the improvements for Grand Avenue.

During the Grand Avenue Corridor Study, public and agency input was solicited from a number of sources. Input was obtained from a steering committee, corridor stakeholders and the general public at a series of public workshops and presentations. Important transportation, development, and economic issues were identified during that process. These issues were presented again to the steering committee, stakeholders, and the general public during the public involvement process of the Grand Avenue MIS. During this process, the issues were grouped into eight categories and ranked by the public in importance. The eight categories are:

1. Six-Legged Intersections
2. Railroad Crossings
3. Regional Mobility
4. Development Opportunities
5. Aesthetics
6. Statewide Significance
7. Multi-Modal Use
8. Projected Traffic

The public's ranking of the issues is presented in Chapter 10.

2.1 PURPOSE AND NEED

Grand Avenue is a major transportation corridor for the West Valley of the Phoenix metropolitan area that provides both regional mobility and local access. Even though traffic volumes on and across Grand Avenue have not significantly increased over the past 13 years, significant traffic problems exist within the corridor that affect the development and economics of the corridor. The eight categories identified above form the purpose and need for making major improvements in the Grand Avenue Corridor. Each category is presented below with a brief description describing its issues and concerns.

1. ***Six-Legged Intersections:*** The six-legged intersections formed by Grand Avenue and the north-south and east-west grid of arterial streets have traffic signal cycle lengths over three minutes which limits roadway capacity and creates long delays for motorists on all intersecting streets. The intersections operate at level of service E-F during the peak hours of travel. Average A.M. peak hour stopped delay is 75 seconds per vehicle per intersection,

while average P.M. peak hour stopped delay is 101 seconds per vehicle per intersection. Air pollution is also increased due to the long delays.

2. **Railroad Crossings:** The railroad parallels Grand Avenue. At the six-legged intersections, the railroad crosses two of the approaches at-grade. Safety concerns exist at the at-grade crossings. One-third of the accidents at the six-legged intersections occurred when trains crossed the intersections (only a few were with the train). Train delays are also an irritation to drivers and occasionally block emergency vehicles. Train activity within the corridor increases delay at some approaches by up to three minutes. As the metropolitan area grows, train activity within the corridor is expected to increase.
3. **Regional Mobility:** Grand Avenue provides the shortest route in distance from Peoria and Glendale to downtown Phoenix. However, limited capacity and delay prevent the corridor from providing reasonable travel times among these cities. Peak-hour travel time between Thomas Road and 91st Avenue is approximately 24 minutes. Average peak hour travel speed on Grand Avenue is 27 mph during the A.M. peak hour and 25 mph during the P.M. peak hour. Capacity along Grand Avenue is lower than other arterial streets in the Phoenix metropolitan area due to limited capacity and delay at the six-legged intersections.
4. **Development Opportunities:** Grand Avenue serves as a commercial corridor for Phoenix, Glendale, and Peoria. There are many viable businesses and industries along Grand Avenue that provide a solid tax base and employment opportunities. However, development in the corridor has lagged compared to the rest of the Phoenix metropolitan area. There are opportunities for redevelopment and enhancement in the corridor and opportunities for major new developments along the corridor.
5. **Aesthetics:** Grand Avenue and the parallel railroad have existed for over 100 years. The visual character of the corridor is generally unattractive and dominated by the railroad and by older marginal commercial establishments.
6. **Statewide Significance:** Grand Avenue is designated as US 60 and connects Wickenburg with the Phoenix metropolitan area. In addition, US 93, which is part of the CANAMEX corridor for NAFTA, connects to US 60 in Wickenburg. Even though US 60 (Grand Avenue) is not designated as part of the CANAMEX corridor, truck traffic may use this route to reach its destination within the Phoenix metropolitan area.
7. **Multi-Modal Use:** The diagonal nature of Grand Avenue and its proximity to three downtown areas provides a unique potential for incorporation of transit and bicycle modes of travel. The wide intersections and the railroad are impediments to pedestrians and to access to transit service.
8. **Projected Traffic:** Traffic volumes along Grand Avenue have remained stable over the last 13 years. However, traffic forecasts show volumes increasing on Grand Avenue from 20,000–35,000 vehicles per weekday in 1998 to 30,000–66,000 vehicles per weekday in 2020. Increased traffic will result in more congestion and delay along Grand Avenue.

2.2 STUDY GOALS AND OBJECTIVES

The main goal of the Grand Avenue MIS was to develop a consensus on selecting a preferred improvement option for the corridor. The preferred option must also meet the additional goals of being able to be constructed and financed within the framework of the accelerated ADOT / MAG Regional Freeway and Expressway Program.

Objectives for the MIS were developed from each of the eight categories of issues presented above. The proposed options are evaluated in Chapter 8 against each of the objectives to determine which option best addresses the key issues within the corridor. The eight objectives are:

1. Eliminate six-legged intersections
2. Eliminate railroad crossings
3. Improve regional mobility
4. Promote development opportunities
5. Improve aesthetics of the corridor
6. Serve the statewide function of US 60
7. Promote multi-modal uses in the corridor
8. Accommodate the projected travel demand in the corridor



Chapter 3.0

TRANSPORTATION CONDITIONS

3.0 SUMMARY

The Grand Avenue Corridor is a unique multi-modal transportation corridor within the Phoenix metropolitan area. Grand Avenue and the parallel BNSF cut diagonally across a grid network of arterial streets forming many six-legged intersections and at-grade railroad crossings. These six-legged intersections and railroad crossings are the cause of limited capacity within the corridor, excessive traffic congestion, long commuter delays (due to the train), and impediments to non-motorized and transit use within the corridor.

This chapter provides a documentation of existing and future roadway and traffic conditions within the study area, and a documentation of transit, bicycle, and pedestrian facilities and usage within the study area. Below is a summation of the transportation conditions that exist within the corridor.

Physical Features

Grand Avenue

- Four or six travel lanes with a raised median
- Right-of-way width of 90 to 100 feet
- Access control on the railroad side only
- 18 traffic signals along Grand Avenue

Six-Legged Intersections

- 27th / Thomas / Grand
- 43rd / Camelback / Grand
- 51st / Bethany Home / Grand
- 55th / Maryland / Grand (collector streets)
- 59th / Glendale / Grand
- 61st / Myrtle / Grand (collector streets)

- 67th / Northern / Grand
- 75th / Olive / Grand

BNSF

- Railroad parallels Grand Avenue
- Train activity is high and expected to increase
- Spur tracks cross Grand Avenue at two locations

Arterial Cross-Streets

- Three travel lanes northbound and westbound
- Two travel lanes southbound and eastbound
- Center two-way left-turn lane

Traffic Conditions

Traffic Volumes

- Existing volumes on Grand Avenue:
 - 20,000 to 36,000 vehicles per day
 - Little change in volume in past 13 years
- Arterial cross-streets:
 - Limited capacity due to delay at the six-legged intersections
- Projected volumes on Grand Avenue:
 - 35,000 to 57,000 vehicles per day in 2020 under Option 4
 - 40,000 to 67,000 vehicles per day in 2020 under Option 5

Travel Time and Speeds

- P.M. peak hour travel time is 24 minutes (between Thomas Road and 91st Avenue)
- Average peak hour travel speed on Grand is:
 - 27 mph during the A.M. peak hour
 - 25 mph during the P.M. peak hour

Congestion and Delay

- Six-legged intersections operate at LOS E or F during peak hours
- Peak hour stopped delay at intersections is:
 - 75 seconds / vehicle – A.M. peak
 - 101 seconds / vehicle – P.M. peak
- Between 6:00 A.M. and 12:00 NOON, trains interrupted traffic:
 - 14 times at 55th / Maryland
 - 12 times at 43rd / Camelback
 - 1 time at 67th / Northern

- Train activity increases delay at some approaches by up to three minutes

Accidents

- Over 1,500 accidents on Grand and at six-legged intersections last three years
- Accident rate at intersections is slightly higher than the City of Phoenix citywide average (1.7 versus 1.4 accidents / million entering vehicles)
- Accident rate (1.5) between intersections is significantly lower than the City of Phoenix citywide average of 5.0 accidents / million VMT
- One-third of accidents at intersections occurred when trains interrupted traffic (only a few were with the train)

Multi-Modal Elements

Transit Service

- Yellow Line serves 1,900 passengers per day and provides local bus service along Grand Avenue; its passenger / mile ratio is below the metropolitan average
- Transfer points at the six-legged intersections are difficult for pedestrians, particularly those with disabilities
- Paratransit and vanpool service also exist
- Three park-and-ride lots

Planned Improvements

- Light rail transit to downtown Glendale
- Increased local and express bus service
- Additional bike facilities

Other Facilities

- Existing bike facilities include bike lanes, bike routes, and multi-use paths
- Six-legged intersections are difficult for pedestrians to cross because of long cross distances
- Sidewalks do not exist along Grand Avenue except in downtown Peoria

Intelligent Transportation Systems

- Grand Avenue and Glendale Avenue are AZTech “Smart Corridors”
- Enhanced traffic detection, data collection and signal coordination will be implemented

3.1 EXISTING ROADWAY INFRASTRUCTURE

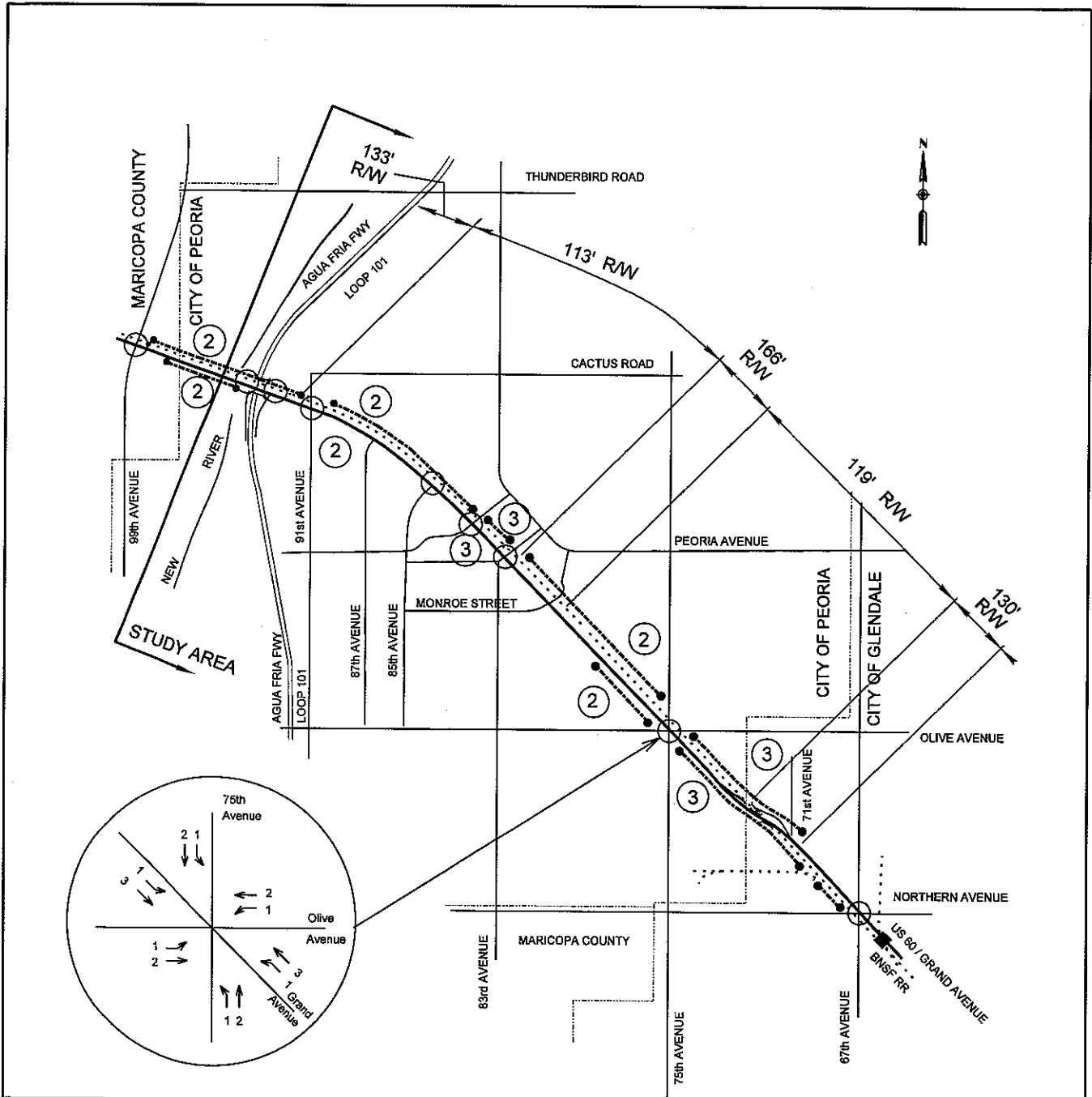
Grand Avenue is a four- or six-lane major arterial street that cuts diagonally across the grid of mile spaced arterial streets in the “West Valley” of the Phoenix metropolitan area. It enters the Phoenix metropolitan area in the northwest corner and travels southeastwardly to downtown Phoenix. Because of its diagonal orientation, six-legged intersections are formed when Grand Avenue crosses the grid of arterial streets. Seven six-legged intersections formed by Grand Avenue and major arterial streets exist within the study area. There are also several additional five- or six-legged intersections formed where Grand Avenue crosses collector streets.

The BNSF parallels Grand Avenue through the study area. The railroad tracks are located north of Grand Avenue between Loop 101 and 75th Avenue. Just east of 75th Avenue, the railroad passes under the southeast-bound lanes and over the northwest-bound lanes to the south side of Grand Avenue. The railroad remains on the south side of Grand Avenue to 19th Avenue. At each of the multi-legged intersections, the railroad crosses one or two approaches of the intersection. The railroad crossings are at-grade and are typically controlled by flashing warning signals. Automatic gates are not located at the majority of the crossings. There are two at-grade crossings of Grand Avenue by spur tracks. Generally, access to Grand Avenue is prohibited on the railroad side except at mile and half mile arterial streets. Access is not limited on the side opposite of the railroad.

Grand Avenue has six travel lanes (three in each direction) the majority of its length within the study area. Between Loop 101 and the 75th / Olive intersection, Grand Avenue is a four-lane arterial street except through downtown Peoria where it widens to six lanes. A raised median generally separates northwest-bound and southeast-bound traffic. Exclusive left-turn lanes are provided at most median breaks and intersections. No left turns are allowed off of Thomas Road at the 27th / Thomas intersection. Left turns are also prohibited off of Camelback Road at the 43rd / Camelback intersection. There are a total of 18 signals (including the pair of signals at the Loop 101 / Grand Avenue interchange) on Grand Avenue between Loop 101 and I-17. Signal spacing varies between less than a quarter of a mile to over one mile. The right-of-way for Grand Avenue is generally 90 to 100 feet wide within the study area. It is as narrow as 85 feet at 75th Avenue and as wide as 166 feet near downtown Peoria. The roadway width for Grand Avenue is typically 84 feet wide. Near I-17, Grand Avenue widens to between 88 and 90 feet wide.

Exhibits 3.1, 3.2, and 3.3 show the roadway infrastructure for Grand Avenue within the cities of Peoria, Glendale, and Phoenix, respectively. Roadway infrastructure shown includes right-of way width, number of lanes, number of turn lanes at the major six-legged intersections, signal locations, at-grade railroad crossings, and access control. The access control lines designate areas where access to Grand Avenue is not permitted due to jurisdictional or physical constraints. The railroad is also shown on the exhibits.

The existing numbers of lanes for the major arterial streets that intersect Grand Avenue within the study area are shown in Exhibit 3.4. Generally within Phoenix, the arterial streets have five travel lanes with the north-south arterial streets having three northbound lanes and two southbound lanes and the east-west arterial streets having three westbound lanes and two eastbound lanes. Most arterial streets also have a center two-way left-turn lane. Many of the major arterial streets within Glendale and Peoria have four travel lanes (two in each direction) and a center two-way left-turn lane. Some two-lane arterial streets exist within the study area in Peoria. There are 18 traffic signals (including the two at the Loop 101 traffic interchange) along Grand Avenue within the study area. The signal locations within the study area are shown in Exhibit 3.5.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.1
Roadway Infrastructure - Peoria Section



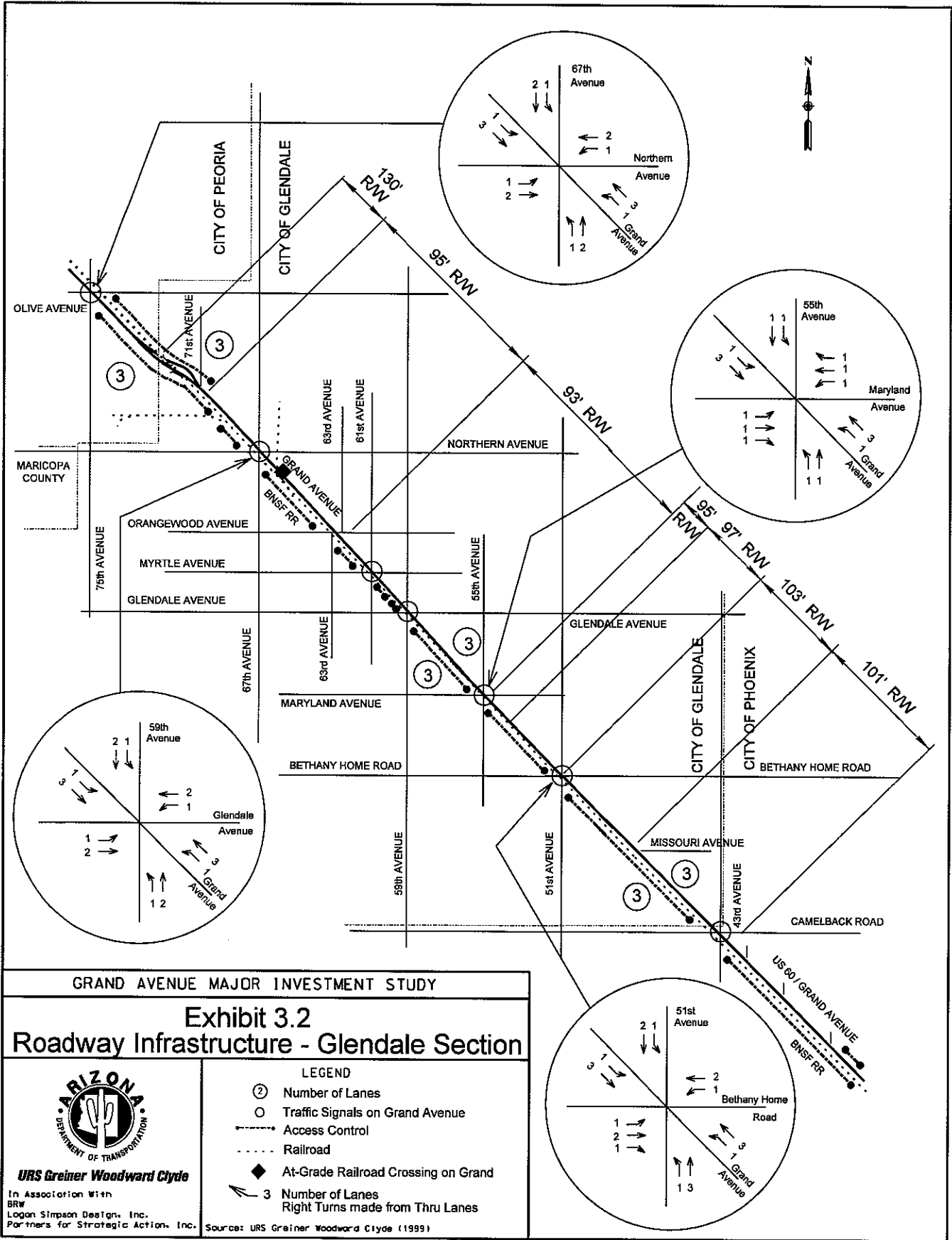
URS Greiner Woodward Clyde

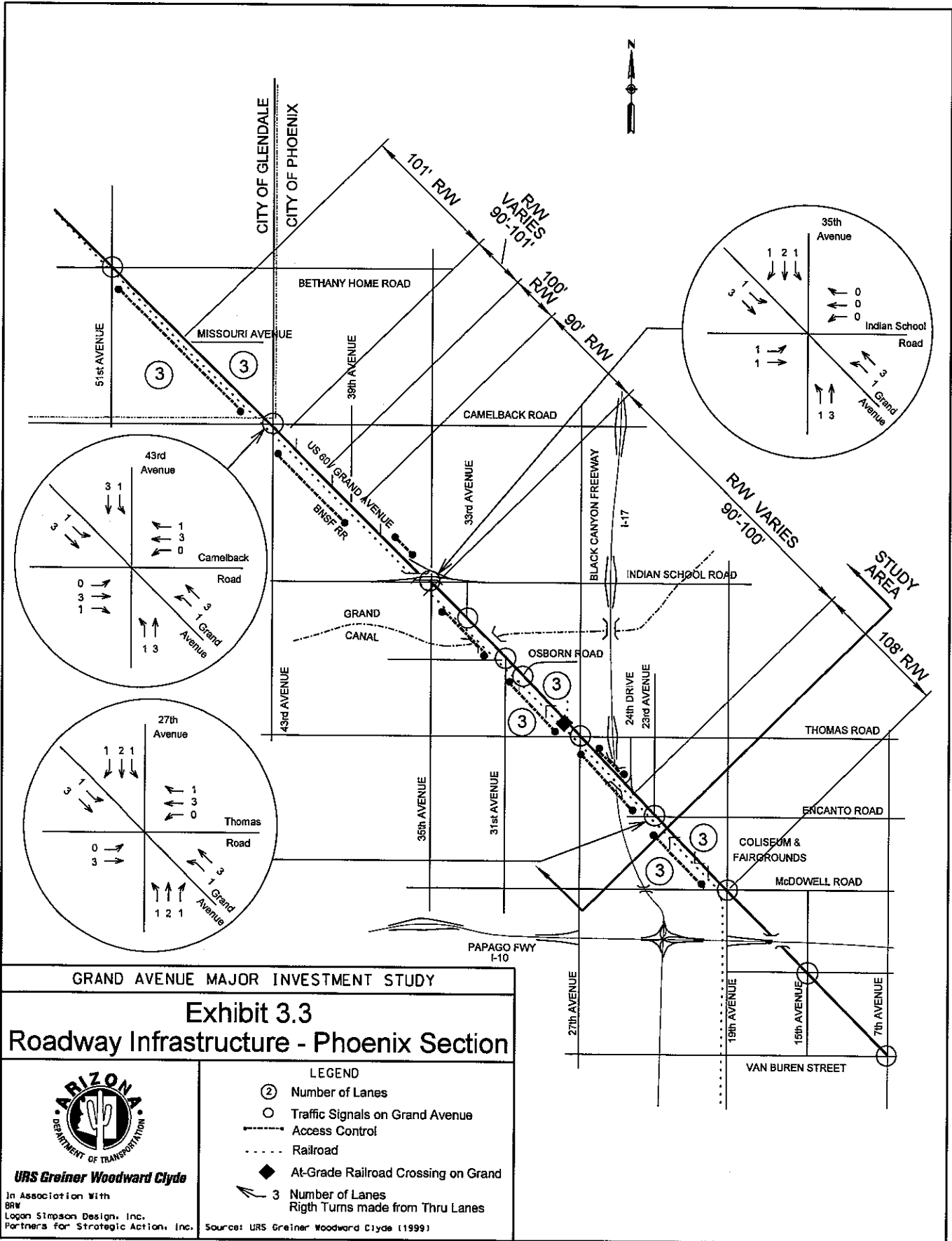
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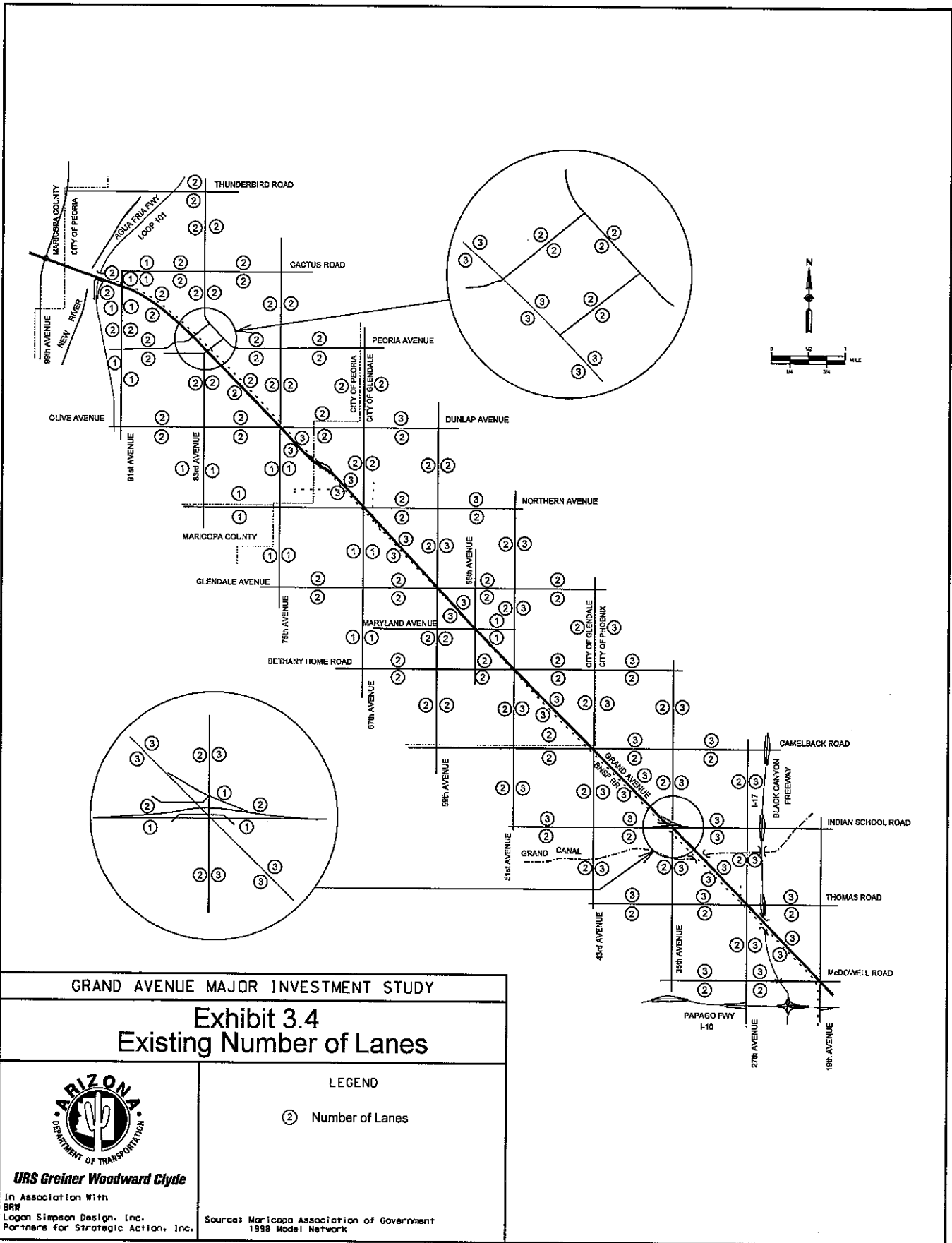
LEGEND

- ② Number of Lanes
- Traffic Signals on Grand Avenue
- - - - Access Control
- Railroad
- ◆ At-Grade Railroad Crossing on Grand
- ↔ 3 Number of Lanes Right Turns made from Thru Lane

Source: URS Greiner Woodward Clyde (1999)







GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.4
Existing Number of Lanes



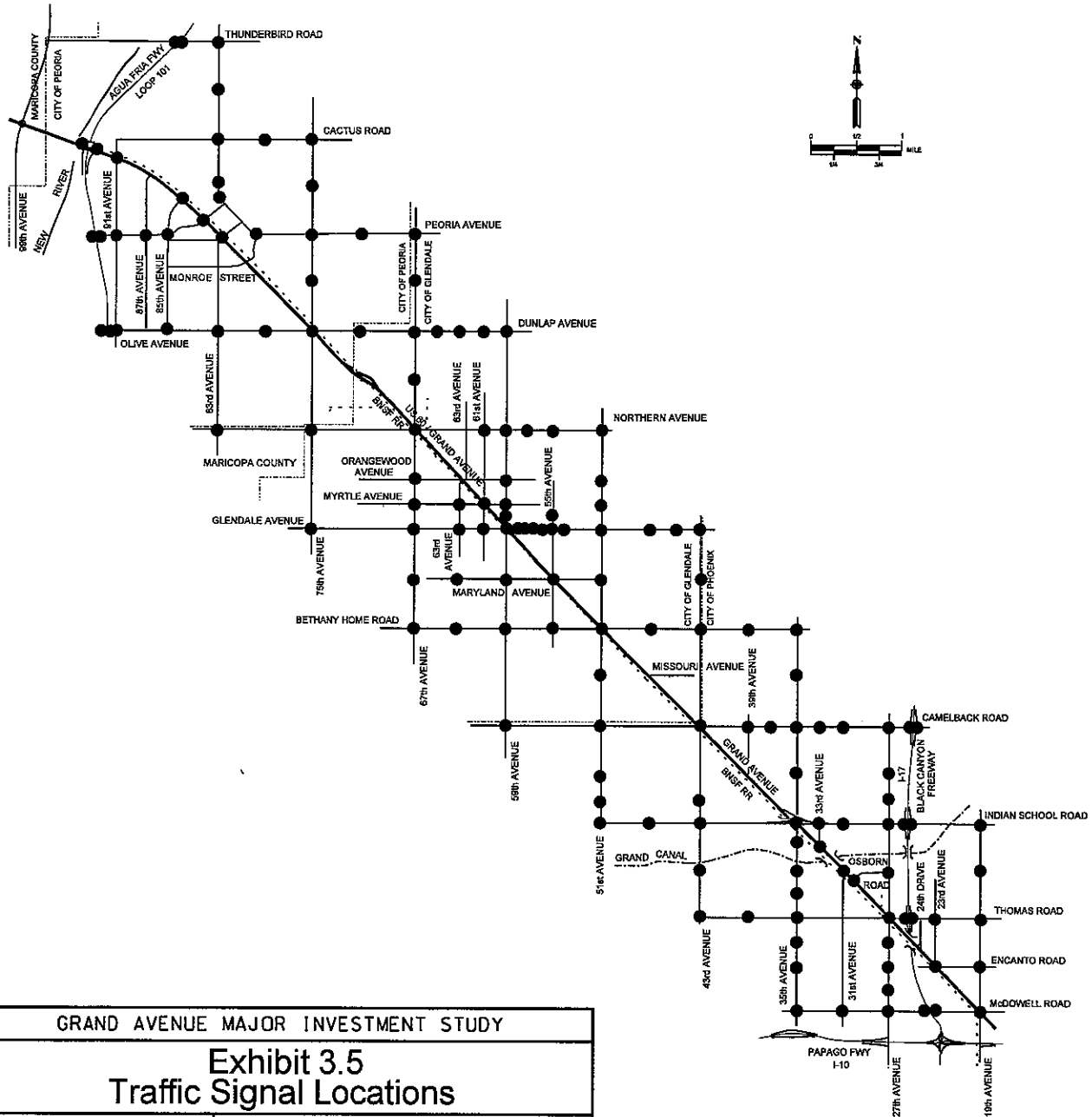
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LEGEND

② Number of Lanes

Source: Maricopa Association of Government
1998 Model Network



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.5
Traffic Signal Locations

LEGEND

- Traffic Signals



URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

Sources: City of Peoria, City of Glendale,
City of Phoenix

Changes to Grand Avenue have been modest over the past two decades. However, major improvements have been made to the regional roadway network during this time period. A summary of the improvements and changes to the regional road system that affect travel on Grand Avenue is provided below:

- Grand Avenue has been widened to a four-lane divided highway (from two lanes undivided) from the Agua Fria River north to the RH Johnson Boulevard intersection.
- New signal bridges have been constructed at six-legged intersections along with operational improvements.
- The Agua Fria Freeway (Loop 101) has been completed from the Black Canyon Freeway (I-17) to south of Northern Avenue. Ramps from the south allow northbound Loop 101 traffic to exit at Grand Avenue and Grand Avenue traffic to enter southbound Loop 101. The ramps are controlled by signals on Grand Avenue. Construction from Northern Avenue to I-10 will be completed in 2000.
- High occupancy vehicle (HOV) lanes and auxiliary lanes are currently being added to I-17 between Thomas Road and Peoria Avenue. The traffic interchanges along this stretch have been or are being reconstructed.
- The Paradise Freeway has been eliminated from the MAG Regional Freeway and Expressway Plan, and the right-of-way is being sold back to individuals.
- Grand Avenue south of McDowell Road has been refurbished with new curbs, gutters, sidewalks and landscaping and has been turned over to the City of Phoenix.
- Loop 303 (Estrella Road) was built as a two-lane highway. It was removed from the planned freeway system, and ADOT is in the process of transferring the road to Maricopa County.
- I-10 has been completed through the West Valley and downtown Phoenix, and the I-10 / I-17 stack interchange is in operation.
- ADOT is currently installing new traffic signal controllers along Grand Avenue with plans to coordinate the signals.

3.2 EXISTING AND HISTORICAL TRAFFIC

3.2.1 Data Collection

New traffic volumes were not collected for the Grand Avenue MIS. Existing data were used to establish the existing traffic conditions within the corridor. Existing traffic volumes along Grand Avenue were obtained from ADOT and MAG. These volumes included 24-hour traffic counts and turning movement counts at intersections within the study area that were collected by Traffic Research Analysis, Inc. (TRA) during 1997 and 1998. Additional sources of data included turning

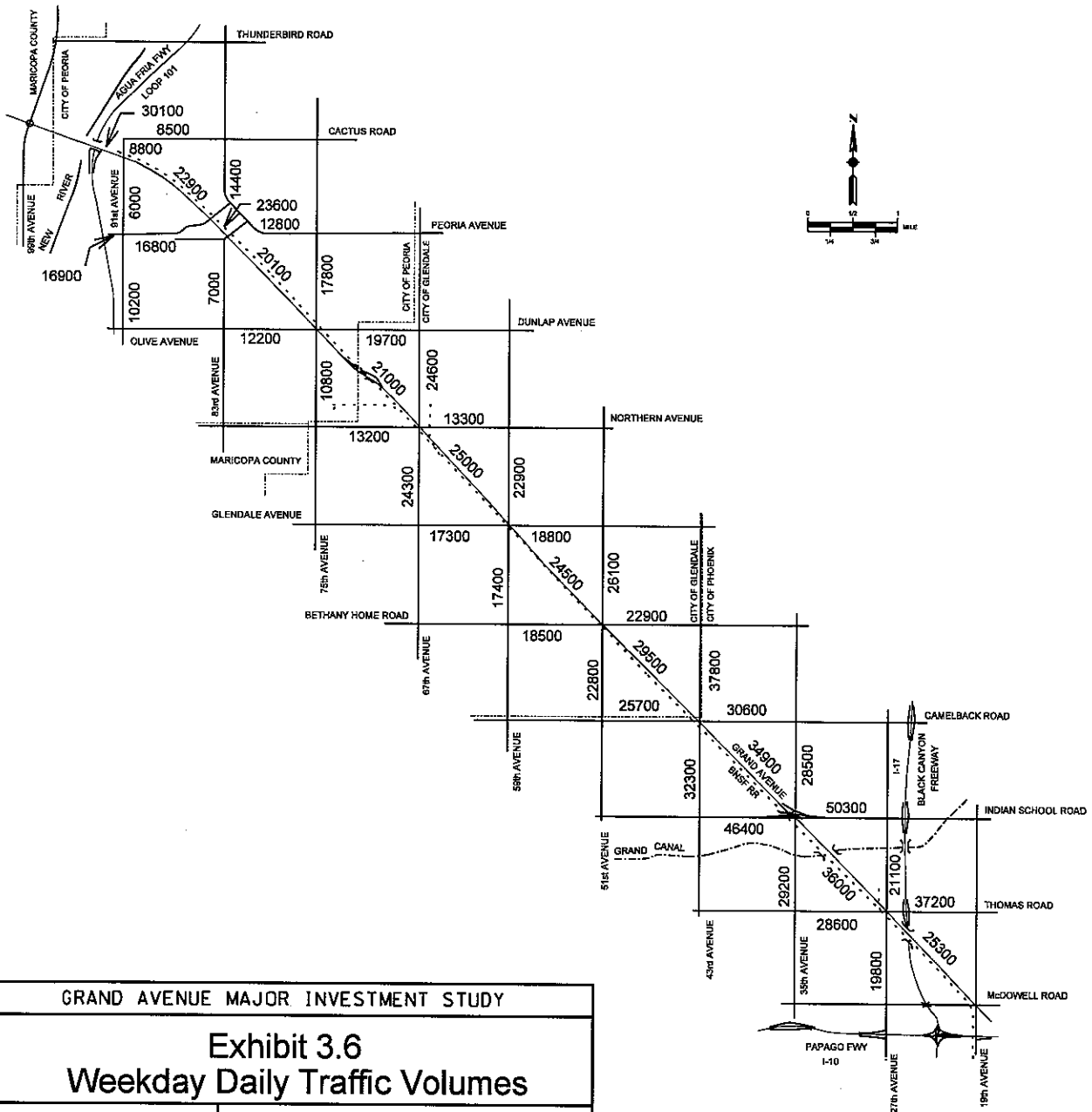
movement counts at some six-legged intersections collected by TRA in February 1999 as part of an AzTech signal coordination project and 1995-1998 daily traffic volumes from the City of Glendale Transportation Department.

3.2.2 Average Weekday Daily Traffic Volumes

Grand Avenue serves between 20,000 and 36,000 vehicles per weekday. A modest amount of this traffic is through traffic, as Grand Avenue serves mostly moderate length urban trips that begin and end in the urban area. The obtained 24-hour counts from ADOT and MAG were adjusted by monthly and daily factors to develop 1998 average weekday daily traffic volumes for each location. The monthly and daily factors were obtained from the *City of Glendale 1997 Average Daily Traffic Map, February 1998*. The adjusted weekday volumes were compared to the turning movement counts and counts reported on the *City of Glendale 1997 Average Daily Traffic Map*, and the volumes in the *Grand Avenue Corridor Study*. The counts at the 43rd / Camelback intersection appeared low. At this location, average daily traffic volumes were calculated from peak hour turning movement counts based on a calculated average K value (ratio of peak hour to daily traffic) of 8%. The average K value was calculated from traffic counts representing the whole West Valley. The same method was used to calculate traffic volumes at the 83rd Avenue and Peoria Avenue intersections with Grand Avenue, as there were no daily volume counts at these intersections. The 1998 average weekday daily traffic volumes for the major arterial streets within the study area are shown in Exhibit 3.6.

Counts from 1985 were obtained from the *Grand Avenue Corridor Study* dated September 1986 by Parsons Brinckerhoff Quade & Douglas, Inc. (PBQ&D). These volumes were compared with the 1998 counts, and the resulting change in volume is shown on Exhibit 3.7 for Grand Avenue and other arterial streets in the study area. Volumes have increased on most arterial streets within the study area. In the past 13 years, traffic volumes on Grand Avenue have generally increased in Phoenix and decreased in Peoria and Glendale. Exhibit 3.8 summarizes the change in daily traffic volumes on Grand Avenue from 1985 to 1998.

The MAG Transportation and Planning Office utilizing the regional computerized traffic forecasting EMME2 model prepared traffic forecasts for the Grand Avenue MIS. A comparison of model-predicted weekday daily volumes to actual counts was made to measure the accuracy of the model in replicating existing traffic volumes. The model was run in February 1999 using the J2 socio-economic database for the year 1998. This comparison of model to actual traffic counts provides a basis for refinement of future traffic forecasts made by the model for the various corridor options to be studied in this project. The comparison was made for a series of screen lines across the West Valley. The screen lines are shown in Exhibit 3.9. The traffic crossing each of the screen lines on the major arterial streets was used in this analysis. The model fairly replicates traffic in the eastern part of the West Valley; however, the model tends to overestimate east-west traffic in the western part of the West Valley. The highest percentage difference (+23%) occurred on the screen line between 75th Avenue and 83rd Avenue.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.6
Weekday Daily Traffic Volumes



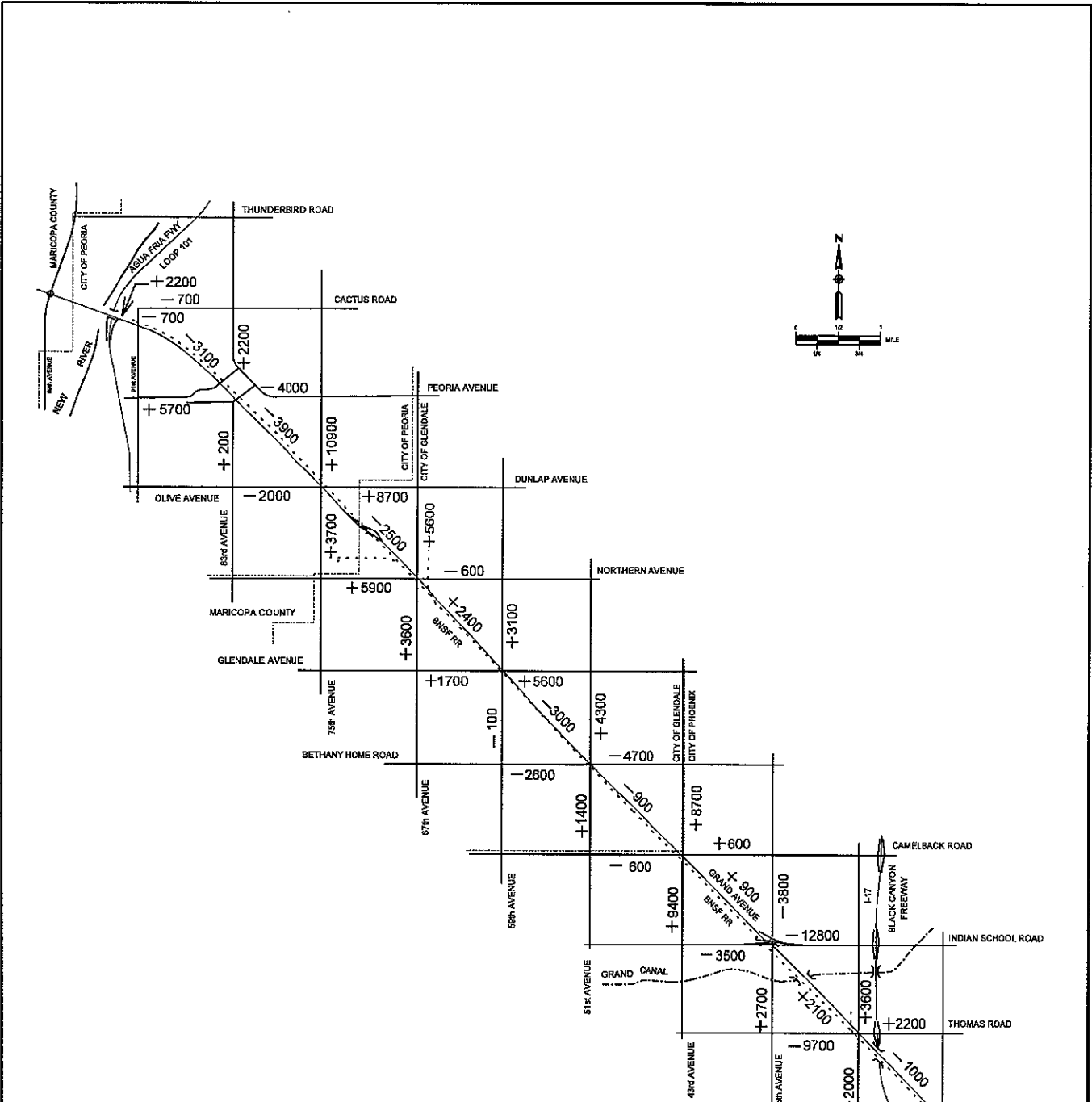
URS Greiner Woodward Clyde

In Association With
BRM
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

LEGEND


36000 1998 Weekday Daily Traffic Volume

Source: Maricopa Association of Governments Counts



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.7
Change in Daily Volume 1985 to 1998



URS Greiner Woodward Clyde
 In Association With
 BRW
 Logan Simpson Design, Inc.
 Partners for Strategic Action, Inc.

LEGEND

+ 5600 Change in Traffic Volumes
 (1998 volume - 1985 Volume)

Source: Maricopa Association of Governments Counts and Grand Avenue Corridor Study (September 1986)

Exhibit 3.8
Change in Traffic Volume on Grand Avenue
1985 to 1998

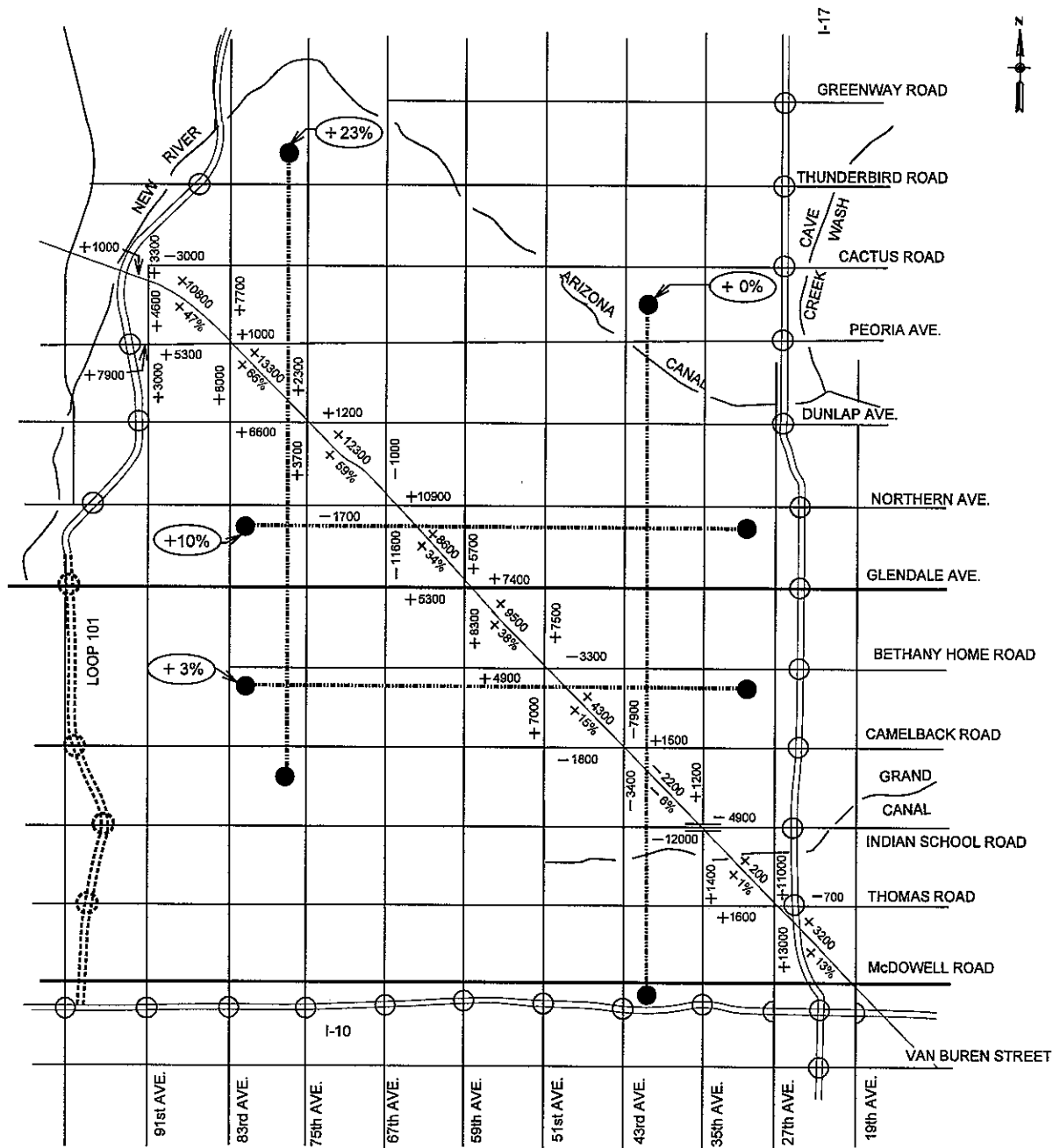
Location	1998 Average Weekday Daily Traffic	1985 Average Weekday Daily Traffic	Change in Volume 1985-1998	Percent Change 1985-1998
SR 101 to 91 st Avenue	30,100	27,900	+2,200	+8%
91 st Avenue to 83 rd Avenue	22,900	26,000	-3,100	-12%
83 rd Avenue to 75 th Avenue	20,100	24,000	-3,900	-16%
75 th Avenue to 67 th Avenue	21,000	23,500	-2,500	-11%
67 th Avenue to 59 th Avenue	25,000	22,600	+2,400	+11%
59 th Avenue to 51 st Avenue	24,500	27,500	-3,000	-11%
51 st Avenue to 43 rd Avenue	29,500	30,400	-900	-3%
43 rd Avenue to 35 th Avenue	34,900	34,000	+900	+3%
35 th Avenue to 27 th Avenue	36,000	33,900	+2,100	+6%
27 th Avenue to 19 th Avenue	25,300	26,300	-1,000	-4%

Source: *Grand Avenue Corridor Study* (September 1986) and Maricopa Association of Government 1997-98 traffic counts.

The volume difference between the model and the actual counts for major arterial streets and Grand Avenue is also shown in Exhibit 3.9. The model tends to overestimate traffic on Grand Avenue. This fact is due in part to the model overestimating traffic from the large retirement communities in the northwestern part of the corridor and the diagonal nature of Grand Avenue. Some motorists may avoid Grand Avenue because of the potential for delays caused by activity on the railroad and because of the long traffic signal cycle lengths at the six-legged intersections. The model has been refined over the years but still is not able to accurately predict traffic on Grand Avenue as well as it does in most other parts of the metropolitan area.

3.2.3 Peak Hour Traffic Volumes and Turning Movement Counts

Peak hour volumes and turning movement volumes were determined from existing turn movement counts obtained from MAG and ADOT. The A.M. peak hour, determined from counts representing the West Valley, occurred between 7:15 A.M. and 8:15 A.M. The P.M. peak hour occurred between 4:45 P.M. and 5:45 P.M. The A.M. and P.M. peak hour volumes for Grand Avenue and major arterial streets within the study area are shown in Exhibit 3.10. Turn movement counts for the major intersections along Grand Avenue are also shown in Exhibit 3.10.



GRAND AVENUE MAJOR INVESTMENT STUDY

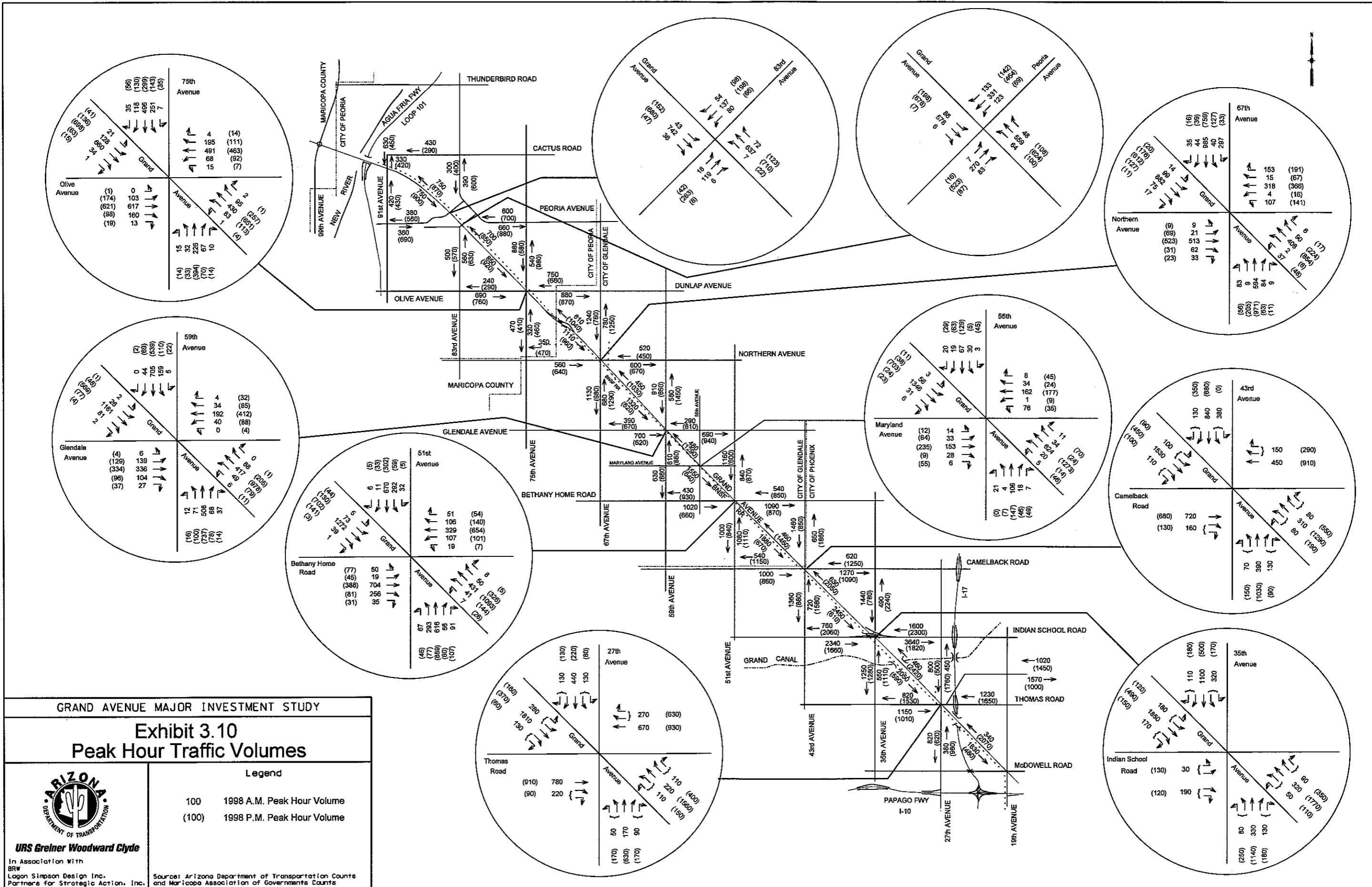
Exhibit 3.9
Volume Comparison 1998 Model Versus 1998 Actual



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Partners for Strategic Action, Inc.

- LEGEND
- 1800 Volume Difference in Weekday Daily Traffic (Model to Actual)
 - % Volume Difference in Percent
 - + 3% Screenline Volume Difference in Percent (Model to Actual)
 - Screenline

Source: BRW (1999)



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Peak hour traffic volumes are slightly higher on Grand Avenue than on crossing arterial streets with the exception of Indian School Road. The peak direction of travel along Grand Avenue during the A.M. peak is toward the southeast and downtown Phoenix. During the P.M. peak hour, travel is heaviest in the northwest direction. On Grand Avenue, the directional split of traffic in the peak direction versus the non-peak direction for the A.M. peak is approximately 50/50 in Peoria and increases to 75/25 in Glendale and 80/20 in Phoenix. The directional split along Grand Avenue in the P.M. peak hour is 50/50 in Peoria, 66/33 in Glendale, and 75/25 in Phoenix. The directional splits indicate that traffic on Grand Avenue is heavily dominated by commuter traffic during the peak periods. Directional splits on the arterial streets that cross Grand Avenue vary by street between a 70/30 split and a 55/45 split but are typically a 60/40 split. Peak directions of travel in the A.M. peak are to the south and east. Peak directions of travel in the P.M. peak are opposite of the A.M. peak with peak travel to the west and north.

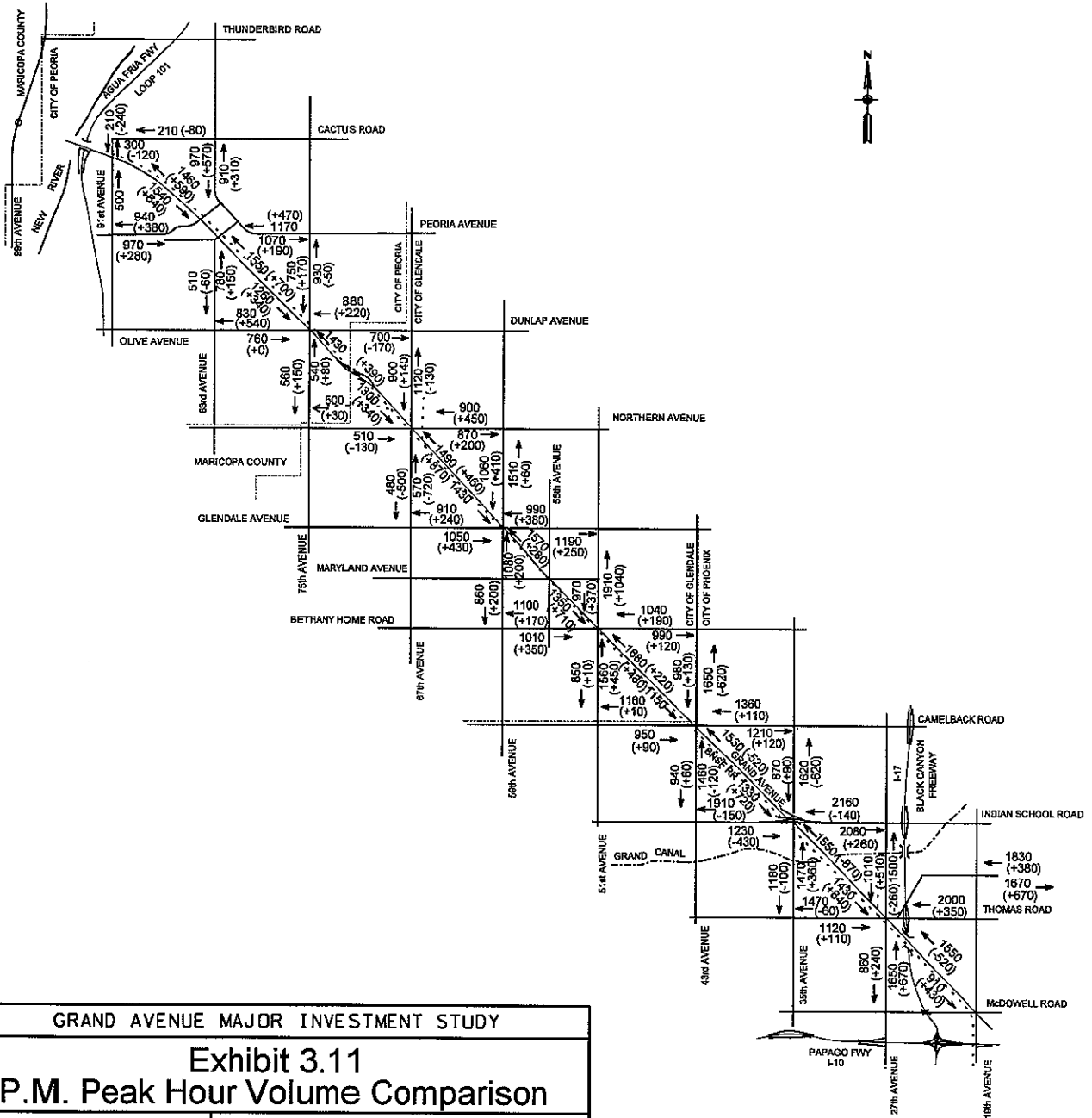
1998 P.M. peak hour traffic volumes were also obtained from the MAG EMME2 model using the J2 socio-economic database. The volumes are shown in Exhibit 3.11. A comparison of P.M. peak hour counts to the model's volumes was made and is also shown in Exhibit 3.11. The volumes from the model were higher than actual counts for most of the study area and in some cases more than double. Some volumes from the model were lower than actual counts. Along Grand Avenue, the model computed volumes in the northwest-bound direction 500 to 900 vehicles less than actual counts in Phoenix, 200 to 500 vehicles higher in Glendale and 600 to 700 vehicles higher in Peoria. In the southeast-bound direction, the model computed volumes 300 to 800 vehicles higher throughout the corridor.

3.3 EXISTING TRAFFIC OPERATING CONDITIONS

3.3.1 Congestion and Level Of Service

Level of service (LOS) is a qualitative measure of the operating conditions of highway facilities. Level of service at intersections is based on delay and ranges from LOS A (zero to minimal delay) to LOS F (breakdown conditions and long delays). LOS E or F represents intersections that are congested and have volume to capacity ratios greater than 0.90. The MAG 1998 EMME2 model using the J2 socio-economic database calculated LOS at intersections along Grand Avenue and at the intersection of major arterial streets within the study area. Exhibit 3.12 shows the P.M. peak-hour LOS at intersections within the study area. All of the six-legged intersections within the study area are congested with a LOS E-F. These six-legged intersections are saturated so future growth will result in longer hours of congestion. The majority of the other major intersections in the study area within Phoenix and Glendale are congested or approaching congestion while most of the intersections in Peoria are uncongested and operate at LOS B or C.

The model was used to calculate volume to capacity ratios for the roadway links between the intersections. Level of service was then determined from the volume to capacity ratios. A volume to capacity ratio over 0.90 represents congested conditions and LOS E or F. Grand Avenue operates at LOS E or F between I-17 and 79th Avenue. Between 79th Avenue and Loop 101, Grand Avenue operates at LOS B or C with a volume to capacity ratio between 0.60 and 0.80.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.11
P.M. Peak Hour Volume Comparison



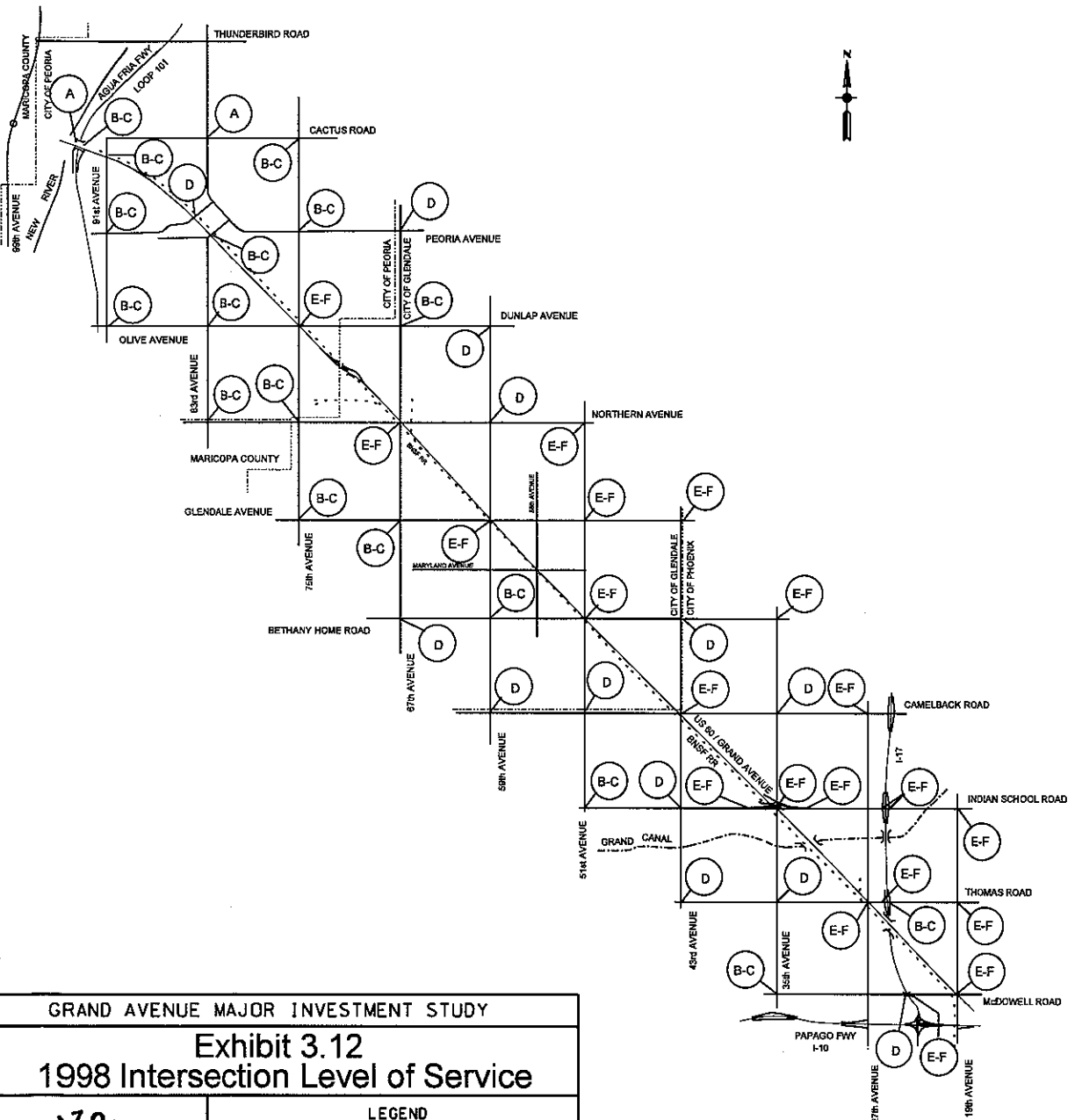
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- 1010 1998 P.M. Peak Hour Volume From MAG Model
- (+350) Volume Difference in P.M. Peak Hour Traffic (Model to Actual)

Source: Maricopa Association of Governments EME2 Model using J2 Socioeconomic Database



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.12
1998 Intersection Level of Service

LEGEND

(B-C) Intersection Level of Service
(1998 P.M. Peak Hour)



URS Greiner Woodward Clyde

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Partners for Strategic Action, Inc.

Source: Maricopa Association of Governments EMME2
Model Using J2 Socioeconomic Database

3.3.2 Travel Time and Speed

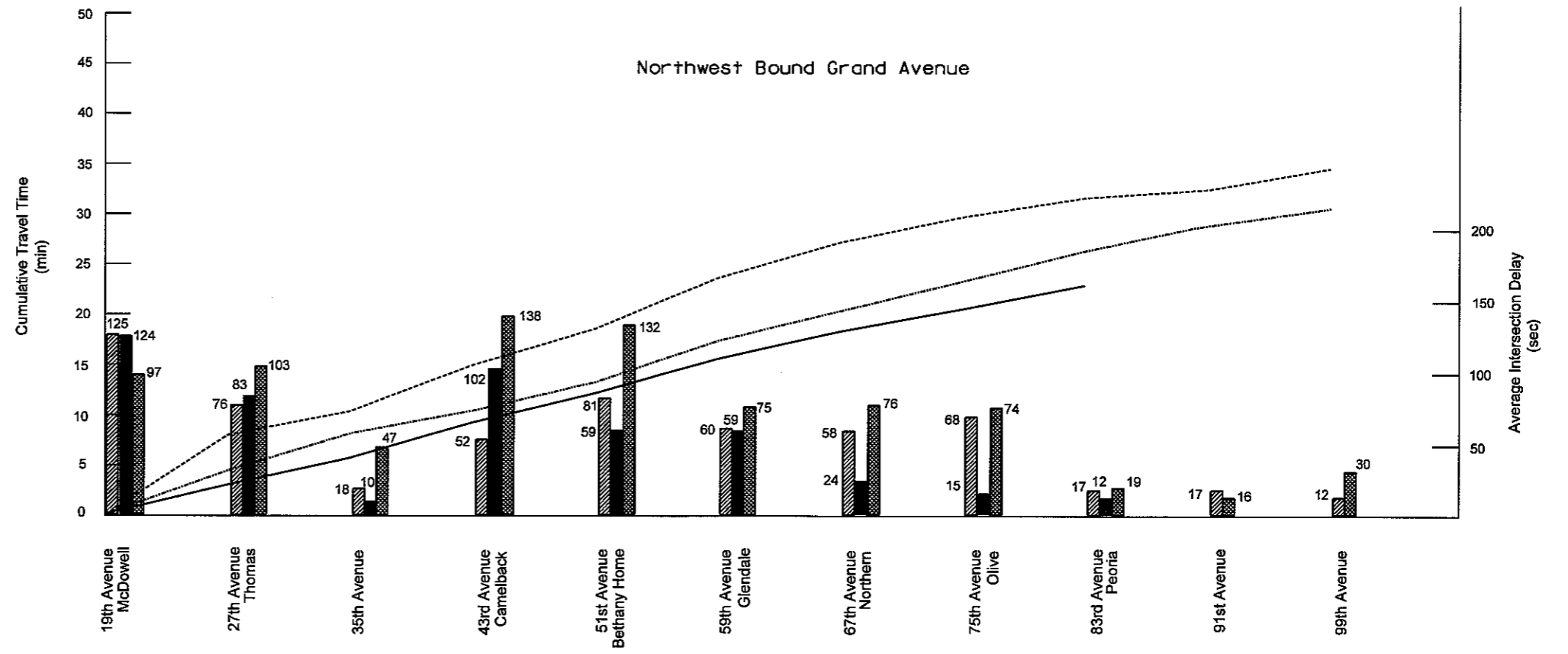
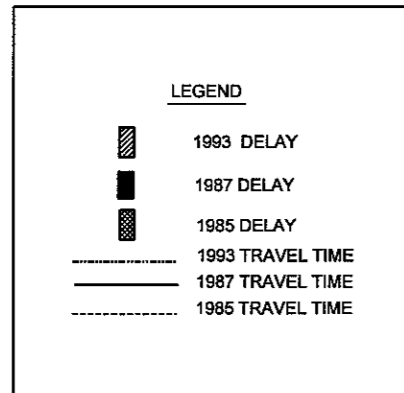
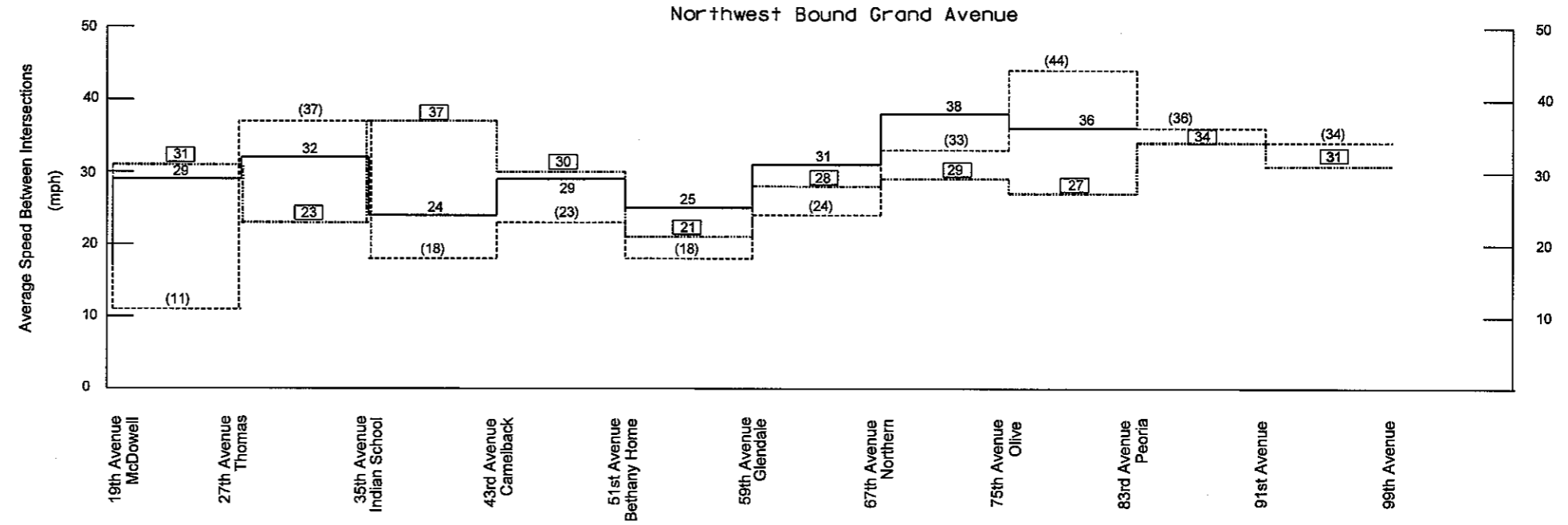
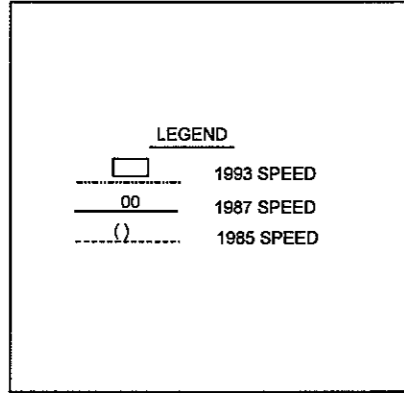
Various sources have documented travel time, speed, and delay along the Grand Avenue Corridor. The various studies were examined to establish a trend in the travel characteristics along the roadway. PBQ&D performed speed and delay studies in 1985 and published their results in the *Grand Avenue Corridor Study* dated September 1986. The exercise was repeated in 1987 by Tudor Engineering Company in their study the *Grand Viaduct Concept*, dated October 1988. The most recent data referenced are 1993 data from the *1993 Study of Travel Speed and Delay in the MAG Region*, dated March 1995 by Lee Engineering. The speed, delay, and travel time for 1985, 1987, and 1993 are plotted graphically on Exhibit 3.13, which shows the P.M. peak-hour data for northwest-bound traffic.

The P.M. peak-hour studies showed that the time to travel from 19th Avenue to 83rd Avenue decreased by about 10 minutes from 1985 to 1987. The 1987 study showed significantly smaller intersection delays than the 1985 study for most of the corridor. The 1985 intersection delays were reduced, presumably by signal phasing improvements. The *1993 Study of Travel Speed and Delay in the MAG Region* appears to show a trend of a slight increase in intersection delay over 1987 intersection delay times at most intersections and, thus, the time to travel between 19th Avenue and 83rd Avenue increased by a few minutes from 1987 to 1993. The study found the highest recurring delay on arterial streets within the Phoenix metropolitan area on Grand Avenue.

The 1993 average travel speeds between intersections along Grand Avenue during the A.M. and P.M. peak hour were 27 and 25 mph, respectively, between I-17 and 67th Avenue. Between 67th Avenue and Loop 101, travel speeds between intersections increased 8 mph for both peak periods. Overall, the travel speeds along Grand Avenue seem to be increasing while delay at signals is also increasing, resulting in minimal travel time changes. The 1993 delay study showed a similar trend throughout the metropolitan area.


Time / delay runs were conducted by Lee Engineering in the spring of 1999 along Grand Avenue between 19th Avenue and 43rd Avenue. Results of the runs are published in the ADOT report *Grand Avenue System Timing Study*, June 1999. The average travel speeds during the A.M. peak were approximately 24 mph in both directions. The average travel speeds during the P.M. peak were approximately 20 mph in northwest-bound direction and 26 mph in the southeast-bound direction. The study also showed that the average number of stops at signalized intersections was three to six stops out of a possible eight signalized intersections.

The City of Glendale conducted a speed study in April and May of 1998 on the arterial streets within the city limits. Spot operating speeds were collected along arterial streets during off-peak periods in an attempt to obtain free-flow speeds. Observed spot speeds along Grand Avenue averaged almost 50 mph. The 85th percentile speed (the speed at which 85% of the drivers are below) was almost 54 mph, 10 mph over the average posted speed limit. Spot operating speeds collected on arterial streets within the study area are shown in Exhibit 3.14. Averages are shown for each street over its full length within the City of Glendale. Results from the speed study showed that as development and access points decrease along a roadway, the average speed increases.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.13
Travel Time, Speed and Delay Diagram



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Source: (1993 Data): 1993 Study Of Travel Speed And Delay
March 1995 By Lee Engineering

Source: (1985 Data): Grand Avenue Corridor Study
September 1986 By Parsons Brinkerhoff Quade and Douglas

Source: (1987 Data): Grand Viaduct Concept
October 1988 By Tudor Engineering Company

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Exhibit 3.14
Average Non-Peak Hour Spot Speeds

Arterial Street ¹	Average Speed ²	85 th Percentile Speed	Posted Speed ³
Grand Avenue (average)	49.47 mph	53.64 mph	43.33 mph
43 rd Avenue to 51 st Avenue	51.80 mph	56.92 mph	45 mph
51 st Avenue to 59 th Avenue	48.71 mph	52.29 mph	40 mph
59 th Avenue to 67 th Avenue	47.90 mph	51.71 mph	45 mph
43 rd Avenue (average)	45.66 mph	48.00 mph	43.00 mph
51 st Avenue (average)	45.34 mph	48.35 mph	41.36 mph
59 th Avenue (average)	44.39 mph	47.37 mph	40 mph
67 th Avenue (average)	44.90 mph	47.96 mph	40 mph
Camelback Road (average)	46.56 mph	50.17 mph	42.14 mph
Bethany Home Road (average)	43.70 mph	46.54 mph	40 mph
Glendale Avenue (average)	46.13 mph	49.65 mph	42.27 mph
Northern Avenue (average)	45.16 mph	48.30 mph	40 mph
Olive Avenue (average)	43.22 mph	45.35 mph	40 mph

Source: City of Glendale Traffic Engineering

¹Averages are shown for each street over its full length within the City of Glendale.

²Average of spot speeds collected by City of Glendale.

³Average of the posted speed along the arterial street.

3.3.3 Stopped Delay

Stopped delay at the major six-legged intersections was determined from queue length data obtained from MAG. Queue lengths were counted from a series of aerial photographs taken in 1997 and 1998. The photographs were taken during the A.M. and P.M. peak periods. Approximately 20 photographs per intersection were used to determine average queue lengths. Queue lengths were counted for both left-turn movements and the through-right turn movements for all six approaches of the intersections. Total stopped delay and average stopped delay were then calculated from the queue lengths. Left-turn average stopped delay was generally higher than through-right turn average stopped delay. The average stopped delay for the corridor is almost 75 seconds per vehicle per intersection during the A.M. peak hour. Average stopped delay at intersections ranged from 59 seconds per vehicle at the 75th / Olive intersection to 104 seconds per vehicle at the 43rd / Camelback intersection.

During the P.M. peak hour average stopped delay for the corridor was 101 seconds per vehicle per intersection and ranged between 76 seconds per vehicle at the 75th / Olive intersection to 132 seconds per vehicle at the 51st / Bethany Home intersection. Queue lengths, total stopped delay and average stopped delay for the A.M. peak hour and the P.M. peak hour are shown in Exhibit 3.15 and Exhibit 3.16, respectively. Queue lengths shown in Exhibits 3.15 and 3.16 may be due in part to train activity.

Exhibit 3.15
A.M. Peak Hour Stopped Delay at Six Legged Intersections

Approach	AM Peak Hour								
	Left Lane				Through-Right Lanes				Approach Total Average Delay1 (Seconds)
	Queue Length (vehicles)	Total Delay1 (Seconds)	Approach Volume (vehicles)	Average Delay1 (Seconds)	Queue Length (vehicles)	Total Delay1 (Seconds)	Approach Volume (vehicles)	Average Delay1 (Seconds)	
Thomas/27th Ave									
Southbound Approach	7	25,200	130	193.8	13	46,800	570	82.1	102.9
Northbound Approach	3	10,800	50	216.0	6	21,600	260	83.1	104.5
Westbound Approach	0	-	0	0.0	7	25,200	840	30.0	30.0
Eastbound Approach	0	-	0	0.0	26	93,600	1000	93.6	93.6
Northwestbound Approach	2	7,200	110	65.5	5	18,000	330	54.5	57.3
Southeastbound Approach	11	39,600	280	141.4	29	104,400	1940	53.8	64.9
Total		82,800	570	145.3		309,600	4940	62.7	71.2
Indian School/35th Ave									
Southbound Approach	10	36,000	320	112.5	18	64,800	1210	53.6	65.9
Northbound Approach	3	10,800	80	135.0	14	50,400	460	109.6	113.3
Westbound Approach	0	-	0	0.0	0	-	0	0.0	0.0
Eastbound Approach	0	-	0	0.0	0	-	0	0.0	0.0
Northwestbound Approach	2	7,200	50	144.0	5	18,000	410	43.9	54.8
Southeastbound Approach	2	7,200	180	40.0	34	122,400	2020	60.6	58.9
Total		61,200	630	97.1		255,600	4100	62.3	67.0
Camelback/43rd Ave									
Southbound Approach	13	46,800	380	123.2	19	68,400	970	70.5	85.3
Northbound Approach	2	7,200	70	102.9	13	46,800	520	90.0	91.5
Westbound Approach	0	-	0	0.0	6	21,600	600	36.0	36.0
Eastbound Approach	0	-	0	0.0	30	108,000	880	122.7	122.7
Northwestbound Approach	3	10,800	80	135.0	7	25,200	390	64.6	76.6
Southeastbound Approach	2	7,200	100	72.0	67	241,200	1640	147.1	142.8
Total		72,000	630	114.3		511,200	5000	102.2	103.6
Bethany Home/51st Ave									
Southbound Approach	12	43,200	320	135.0	31	111,600	690	161.7	153.3
Northbound Approach	2	7,200	360	20.0	9	32,400	760	42.6	35.4
Westbound Approach	1	3,600	130	27.7	10	36,000	490	73.5	63.9
Eastbound Approach	2	7,200	70	102.9	14	50,400	1000	50.4	53.8
Northwestbound Approach	2	7,200	50	144.0	9	32,400	490	66.1	73.3
Southeastbound Approach	4	14,400	80	180.0	39	140,400	1310	107.2	111.4
Total		82,800	1010	82.0		403,200	4740	85.1	84.5
Glendale/59th Ave									
Southbound Approach	4	14,400	160	90.0	16	57,600	750	76.8	79.1
Northbound Approach	1	3,600	80	45.0	8	28,800	610	47.2	47.0
Westbound Approach	1	3,600	40	90.0	4	14,400	230	62.6	66.7
Eastbound Approach	2	7,200	150	48.0	7	25,200	470	53.6	52.3
Northwestbound Approach	1	3,600	60	60.0	8	28,800	490	58.8	58.9
Southeastbound Approach	1	3,600	30	120.0	24	86,400	1240	69.7	70.9
Total		36,000	520	69.2		241,200	3790	63.6	64.3
Northern/67th Ave									
Southbound Approach	8	28,800	340	84.7	17	61,200	1060	57.7	64.3
Northbound Approach	2	7,200	90	80.0	11	39,600	690	57.4	60.0
Westbound Approach	2	7,200	110	65.5	9	32,400	490	66.1	66.0
Eastbound Approach	2	7,200	30	240.0	7	25,200	610	41.3	50.6
Northwestbound Approach	1	3,600	40	90.0	8	28,800	500	57.6	60.0
Southeastbound Approach	4	14,400	110	130.9	21	75,600	970	77.9	83.3
Total		68,400	720	95.0		262,800	4320	60.8	65.7
Olive/75th Avenue									
Southbound Approach	5	18,000	260	69.2	7	25,200	650	38.8	47.5
Northbound Approach	1	3,600	50	72.0	4	14,400	300	48.0	51.4
Westbound Approach	1	3,600	80	45.0	10	36,000	690	52.2	51.4
Eastbound Approach	1	3,600	100	36.0	23	82,800	790	104.8	97.1
Northwestbound Approach	2	7,200	80	90.0	7	25,200	530	47.5	53.1
Southeastbound Approach	3	10,800	150	72.0	8	28,800	700	41.1	46.6
Total		46,800	720	65.0		212,400	3660	58.0	59.2
Grand Total		450,000	4800	93.8		2,196,000	30550	71.9	74.9

1. All delay values are stopped delay.

Source: Maricopa Association of Governments - queue data, 1997-1998.

Exhibit 3.16
P.M. Peak Hour Stopped Delay at Six Legged Intersections

Approach	PM Peak Hour								Approach Total Average Delay1 (Seconds)
	Left Lane				Through-Right Lanes				
	Queue Length (vehicles)	Total Delay1 (Seconds)	Approach Volume (vehicles)	Average Delay1 (Seconds)	Queue Length (vehicles)	Total Delay1 (Seconds)	Approach Volume (vehicles)	Average Delay1 (Seconds)	
Thomas/27th Ave									
Southbound Approach	3	10,800	80	135.0	6	21,600	350	61.7	75.3
Northbound Approach	8	28,800	170	169.4	32	115,200	800	144.0	148.5
Westbound Approach	0	-	0	0.0	40	144,000	1560	92.3	92.3
Eastbound Approach	0	-	0	0.0	14	50,400	1000	50.4	50.4
Northwestbound Approach	4	14,400	150	96.0	35	126,000	1960	64.3	66.5
Southeastbound Approach	8	28,800	160	180.0	6	21,600	430	50.2	85.4
Total		82,800	560	147.9		478,800	6100	78.5	84.3
Indian School/35th Ave									
Southbound Approach	2	7,200	170	42.4	6	21,600	680	31.8	33.9
Northbound Approach	8	28,800	250	115.2	74	266,400	1320	201.8	188.0
Westbound Approach	0	-	0	0.0	0	-	0	0.0	0.0
Eastbound Approach	0	-	0	0.0	0	-	0	0.0	0.0
Northwestbound Approach	2	7,200	110	65.5	62	223,200	2120	105.3	103.3
Southeastbound Approach	1	3,600	120	30.0	10	36,000	640	56.3	52.1
Total		46,800	650	72.0		547,200	4760	115.0	109.8
Camelback/43rd Ave									
Southbound Approach	7	25,200	380	66.3	11	39,600	1170	33.8	41.8
Northbound Approach	5	18,000	150	120.0	77	277,200	1120	247.5	232.4
Westbound Approach	0	-	0	0.0	32	115,200	570	202.1	202.1
Eastbound Approach	0	-	0	0.0	28	100,800	810	124.4	124.4
Northwestbound Approach	5	18,000	190	94.7	54	194,400	1840	105.7	104.6
Southeastbound Approach	2	7,200	90	80.0	9	32,400	550	58.9	61.9
Total		68,400	810	84.4		759,600	6060	125.3	120.5
Bethany Home/51st Ave									
Southbound Approach	5	18,000	70	257.1	21	75,600	340	222.4	228.3
Northbound Approach	6	21,600	120	180.0	47	169,200	1040	162.7	164.5
Westbound Approach	1	3,600	110	32.7	33	118,800	850	139.8	127.5
Eastbound Approach	4	14,400	120	120.0	20	72,000	500	144.0	139.4
Northwestbound Approach	6	21,600	170	127.1	58	208,800	1420	147.0	144.9
Southeastbound Approach	3	10,800	170	63.5	7	25,200	850	29.6	35.3
Total		90,000	760	118.4		669,600	5000	133.9	131.9
Glendale/59th Ave									
Southbound Approach	2	7,200	130	55.4	10	36,000	610	59.0	58.4
Northbound Approach	3	10,800	120	90.0	28	100,800	830	121.4	117.5
Westbound Approach	3	10,800	90	120.0	12	43,200	560	77.1	83.1
Eastbound Approach	3	10,800	130	83.1	9	32,400	470	68.9	72.0
Northwestbound Approach	4	14,400	90	160.0	26	93,600	1180	79.3	85.0
Southeastbound Approach	2	7,200	50	144.0	13	46,800	700	66.9	72.0
Total		61,200	610	100.3		352,800	4350	81.1	83.5
Northern/67th Ave									
Southbound Approach	3	10,800	160	67.5	13	46,800	810	57.8	59.4
Northbound Approach	6	21,600	260	83.1	27	97,200	1050	92.6	90.7
Westbound Approach	8	28,800	160	180.0	13	46,800	620	75.5	96.9
Eastbound Approach	6	21,600	80	270.0	11	39,600	580	68.3	92.7
Northwestbound Approach	5	18,000	90	200.0	51	183,600	1100	166.9	169.4
Southeastbound Approach	2	7,200	200	36.0	12	43,200	750	57.6	53.1
Total		108,000	950	113.7		457,200	4910	93.1	96.5
Olive/75th Avenue									
Southbound Approach	2	7,200	180	40.0	7	25,200	490	51.4	48.4
Northbound Approach	1	3,600	50	72.0	16	57,600	480	120.0	115.5
Westbound Approach	1	3,600	100	36.0	13	46,800	590	79.3	73.0
Eastbound Approach	1	3,600	180	20.0	23	82,800	740	111.9	93.9
Northwestbound Approach	3	10,800	120	90.0	20	72,000	910	79.1	80.4
Southeastbound Approach	5	18,000	210	85.7	10	36,000	780	46.2	54.5
Total		46,800	840	55.7		320,400	3990	80.3	76.0
Grand Total		504,000	5180	97.3		3,585,600	35170	102.0	101.4

1. All delay values are stopped delay.

Source: Maricopa Association of Governments - queue data, 1997-1998.

3.3.4 Train Delay

BNSF operations on the track paralleling Grand Avenue cause additional delay for the cross streets. The flashing warning signals are activated as a train approaches the at-grade railroad crossings. When a train passes through the intersection in Glendale and Peoria, the traffic signal proceeds into a flashing yellow light for traffic on Grand Avenue and a flashing red light for the cross street. In Phoenix, the traffic signal provides green time to the through movement on Grand Avenue and then cycles to other movements that do not cross the railroad tracks when a train passes through a six-legged intersection.

On February 24, 1999, TRA collected vehicle delay due to train crossings at three six-legged intersections along Grand Avenue: 43rd / Camelback, 55th / Maryland, and 67th / Northern. Data were collected between 6:00 A.M. and 12:00 NOON for the east-west street and north-south street that are located southwest of the railroad tracks. During the six-hour period, traffic was interrupted by the train 12 times at the 43rd / Camelback intersection, 14 times at the 55th / Maryland intersection and only once at the 67th / Northern intersection. In most instances, the train interrupted traffic for 60 seconds or less; however, some interruptions lasted 240 seconds (4 minutes).

The average stopped delay at the 43rd / Camelback intersection during train interruptions is shown in Exhibit 3.17. Vehicles on eastbound Camelback Road and northbound 43rd Avenue had an average stopped delay of 167 and 165 seconds per vehicle, respectively, during the six-hour period. During the A.M. peak period (6:00 A.M. to 9:00 A.M.), stopped delay on westbound Camelback Road averaged 220 seconds per vehicle. This was 98 seconds per vehicle greater than the stopped delay shown in Exhibit 3.15 (122 seconds per vehicle) for average A.M. peak period stopped delay on this approach. During the A.M. peak period (6:00 A.M. to 9:00 A.M.), stopped delay on northbound 43rd Avenue averaged 188 seconds per vehicle. This stopped delay was 97 seconds per vehicle greater than the stopped delay shown in Exhibit 3.15 (91 seconds per vehicle) for average A.M. peak period stopped delay on this approach.

The average stopped delay due to the train at the 55th / Maryland intersection and the 67th / Northern intersection is shown in Exhibit 3.18. Vehicles on eastbound Maryland Avenue and northbound 55th Avenue had an average stopped delay of 151 and 148 seconds per vehicle, respectively. Average stopped delay for vehicles on eastbound Northern Avenue was 176 seconds per vehicle while vehicles on northbound 67th Avenue experienced 244 seconds of delay per vehicle. This stopped delay was 110 seconds higher for Northern Avenue and 178 seconds higher for 67th Avenue than the stopped delay shown in Exhibit 3.15. The data collected indicate that train interruptions at the six-legged intersections significantly increase delay at the six-legged intersections.

3.3.5 Accidents

The latest three years of accident data along Grand Avenue were obtained from ADOT and the Cities of Phoenix, Glendale, and Peoria. The data cover the time period between August 1, 1995, and July 31, 1998. A total of 1,572 accidents occurred within the study area over the three-year period. Accidents were classified into three categories: fatal accidents, injury accidents and property damage

Exhibit 3.17
Delay Due to the Train
(Camelback Road/ 43rd Avenue)

Time	Length of Signal Flashing (seconds)	Vehicle Delay (seconds)	Vehicles in Queue	Average Vehicle Delay (seconds/vehicle)	Additional Time for Queue to Clear (seconds)	Additional Delay for Queue to Clear (seconds)	Total Delay ¹ (seconds)	Average Total Delay (seconds/vehicle)
Eastbound Camelback Road								
6:38 AM	60	750	32	23	142	4,064	4,814	150
8:36 AM	90	5,790	107	54	345	24,218	30,008	280
8:53 AM	60	2,670	74	36	280	9,296	11,966	162
9:19 AM	210	2,910	35	83	185	5,880	8,790	251
9:39 AM	60	1,920	40	48	70	2,040	3,960	99
9:55 AM	60	570	15	38	78	1,065	1,635	109
10:34 AM	60	690	23	30	122	2,553	3,243	141
10:50 AM	60	870	21	41	55	945	1,815	86
10:57 AM	60	1,530	33	46	45	957	2,487	75
11:23 AM	90	690	26	27	62	1,300	1,990	77
11:54 AM	90	1,710	29	59	84	2,030	3,740	129
11:57 AM	60	690	21	33	55	945	1,635	78
Total		20,790	456			55,293	76,083	
Northbound 43rd Avenue								
6:38 AM	60	1,080	20	54	140	2,680	3,760	188
8:36 AM	90	2,490	33	75	155	4,785	7,275	220
8:53 AM	60	1,800	36	50	120	3,924	5,724	159
9:19 AM	210	4,860	34	143	95	2,890	7,750	228
9:39 AM	60	660	14	47	100	1,344	2,004	143
9:55 AM	60	720	17	42	110	1,785	2,505	147
10:34 AM	60	510	18	28	100	1,710	2,220	123
10:50 AM	60	570	19	30	90	1,615	2,185	115
10:57 AM	60	870	19	46	105	1,900	2,770	146
11:23 AM	90	540	17	32	90	1,445	1,985	117
11:54 AM	90	1,110	14	79	75	994	2,104	150
11:57 AM	60	300	12	25	100	1,164	1,464	122
Total		15,510	253			26,236	41,746	

1. Total Delay includes delay occurred as the train crossed the intersection and additional delay occurred to clear the standing queue.
Source: URS Greiner Woodward Clyde and Traffic Research Analysis, Inc. (1999)

Exhibit 3.18
Delay Due to the Train
(Maryland Avenue/ 55th Avenue and Northern Avenue/ 67th Avenue)

Time	Length of Signal Flashing (seconds)	Vehicle Delay (seconds)	Vehicles in Queue	Average Vehicle Delay (seconds/vehicle)	Time for Queue to Clear (seconds)	Additional Delay for Queue to Clear (seconds)	Total Delay ¹ (seconds)	Average Total Delay (seconds/vehicle)
Eastbound Maryland Avenue								
7:24 AM	60	540	13	42	130	1,534	2,074	160
8:25 AM	210	1,320	13	102	100	1,144	2,464	190
9:00 AM	90	300	8	38	70	504	804	101
9:06 AM	60	300	6	50	60	330	630	105
9:40 AM	210	3,120	21	149	100	1,680	4,800	229
9:49 AM	120	1,110	13	85	110	1,274	2,384	183
10:03 AM	120	690	9	77	60	468	1,158	129
10:08 AM	120	600	6	100	60	330	930	155
10:18 AM	120	30	3	10	60	174	204	68
10:24 AM	30	-	8	-	70	504	504	63
10:58 AM	10	-	2	-	50	98	98	49
11:03 AM	10	-	2	-	60	118	118	59
11:10 AM	10	-	5	-	65	305	305	61
11:12 AM	10	270	3	90	75	219	489	163
Total		8,280	112			8,682	16,962	
Northbound 55th Avenue								
7:24 AM	180	1,110	10	111	115	1,060	2,170	217
8:25 AM	210	360	4	90	60	228	588	147
9:00 AM	90	390	7	56	60	378	768	110
9:06 AM	150	210	3	70	80	234	444	148
9:40 AM	90	1,410	10	141	116	1,070	2,480	248
9:49 AM	240	630	6	105	57	312	942	157
10:03 AM	180	750	5	150	52	240	990	198
10:08 AM	240	120	6	20	72	402	522	87
10:18 AM	120	150	5	30	65	305	455	91
10:24 AM	90	240	12	20	65	648	888	74
10:58 AM	30	90	3	30	85	249	339	113
11:03 AM	30	240	3	80	53	153	393	131
11:10 AM	150	-	-	-	-	-	-	-
11:12 AM	10	-	-	-	-	-	-	-
Total		5,700	74			5,279	10,979	
Eastbound Northern Avenue								
8:32 AM	240	750	5	150	30		880	176
Northbound 67th Avenue								
8:32 AM	240	12,600	75	168	150		18,300	244

1. Total Delay includes delay occurred as the train crossed the intersection and additional delay occurred to clear the standing queue.
Source: URS Greiner Woodward Clyde and Traffic Research Analysis, Inc. (1999)

accidents. The majority of the accidents, 968 accidents, were property damage only accidents, 601 accidents were injury accidents, and three accidents were fatal.

A summary of the accidents occurring at each of the six-legged intersections is shown in Exhibit 3.19. Accidents within 150 feet of the intersection were considered to occur at the intersection. Almost two-thirds of the accidents on Grand Avenue occurred at the six-legged intersections. Accident rates were calculated for each intersection. The rates were calculated as the number of accidents occurring per million vehicles entering the intersection. The citywide average accident rate for all intersections in the City of Phoenix is 1.4 collisions per million entering vehicles. The average accident rate at the six-legged intersections along Grand Avenue was 1.7 accidents per million entering vehicles. Five of the intersections had accident rates higher than the City of Phoenix average. During the time period analyzed, a total of nine accidents involved vehicles colliding with a train. Two of the accidents occurred at 55th Avenue, three at 51st Avenue and four at 27th Avenue.

Exhibit 3.19
Accidents by Severity on Grand Avenue at Six-Legged Intersections
(8/1/95 to 7/31/98)

Location	Number of Accidents by Severity ¹				Million Vehicles Entering the Intersection (MVEI)	Accidents Rate (Accidents per MVEI)
	Property Damage Only	Injury	Fatal	Total		
83 rd / Peoria	41	17	0	58	48	1.2
75 th / Olive	79	32	0	111	52	2.1
67 th / Northern	76	39	0	115	62	1.9
59 th / Glendale	86	46	0	132	64	2.1
55 th / Maryland	49	20	0	69	~ 40	~ 1.7
51 st / Bethany Home	160	78	0	238	73	3.3
43 rd / Camelback	81	47	0	128	97	1.3
35 th / Indian School	43	34	0	77	65	1.2
27 th / Thomas	62	29	0	91	85	1.1
Total	677	342	0	1019	~ 585	~1.7

1. Accident totals include accidents on all approaches to the intersection. If an accident occurs within approximately 150 feet of the intersection, it is considered to occur at the intersection.

Source: ADOT, City of Phoenix, City of Glendale, City of Peoria

A summary of the accidents occurring along Grand Avenue between the six-legged intersections is shown in Exhibit 3.20. Accident rates were also calculated for these roadway sections. Rates were calculated as the number of accidents per million vehicle miles of travel (VMT). The average accident rate along Grand Avenue between the six-legged intersections was 1.5 accidents per million VMT. This rate is significantly lower than the City of Phoenix citywide average of 5.0 collisions per million VMT.

Exhibit 3.20
Accidents by Severity on Grand Avenue Between Six-Legged Intersections
(8/1/95 to 7/31/98)

Location	Number of Accidents by Severity ¹				Million Vehicle Miles of Travel (MVMT)	Accident Rate (Accidents per MVMT)
	Property Damage Only	Injury	Fatal	Total		
Loop 101 to 83 rd Avenue	37	20	1	58	34	1.7
83 rd Avenue to 75 th Avenue	20	14	0	34	40	0.9
75 th Avenue to 67 th Avenue	16	17	0	33	33	1.0
67 th Avenue to 59 th Avenue	55	59	0	114	34	3.3
59 th Avenue to 55 th Avenue	14	8	0	22	21	1.1
55 th Avenue to 51 st Avenue	12	10	0	22	21	1.1
51 st Avenue to 43 rd Avenue	13	19	0	32	44	0.7
43 rd Avenue to 35 th Avenue	49	34	2	85	53	1.6
35 th Avenue to 27 th Avenue	33	42	0	75	52	1.5
27 th Avenue to I-17	42	36	0	78	34	2.3
Total	291	259	3	553	366.0	1.5

1. Accident totals do not include accidents at the six-legged intersections. If an accident occurs within approximately 150 feet of the intersection, it is considered to occur at the intersection.

Source: ADOT, City of Phoenix, City of Glendale, City of Peoria

As part of a signal coordination project on Grand Avenue, Lee Engineering completed a detailed accident analysis for the six-legged intersections along Grand Avenue between 51st Avenue and 75th Avenue. The study covered a one-year time period from August 1, 1997, through July 31, 1998. Actual police field reports were used in the analysis. The study found that almost one-third of the accidents at the six-legged intersections occurred while the train crossed the intersections and the traffic signals were in flashing mode. The following information, obtained from the draft report titled *Grand Avenue System Timing Study, Group 1 Accident Analysis* dated February 1999, summarizes the impact of the train on accidents at the six-legged intersections.

- Almost one-third of all accidents at intersections within the Grand Avenue Corridor study area (31 out of 103) occurred during the signal flashing operations.
- Almost one-half of the accidents (14 out of 30) at the 51st/ Bethany Home intersection occurred during the signal flashing operations.
- Almost one-half of the accidents (5 out of 11) at the 55th/ Maryland intersection occurred during the signal flashing operations.
- One-fourth of the accidents (3 out of 12) at the 59th/ Glendale intersection occurred during the signal flashing operations.
- One-fifth of the accidents (3 out of 15) at the 67th/ Northern intersection occurred during the signal flashing operations.
- Only 6 out of 35 accidents at the 75th/ Olive intersection occurred during the signal flashing operations.

3.4 EXISTING AND PLANNED MULTI-MODAL FACILITIES AND USAGE

Although the predominant method of travel within the corridor is by private automobile, Grand Avenue is a multi-modal transportation corridor. Local bus service and paratransit service are available within the study area. The corridor also serves pedestrian and bicycle travel. There are short- and long-term plans to enhance the multi-modal facilities within the corridor.

3.4.1 Public Transit Service

Existing Public Bus Service

As Exhibit 3.21 indicates, Valley Metro operates many bus routes through the Grand Avenue Corridor. The Yellow Line is a local route that runs along Grand Avenue from downtown Peoria to 19th Avenue, and then continues to the State Capitol, downtown Phoenix and downtown Tempe. Service operates every 30 minutes on weekdays only, with approximately 1,900 boardings on a typical day. The Yellow Line intersects 11 north-south and east-west routes in the study corridor: Routes 24, 27, 35, 41, 43, 50, 59, 60, 67, 106 and the Green Line. Weekday ridership by route ranges from fewer than 1,000 to nearly 10,000 passengers.

Exhibit 3.21 also provides data on routes that enter the study area without reaching Grand Avenue. Three express routes, Routes 580, 581 and 591, operate non-stop on I-17 between Metrocenter and the State Capitol. A fourth express route, Route 570, provides two A.M. inbound trips and two P.M. outbound trips from Manistee Town Center (at 59th Avenue and Northern Avenue) to central Phoenix via Northern Avenue and I-17. Exhibit 3.22 illustrates all local and express bus services in the study corridor.

The following service improvements affecting the Grand Avenue Corridor were implemented in March 1999:

- New Saturday service on Routes 27, 60 (east of 43rd Avenue only), 67, 80 and 90.
- Extension of Route 60 west from 43rd Avenue to 69th Avenue.

Several routes operate in more than one of the three study area communities. Exhibit 3.23 breaks down weekday and Saturday ridership of these routes by city.

In May 1998, the Yellow Line ranked 22nd out of 56 local routes in daily ridership and 38th in passengers per mile. According to the 1998 *Grand Avenue Corridor Study*, the largest number of Yellow Line boardings and alightings in the corridor occurs at 59th Avenue, followed by 35th, 27th and 43rd Avenues.

Bus stops are typically spaced approximately one-fourth mile apart, and some are equipped with passenger amenities. Of 31 bus stops at major Grand Avenue intersections, 12 have shelters and 8 have unsheltered benches.

Exhibit 3.21
Existing Valley Metro Bus Routes

Route	Weekday Hours	Headway			Weekday Ridership*		Saturday Ridership*	
		Peak	Base	Sat.	Daily	Per Mi	Daily	Per Mi
Routes Along Grand Avenue								
Yellow (Grand)	5:00 A.M.-8:00 P.M.	30	30	—	1,919	1.33	—	—
Routes Intersecting Grand Avenue								
Green (Thomas)	5:00 A.M.-10:00 P.M.	10	20	30	9,910	4.42	3,657	3.23
24 (Glendale)	5:00 A.M.-11:00 P.M.	30	30	60	4,722	3.39	1,902	3.20
27 (27 th Avenue)	5:00 A.M.-7:00 P.M.	30	60	60	2,176	2.73	**	**
35 (35 th Avenue)	5:00 A.M.-9:00 P.M.	30	30	60	4,491	3.16	2,024	2.94
41 (Indian School)	5:00 A.M.-8:00 P.M.	10	20	30	7,891	4.05	3,058	3.30
43 (43 rd Avenue)	5:00 A.M.-10:00 P.M.	30	30	60	**	**	**	**
50 (Camelback)	5:00 A.M.-9:30 P.M.	20	30	45	5,576	3.83	2,346	3.69
59 (59 th Avenue)	6:00 A.M.-7:00 P.M.	30	30	—	1,834	2.41	—	—
60 (Bethany Home)	5:00 A.M.-7:30 P.M.	35	35	—	930	2.31	**	**
67 (67 th Avenue)	6:00 A.M.-7:30 P.M.	60	60	60	944	2.08	**	**
106 (Peoria)	5:00 A.M.-9:00 P.M.	60	60	—	3,069	1.61	—	—
Other Routes Serving 2-Mile Study Corridor								
17 (McDowell / 51 st)	5:00 A.M.-8:30 P.M.	30	30	60	8,138	3.92	3,468	3.08
80 (Northern)	5:00 A.M.-7:00 P.M.	30	30	60	1,077	2.45	**	**
90 (Dunlap / Olive)	5:30 A.M.-7:00 P.M.	30	30	65	1,744	2.07	**	**
122 (Cactus / 39 th)	6:00 A.M.-6:30 P.M.	60	60	60	323	0.93	236	0.68
570 (Glendale)	4 trips / day	30	—	—	84	1.28	—	—
580 (North Mountain)	10 trips / day	20	—	—	249	1.29	—	—
581 (North Mountain)	6 trips / day	30	—	—	155	1.44	—	—
591 (Deer Valley)	4 trips / day	30	—	—	97	1.19	—	—

* Ridership for May 1998.

**New route or new Saturday service in study area.

Sources: Valley Metro BusBook, March 1999; "Phoenix Metropolitan Area Monthly Transit Ridership Report," May 1998.

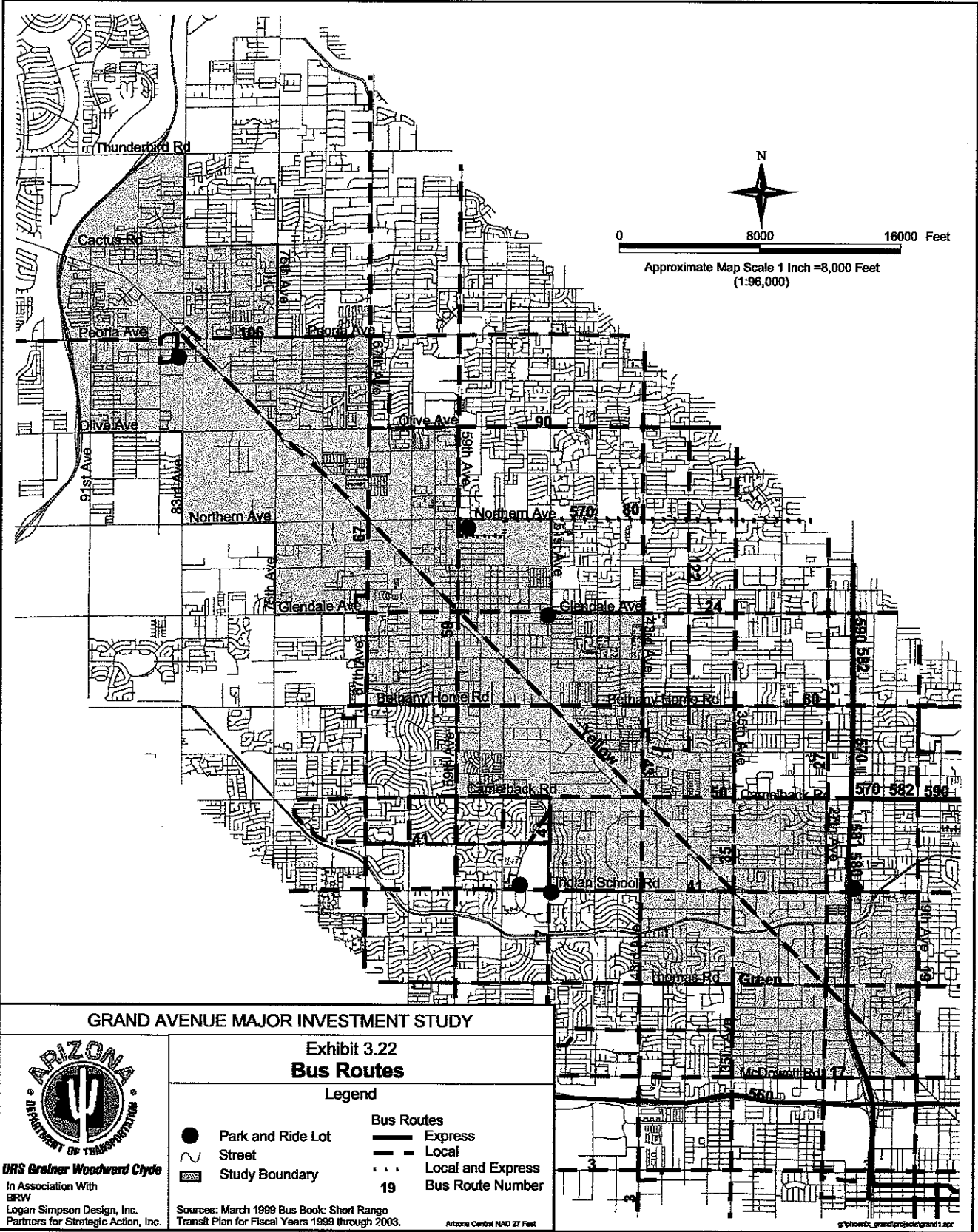


Exhibit 3.23
Bus Route Ridership By Community

Route	Community	Weekday Ridership		Saturday Ridership	
		Daily	Per Mile	Daily	Per Mile
Yellow	Phoenix	1,152	1.37	—	—
	Glendale	293	1.07	—	—
	Peoria	177	1.34	—	—
	Other*	298	1.53	—	—
	Total	1,919	1.33	—	—
24	Phoenix	3,699	3.13	1,467	2.90
	Glendale	1,023	4.85	434	4.96
	Total	4,722	3.39	1,902	3.20
59	Phoenix	646	3.49	—	—
	Glendale	1,188	2.07	—	—
	Total	1,834	2.41	—	—
67	Phoenix	433	2.88	—	—
	Glendale	511	1.68	—	—
	Total	944	2.08	—	—
80	Phoenix	563	1.88	—	—
	Glendale	514	3.66	—	—
	Total	1,077	2.45	—	—
90	Phoenix	1,304	1.81	—	—
	Glendale	440	3.68	—	—
	Total	1,744	2.07	—	—
106	Phoenix	2,315	1.97	**	**
	Glendale	222	1.85	—	—
	Peoria	168	1.03	—	—
	Other*	363	0.81	—	—
	Total	3,069	1.61	**	**
570	Phoenix	77	1.37	—	—
	Glendale	7	0.73	—	—
581	Phoenix	138	1.44	—	—
	Glendale	17	1.41	—	—
	Total	155	1.44	—	—

* Jurisdictions outside the Grand Avenue study area.

**No Saturday service in study area.

Source: "Phoenix Metropolitan Area Monthly Transit Ridership Report," May 1998.

Existing Paratransit Service

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

Exhibit 3.24 lists paratransit systems operating in the study corridor. These services comply with the requirements of the Americans with Disabilities Act (ADA) to provide paratransit service complementary to local bus service for persons certified as ADA eligible. They also serve non-certified elderly and disabled persons and, in some cases, the general public.

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

Exact hours of operation vary by system. Basic weekday operating hours are 7:30 A.M. to 5:00 P.M. in Glendale, 6:00 A.M. to 6:00 P.M. in Peoria, and 7:00 A.M. to 7:00 P.M. in Phoenix. ADA complementary paratransit service has longer hours of operation to match fixed route service. Phoenix provides Saturday service to the elderly and disabled and Sunday service to the general public, while Glendale offers Saturday service to ADA-eligible persons only. ADA service in Peoria and Glendale is restricted to areas within three-fourths mile of fixed route bus service.

The base fare for dial-a-ride service is \$2.00 in both Glendale and Peoria. Phoenix has a zone fare structure, with a base fare of \$2.40 plus \$1.20 per additional zone. All systems charge half-fare for the elderly, disabled and children, except for ADA riders who pay full fare.

Exhibit 3.24 Paratransit Systems Serving Grand Avenue Corridor (FY 1997-98)

System	Eligibility	Vehicles	No. of Annual Boardings
Glendale Dial-a-Ride	General Public	15	67,627
Maricopa County/ American Red Cross	Elderly, Disabled, Low Income	70	125,497
Peoria Dial-a-Ride	General Public	7	42,899
Phoenix Dial-a-Ride	Elderly, Disabled*	70	163,328

*Serves the general public on Sunday and holidays.

Sources: Valley Metro Short Range Transit Plan for Fiscal Years 1999 through 2003; March 1998 BusBook.

Existing Vanpool Service

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

The Valley Metro Vanpool Program provides vans to groups of 8 to 15 commuters throughout the Phoenix metropolitan area, including the Grand Avenue Corridor study area. Passengers share the basic operating cost (fuel, preventative maintenance, etc.) of the van by paying an equitable monthly fee.

Park and Ride Lots

There are three park-and-ride lots in the Grand Avenue study corridor. Two of these facilities are in Glendale and the third in Peoria. The lots are available to transit riders through informal agreements between property owners and Valley Metro that are subject to change on short notice. Exhibit 3.25 lists the locations of the park-and-ride lots and the bus routes that serve each.

Exhibit 3.25
Park-and-Ride Lots

Location	Routes Designated	Spaces	Typical Occupancy
Southwest Supermarket, 51 st Avenue / Glendale	24	10	0
Manistee Town Center, 59 th Avenue / Northern	59, 80, 570	35	5
Peoria Community Center, 84 th Avenue / Jefferson	Yellow	25	31

Sources: March 1999 BusBook; "Park-and-Ride Utilization Report Ending December, 1998."

Programmed and Planned Transit Improvements

Exhibit 3.26 lists planned operating improvements in the *Valley Metro Short Range Transit Plan* for fiscal years 1999-2003. All improvements affecting the Grand Avenue study area are planned for fiscal year 1999. No capital projects specific to the Grand Avenue Corridor are programmed for the next five years.

Exhibit 3.26
Planned Transit Operating Improvements: FY 1999-2003

Jurisdiction	Planned Operating Improvement
City of Glendale	Implement central Glendale circulator demonstration route.
	Provide additional trips and/or service hours for fixed routes and paratransit services.
Maricopa County	Implement Work Links project to provide brokered transportation services to eligible citizens throughout the County.
City of Phoenix	Provide up to 12 additional trips (systemwide) to help alleviate overcrowding. Increase dial-a-ride service by an average of 25 vehicle hours per day.

Source: Valley Metro Short Range Transit Plan (1999-2003).

Long-range transit plans for the Phoenix metropolitan area, which would require a dedicated funding source for implementation, call for frequent daytime and evening local bus service seven days a week, plus an expanded dial-a-ride system that crosses jurisdictional boundaries. *The MAG Long-Range Transportation Plan and 1999 Update* calls for nearly tripling bus service after dedicated funding is acquired, as well as doubling paratransit service by 2010 and tripling paratransit service by 2020. Bus routes would be added on arterial streets that currently lack service, including several that cross Grand Avenue. Arterial streets within the corridor for which service could be added or extended include 51st, 75th, 83rd, 91st, Northern and Olive Avenues, as well as Grand Avenue northwest of downtown Peoria. New express routes and expanded hours of express service would also be implemented.

Valley Metro has been engaged in several Regional Transit System Corridor Studies since 1996. These regional planning efforts resulted in the recommendation of the Phoenix / East Valley Corridor as the highest priority corridor for high-capacity transit in the Phoenix metropolitan area. This corridor, which is currently the subject of a Draft Environmental Impact Statement / Preliminary Engineering, extends from Chris-Town Mall to downtown Mesa via Central Avenue, downtown Phoenix, the Sky Harbor area, downtown Tempe and Arizona State University. Light rail transit (LRT) was selected as the preferred transit technology for this corridor.

The recently completed *Phoenix / Glendale Major Investment Study* considered future extensions of this high-capacity transit corridor to the north and west of Chris-Town. Like the *Phoenix / East Valley MIS*, this study recommended LRT as the preferred technology. Two alignments were recommended for more detailed planning and development:

- 1) Chris-Town to Metrocenter Mall via 19th Avenue
- 2) Chris-Town to downtown Glendale via 19th and Glendale Avenues

The route to downtown Glendale would provide a rapid transit connection between a key activity center in the Grand Avenue Corridor and major regional destinations in Phoenix, Tempe and Mesa. The precise routing of an LRT line in downtown Glendale, as well as its terminus in or near downtown Glendale, will need to be determined in subsequent studies. Alternatives to be considered would include the following:

- An LRT couplet along Glenn Drive and Lamar Road
- Development of transit facilities and link to the Sugar Beet Factory at 52nd / Lamar Road
- Connection to the multi-modal transit center tentatively planned in the vicinity of Grand Avenue / Lamar Road

3.4.2 Non-Motorized Transportation Facilities

The following types of facilities for cyclists and pedestrians exist or are planned in the Grand Avenue study corridor:

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

Existing Facilities

Exhibit 3.27 lists existing bikeways and trails that cross Grand Avenue or enter the study corridor. These facilities include bike lanes, signed bike routes and multi-use paths on the banks of the Grand Canal, which crosses the corridor northwest of Osborn Road.

Programmed and Planned Facilities

Only two bicycle and pedestrian improvements other than sidewalks are programmed for construction during the next five years (see Exhibit 3.28). Both are City of Glendale projects.

Exhibit 3.29 lists planned bikeways and trails in Phoenix, Glendale and Peoria. These facilities appear on adopted plans but are not necessarily programmed for construction. All of the listed facilities except multi-use paths are on-street. Existing and planned non-motorized routes are illustrated in Exhibit 3.30.

**Exhibit 3.27
Existing Bikeways and Trails**

Location	Facility Type	City
Facilities that Cross Grand Avenue		
Grand Canal	Multi-Use Paths	Phoenix
Maryland Avenue	Bike Lanes	Glendale
61 st Avenue	Undesignated*	Glendale
Other Facilities Entering Corridor		
Osborn Road, 35 th -47 th Avenue	Bike Lanes	Phoenix
31 st Avenue, Indian School-Camelback Road	Bike Lanes	Phoenix
37 th Ave, Campbell-Missouri Avenue	Bike Lanes	Phoenix
Campbell Avenue, 27 th -35 th Avenue	Bike Lanes	Phoenix
Marshall / Missouri Avenue, 47 th -43 rd Avenue	Bike Route	Glendale
47 th Avenue, Marshall Avenue-Arizona Canal	Bike Lanes	Glendale
63 rd Avenue, Northern-Peoria Avenue	Bike Lanes	Glendale
63 rd Avenue, Glendale Avenue-Camelback Road	Bike Lanes	Glendale
71 st Avenue, Olive-Peoria Avenue	Bike Lanes	Peoria
79 th Avenue, Peoria-Sweetwater Avenue	Bike Lanes	Peoria
84 th Avenue, Monroe Street-Peoria Avenue	Bike Route	Peoria
Monroe Street, 83 rd -87 th Avenue	Bike Route	Peoria
87 th Avenue, Monroe Street-Butler Drive	Bike Route	Peoria
Varney Lane / Cholla Street, 87 th -49 th Avenue	Bike Lanes	Peoria / Glendale

*Popular on-street connector to designated bicycle facilities.

Sources: "Bikeways in the Phoenix Metropolitan Area" (MAG, 1997); Glendale Bicycle Map; MAG Regional Bicycle Plan (revised January 1999).

**Exhibit 3.28
Programmed Bicycle / Pedestrian Improvements
1999-2003**

Location	Description	Year	Cost
Grand Avenue / 43 rd Avenue	Construct pedestrian and bike improvements and artwork	1999	\$456,000
Glendale Avenue, 67 th -115 th Avenue	Widen street for bicycle lanes.	2000	\$300,000

Source: MAG Transportation Improvement Program (FY 1999-2003), August 1998.

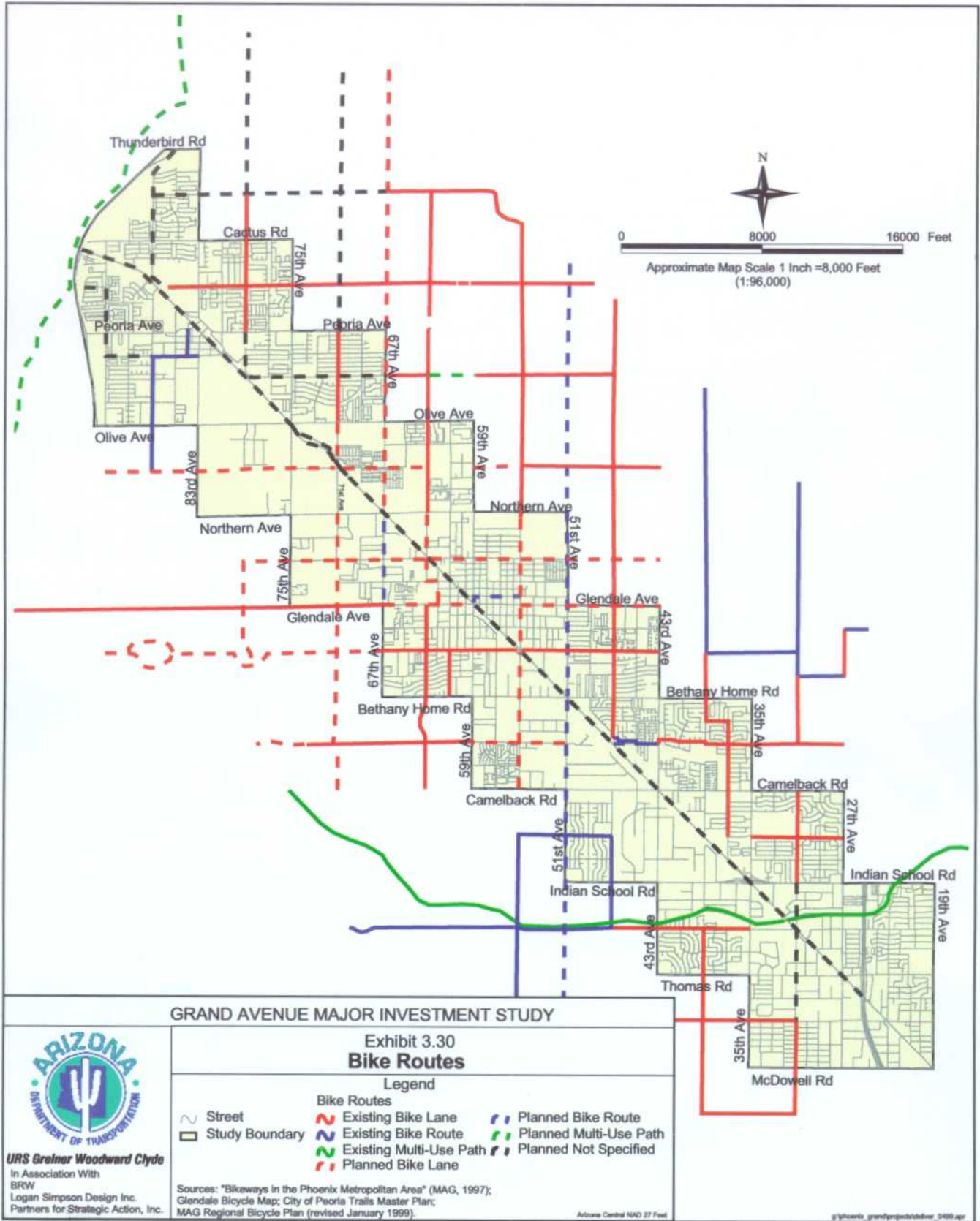
Exhibit 3.29
Planned Bikeways and Trails

Location	Facility Type	City
Within Grand Avenue Right-of-Way		
I-17 to 43 rd Avenue*	Unclassified	Phoenix
43 rd Avenue to 75 th Avenue	Unclassified	Glendale / Peoria
75 th Avenue to SR 101L*	Unclassified	Peoria
Facilities that Cross Grand Avenue		
31 st Avenue, Indian School-Encanto Boulevard*	Unclassified	Phoenix
51 st Avenue*	Bike Route	Glendale
55 th Avenue, Cactus-Camelback Road	Bike Lanes	Glendale
Glendale Avenue / 59 th Avenue / Glenn Drive	Bike Lanes**	Glendale
Orangewood Avenue, 79 th -43 rd Avenue	Bike Lanes	Glendale
63 rd Avenue, Northern-Myrtle Avenue	Bike Lanes	Glendale
67 th Avenue, Glendale Avenue-Pinnacle Peak*	Varies	Glendale / Peoria
Butler Drive, 63 rd -91 st Avenue	Bike Lanes	Glendale / Peoria
New River	Multi-Use Path	Peoria
Facilities that End at Grand Avenue		
Missouri Avenue, Grand-45 th Avenue	Bike Route	Glendale
71 st Avenue, Butler Drive-Olive Avenue	Bike Lanes	Peoria
Other Facilities Entering Corridor		
Missouri Avenue, 51 st Avenue-Grand Canal	Bike Lanes	Glendale
Glendale Avenue, 55 th -43 rd Avenue	Bike Lanes	Glendale
71 st Avenue, Northern Avenue-Camelback Road	Bike Lanes	Glendale
79 th Avenue / Railroad Frontage / Mountain View	Undetermined	Peoria
87 th Avenue / Railroad Frontage / Varney Lane	Undetermined	Peoria
Monroe Street, 87 th -91 st Avenue	Undetermined	Peoria
91 st Avenue, Monroe Street-Cholla Street	Undetermined	Peoria
Cholla Street, 91 st Avenue-SR 101L	Undetermined	Peoria

*Facility recommended in MAG Regional Bicycle Plan that is “not on local plans.”

**Bike Route (no striping) on 59th Avenue and Glenn Drive, northeast of Grand.

Sources: Glendale Bicycle Map; City of Peoria Trails Master Plan; MAG Regional Bicycle Plan (revised January 1999).



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Impediments to Non-Motorized Travel

Because of its traffic volume, width, distance between signalized intersections, and limited access across the railroad tracks, Grand Avenue constitutes a major barrier to non-motorized travel across the corridor. Exhibit 3.31 lists significant impediments to existing and planned bikeways and multi-use paths.

Exhibit 3.31
Existing Impediments to Non-Motorized Travel

Facility	Impediment
Grand Canal multi-use path	Nearest signalized crossing is over 800 feet away at 31 st Avenue.
Indian School Road overpass	Pedestrians and bicycles not permitted on bridge; detour required to cross Grand Avenue.
47 th Avenue bike lanes	No crossing to/from southwest side of Grand Avenue; no access across railroad.
Missouri Avenue bike route / lanes	No connection across corridor between existing and planned facilities to east and west.
63 rd Avenue bike lanes (planned)	No signalized crossing of Grand Avenue or access across railroad.
Orangewood Avenue bike lanes (planned)	No signalized crossing of Grand Avenue or access across railroad.
Butler Drive bike lanes (planned)	No signalized crossing of Grand Avenue or access across railroad.
71 st Avenue bike lanes (planned)	No connection across corridor between planned facilities to north and south.
79 th Avenue bikeway (planned)	No crossing to/from southwest side of Grand Avenue or across railroad.
Varney Lane bike lanes	No crossing to/from southwest side of Grand Avenue or across railroad.
87 th Avenue bikeway (planned)	No crossing to/from southwest side of Grand Avenue or across railroad.
Grand Avenue bikeway (planned)	No direct at-grade access to Indian School Road.

Source: BRW, Inc., February 1999.

3.4.3 Pedestrian Facilities And Restrictions

Much of Grand Avenue is bordered by industrial or undeveloped land that generates minimal pedestrian activity. Extensive retail uses, which are associated with higher levels of pedestrian activity, exist in downtown Glendale, downtown Peoria, and the area within one-half mile of 35th / Indian School intersection (especially east of 35th Avenue and south of Indian School Road). They

also exist to a lesser extent near the 27th / Thomas intersection and on the east side of the 43rd / Camelback intersection. Neighborhood retail establishments within walking distance of residential areas exist at several locations, such as the northeast quadrant of the 35th / Grand intersection and Glendale Avenue west of Grand Avenue. The only truly pedestrian oriented development within the corridor, however, is downtown Glendale with its many boutiques, restaurants, offices, City Hall, Murphy Park and a branch library. Access to and from downtown Glendale, with its ample free parking and limited transit service, is primarily by automobile, but substantial pedestrian traffic circulates within the downtown, especially during special events. Grand Avenue sharply divides the traditional downtown from the neighborhoods to the west, so the pedestrian oriented district is confined to the northeast side.

Aside from these impediments to users of specific bikeways and multi-use paths, the six-leg arterial intersections are not pedestrian friendly environments. Pedestrians crossing at these locations face the following challenges:

- Curb-to-curb crossing distances are often long, and intermediate pedestrian refuges on raised islands are provided in only a few instances.
- Although pedestrian buttons are provided, the WALK indication typically appears for a short time. In some cases, a slow-moving pedestrian (e.g., an elderly or disabled person) may have difficulty reaching the curb within the available crossing time.
- Waits for a given WALK indication are often long. If crossing of two or more streets is required, it may take several minutes to traverse the intersection.
- The correct button for the desired movement may be difficult to find. The buttons embedded in columns at the 35th Avenue / Indian School Road intersection are examples.
- The pedestrian environment is confusing and guidance is poor. Long waits for a WALK indication tempt pedestrians to cross during DON'T WALK periods when conflicting traffic appears to be absent. These appearances can be deceiving because of the complexity of the signal operations.
- The most difficult intersections for pedestrians are 27th / Thomas and 43rd / Camelback. Reasons include the intersection design, heavy traffic volumes and additional conflicts due to vehicle turns into and out of adjacent businesses. The 59th / Glendale intersection is more pedestrian friendly due to the narrow width of Glendale Avenue. Pedestrian crossing volumes at 67th / Northern and 75th / Olive intersections appear to be lower than in Phoenix and downtown Glendale.
- The same conditions that create problems for pedestrians in general also affect transit riders. Passengers transferring from one route to another must often cross more than one street to reach their bus stop. This problem could be mitigated by providing both near and far side bus stops at six-leg intersections, but in the majority of cases only far side stops exist.

- Pedestrians and cyclists face special barriers at the 35th / Grand intersection. Neither the Indian School Road overpass nor the ramp from westbound Indian School Road to northwest-bound Grand Avenue accommodates pedestrians, resulting in long and circuitous routing to cross the Grand Avenue Corridor in an east-west direction. Moreover, the 35th / Grand intersection is not much easier to negotiate than the other six-leg intersections along Grand Avenue. Transit riders face special problems in transferring to or from Route 41 (Indian School). The nearest eastbound and westbound bus stops are several blocks away at 33rd and 39th Avenues. There is no provision for buses to leave the Indian School Road mainline to load or unload passengers at the 35th / Grand intersection.

3.4.4 Rail Facilities and Services

The BNSF parallels and adjoins Grand Avenue through the study area. The tracks are located northeast of Grand Avenue between Loop 101 and 75th Avenue. Just east of 75th Avenue, the railroad passes under the southeast-bound lanes and over the northwest-bound lanes to the southwest side of Grand Avenue. The railroad remains on the southwest side of Grand Avenue to 19th Avenue.

At each multi-legged intersection along Grand, the railroad crosses at least one leg of the intersection at-grade. (The only grade separated railroad crossing in the study area is the Indian School Road overpass.) Two spur tracks cross Grand Avenue at grade: one near 28th Avenue and another near 65th Avenue. Other spurs, which do not cross Grand Avenue, serve the western portion of the corridor north of Camelback Road and north of Northern Avenue.

The BNSF line paralleling Grand Avenue is a very active facility that plays a key role in the Phoenix area's freight transportation system. The line currently carries approximately 13 million tons of freight per year on ten trains per day between Wickenburg and Glendale. Southeast of Glendale Avenue, the amount of freight carried drops to 8 million tons, but the number of daily trains increases to 14 because of switching operations. Although specific traffic forecasts are not available, freight volumes carried by this line are expected to increase as Maricopa County continues its growth. The Grand Avenue route provides the only rail connection with the BNSF transcontinental mainline through Flagstaff, which carries approximately 140 million tons per year. The line also connects with the Union Pacific Railroad in central Phoenix, although more than 95% of Grand Avenue trains originate or terminate in the Phoenix market.

BNSF has two active intermodal facilities within the study corridor. Switching and other train operations, and therefore impacts on roadway grade crossings, are concentrated near these facilities. The Glendale Auto Yard is located at 5090 West Camelback Road (approximately one mile west of 43rd and Grand Avenues) and comprises 25 acres. Two tracks serve the facility, which has a storage capacity of 1,900 autos. The Yard handles (as of 1994) 1,300 autos per year on an as-needed basis. This yard supplements the newer and much larger El Mirage Auto Distribution Facility.

The Glendale Intermodal (Trailer on Flat Car) Yard is located at 5281 Tom Murray Avenue, between Bethany Home Road and Glendale Avenue. This 38-acre facility was constructed in 1980 and last upgraded in 1990. It has two intermodal tracks with 50 railcar spots. The yard includes warehousing, two translifts, two portable end load ramps and a permanent end load ramp. It operates 24 hours a

day, 363 days a year, with two traffic lanes on Tom Murray Avenue to access the facility. There is no land available for expansion of this yard to meet rising demand.

In addition, the old Glendale Freight Yard is located in central Glendale between Glenn Drive and Palmyra Avenue. This facility is currently inactive.

3.5 INTELLIGENT TRANSPORTATION SYSTEMS

The *Maricopa County 2020 Eye to the Future Transportation System Plan* (December 17, 1997) defines the AZTech Model Deployment Initiative as a seven-year project (two-year implementation and five-year operation) to develop an integrated intelligent transportation system for the Phoenix metropolitan area. AZTech has been developed as a partnership between the public and private sectors. AZTech's goal is to produce freeway and arterial street networks that are safer and more efficient for the traveling public. Its objectives are to integrate the existing transportation technology components into a regional system, establish a regional integrated traveler information system, and expand the transportation management system.

Grand Avenue from Van Buren Street to Bell Road is one of eight "Smart Corridors" where AZTech will implement enhanced traffic detection, data collection and signal control. Another of the designated Smart Corridors, Glendale Avenue, crosses the Grand Avenue Corridor on an east-west alignment. These corridors were selected on the basis of the following criteria:

- Location within AZTech partner jurisdictions
- Proximity to congested freeway segments
- Cross-jurisdictional linkages
- Traffic congestion
- Continuity within the metropolitan area

Smart Corridors will have many of the following new or enhanced elements:

- Cross-jurisdictional traffic signal coordination
- Upgraded traffic signal systems
- Additional and upgraded traffic detectors to add data collection capabilities
- Additional video traffic monitors
- Distributed control of traffic signal systems from local traffic operation centers
- Additional variable message signs
- Local traffic operation centers linked to the AZTech data server
- Proactive, optimized corridor signal control
- Real-time traffic data collection and distribution on the AZTech data server

Several of these elements are in place or under way in the study corridor. ADOT has systematically upgraded the traffic signal systems at the major six-legged intersections with advanced controllers that allow up to 12 signal phases, four more than could be accommodated by older technology. At least five loop detectors have been installed and a total of 12 are planned. In addition, a study to

improve signal coordination along Grand Avenue between Van Buren Street in Phoenix and Primrose Street in El Mirage also occurred. The study found that to improve signal progression opportunities along the section of Grand Avenue with the six-legged intersections, left turns would need to be prohibited from the east-west arterial streets at these intersections. The current decision is to not eliminate these left-turn movements and use the existing coordination plans providing progression for the peak direction of travel.

3.6 PROPERTY BOUNDARIES

Property boundaries within the study area were identified utilizing Maricopa County property assessor maps and Geographic Information System (GIS) files obtained from the City of Phoenix. Parcel lines were mapped on the aerial photography base files. A notebook of assessor maps and property ownerships was created. Parcel lines were mapped for only the areas along Grand Avenue and the cross-streets where proposed geometric improvements are being analyzed. In addition, properties owned by ADOT or the State of Arizona were noted on the drawings.

3.7 FUTURE CONDITIONS

3.7.1 Future Volumes

The traffic forecasts for the Grand Avenue MIS were prepared by the MAG Transportation and Planning Office utilizing the EMME2 regional computerized traffic forecasting model. The model was run in May 1999 simulating the 2020 traffic volumes along Grand Avenue. Three model runs were made. These runs include a base conditions run (no improvements to Grand Avenue) and runs representing the grade separations and other improvements proposed in Option 4 and Option 5. The two options are presented and discussed in Chapter 6. Common to all three model runs were express bus service on Grand Avenue, LRT service to downtown Glendale, and planned roadway improvements in the MAG Long-Range Transportation Plan.

The predicted change in daily volume along Grand Avenue is based on a comparison of the 1998 model and the 2020 forecasts. Since the comparison is based on two model runs, the basic inaccuracies of the model should be generally eliminated. The predicted change in daily weekday traffic volume is shown in Exhibit 3.32. From historic traffic volumes, it appears that the capacity of Grand Avenue is approximately 35,000 vehicles per day, which is significantly lower than the 45,000 to 50,000 vehicles per day observed on some arterial streets within the Phoenix metropolitan area. Because existing traffic volumes approach this capacity, only a modest increase in traffic volume is expected over the 22-year period with no improvements on Grand Avenue. The largest traffic increase is predicted to be in Peoria where the most new urban development is expected and capacity on Grand Avenue is not restricted by the six-legged intersections. Traffic volumes on Grand Avenue in Glendale and Phoenix are expected to remain constant. The second largest traffic increase is predicted for the portion from I-17 to downtown Phoenix. Traffic volumes on the arterial streets that cross Grand Avenue also show large predicted increases in Peoria and modest increases in Glendale and Phoenix.

Exhibit 3.32
Predicted Traffic Volume Change on
Grand Avenue with the Current Plan

<i>Location</i>	<i>1998 Model Estimate</i>	<i>2020 Base Conditions Model Forecast</i>	<i>1998 to 2020 Change</i>	<i>Percent Change 1998-2020</i>
SR 101 to 91 st Avenue	31,100	44,400	13,300	43%
91 st Avenue to Peoria Avenue	33,700	39,500	5,800	17%
Peoria Avenue to 83 rd Avenue	39,000	48,300	9,300	24%
83 rd Avenue to 75 th Avenue	33,400	36,100	2,700	8%
75 th Avenue to 67 th Avenue	33,300	33,400	100	0%
67 th Avenue to 59 th Avenue	33,600	33,300	-300	-1%
59 th Avenue to 51 st Avenue	34,000	34,000	0	0%
51 st Avenue to 43 rd Avenue	33,800	34,700	900	3%
43 rd Avenue to 35 th Avenue	32,700	34,500	1,800	6%
35 th Avenue to 27 th Avenue	36,200	34,800	-1,400	-4%
27 th Avenue to 19 th Avenue	28,500	32,700	4,200	15%

Source: MAG EMM2 Model Runs using J2 socio-economic database.

As previously discussed, the model tends to overestimate traffic on Grand Avenue. The model also tends to overestimate east-west traffic in the western and central part of the West Valley and to underestimate traffic in the eastern part of the West Valley. The difference between the model and the actual counts for 1998 volumes was shown in Exhibit 3.9 as the volume difference and the percentage difference. The predicted traffic volumes for 2020 from the three model runs were adjusted to account for this difference by subtracting the difference in volume from the 1998 model run and 1998 actual counts.

A comparison of the daily weekday traffic volumes along Grand Avenue for the three model runs is shown in Exhibit 3.33. Through Glendale and Phoenix, traffic volumes are expected to be 15,000 to 20,000 vehicles per day higher along Grand Avenue under Option 4 than under 2020 base conditions. Daily weekday traffic volumes are expected to reach 56,700 vehicles per day under Option 4. Traffic volumes are expected to be 20,000 to 35,000 vehicles per day higher under Option 5 than under 2020 base conditions. Daily traffic volumes are expected to reach 66,600 vehicles per day under Option 5. The adjusted volumes for the 2020 base condition are shown in Exhibit 3.34. Adjusted volumes for 2020 under Option 4 and Option 5 are shown in Exhibits 3.35 and 3.36, respectively. Exhibit 3.37 summarizes the daily weekday traffic volumes that each

overpass is expected to carry in Option 4. Exhibit 3.38 summarizes the daily weekday traffic volumes that each overpass is expected to carry in Option 5.

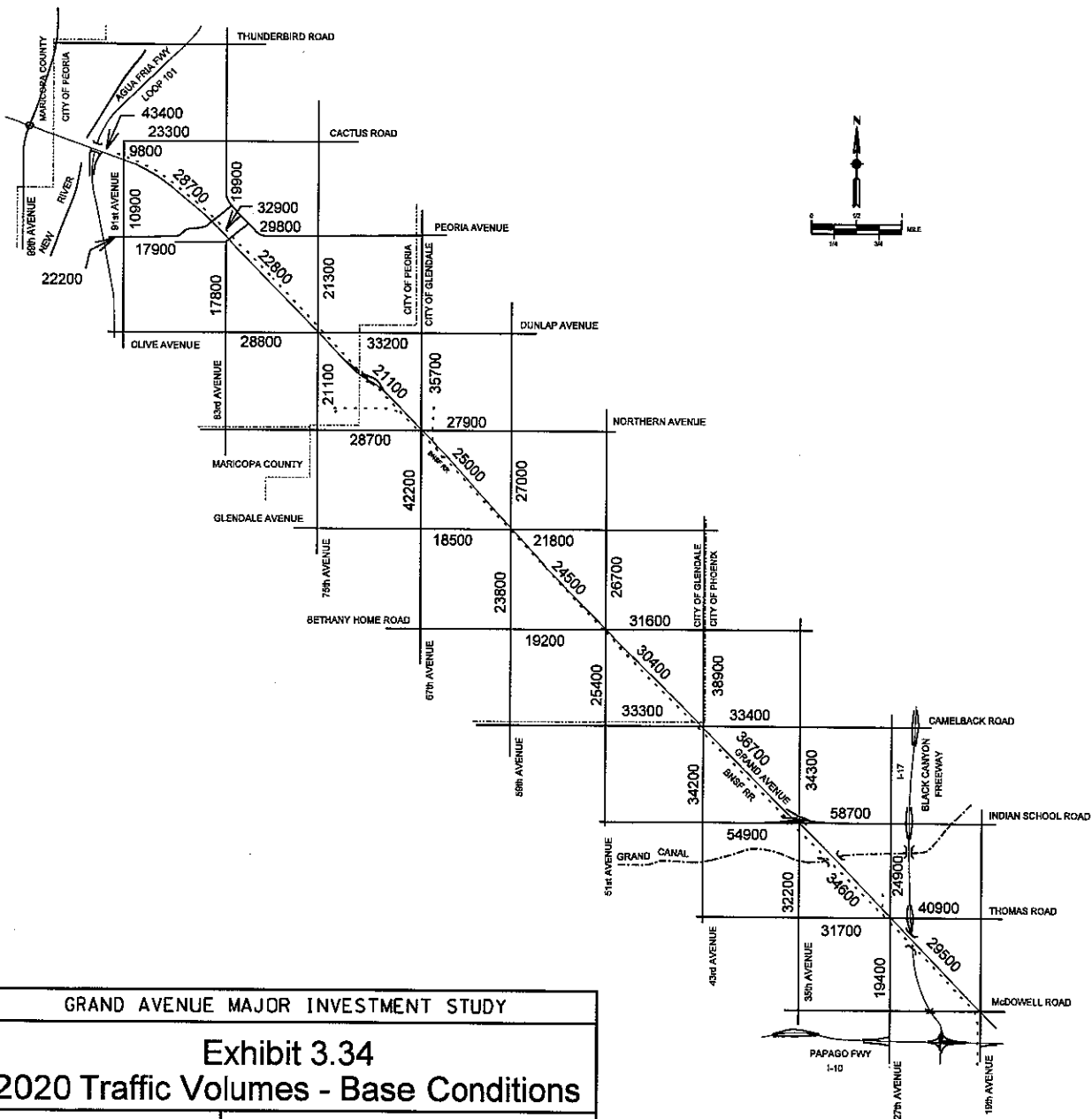
Exhibit 3.33
Adjusted Daily Weekday Traffic Volumes for 2020 Along Grand Avenue

<i>Location</i>	<i>2020 Base Conditions</i>	<i>2020 Option 4</i>	<i>2020 Option 5</i>
SR 101 to 91 st Avenue	43,400	45,900	48,300
91 st Avenue to Peoria Avenue	28,700	29,800	31,600
Peoria Avenue to 83 rd Avenue	32,900	35,500	38,400
83 rd Avenue to 75 th Avenue	22,800	32,900	40,700
75 th Avenue to 67 th Avenue	21,100	35,500	50,400
67 th Avenue to 59 th Avenue	24,700	43,200	61,700
59 th Avenue to 51 st Avenue	24,500	41,400	58,700
51 st Avenue to 43 rd Avenue	30,400	47,300	66,600
43 rd Avenue to 35 th Avenue	36,700	56,700	66,000
35 th Avenue to 27 th Avenue	34,600	49,500	54,400
27 th Avenue to 19 th Avenue	29,500	42,700	43,100

Source: MAG EMME2 Model Runs using J2 socio-economic database.

3.7.2 Future Level of Service

The MAG EMME2 model using the J2 socio-economic database calculated 2020 P.M. peak hour LOS at intersections along Grand Avenue and at the intersection of major arterial streets within the study area for the 2020 base case and both options. Exhibits 3.39, 3.40 and 3.41 show the P.M. peak-hour LOS at intersections within the study area for the 2020 base case, Option 4 and Option 5, respectively. A comparison of the three runs is provided in Section 8.2.7 of Chapter 8. Many of the intersections (especially in Peoria) that are not congested today are expected to become congested by 2020 and operate at a poorer LOS.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.34
2020 Traffic Volumes - Base Conditions



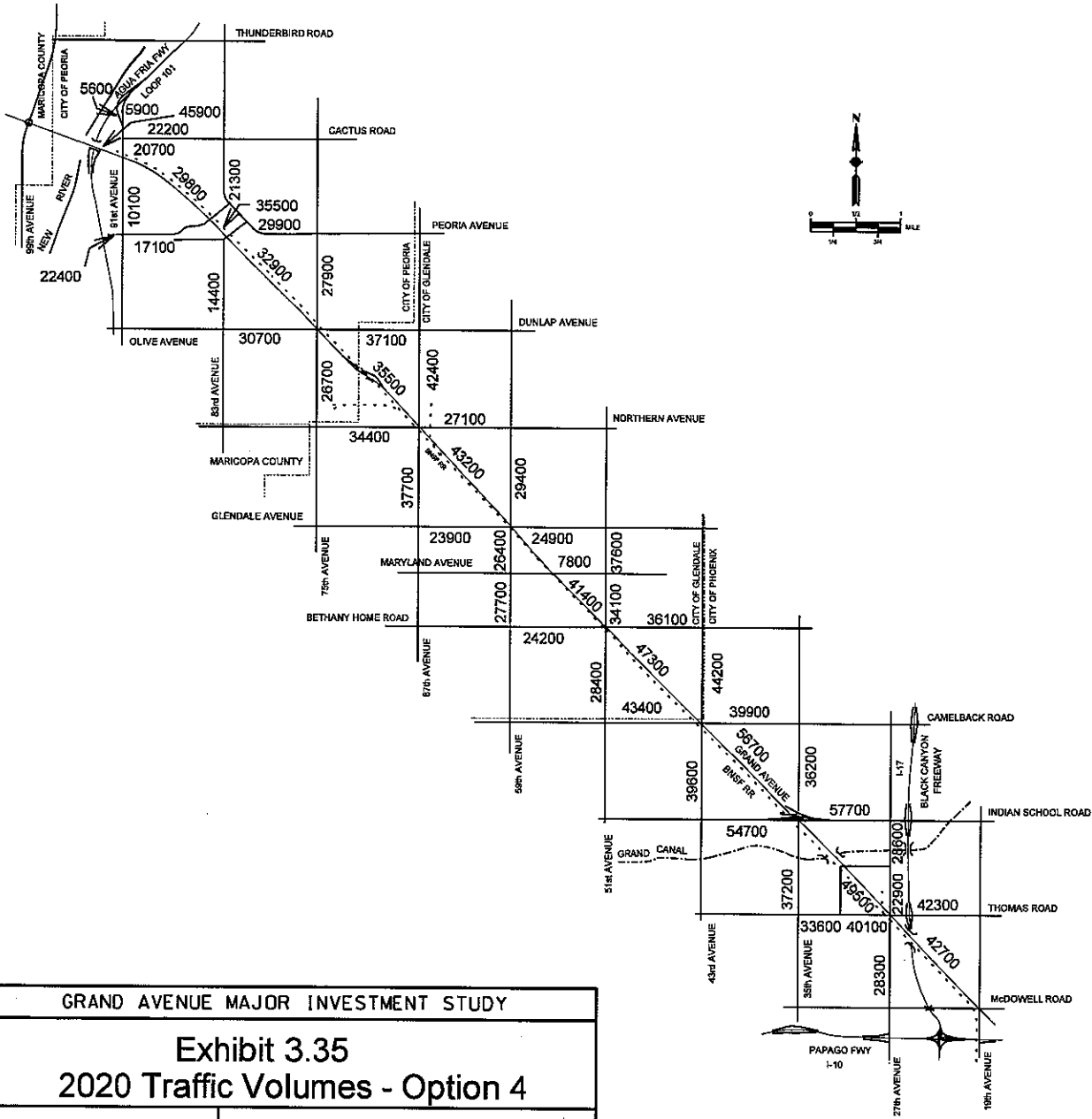
URS Greiner Woodward Clyde

In Association With
 BSM
 Logan Simpson Design, Inc.
 Partners for Strategic Action, Inc.

LEGEND

36000 2020 Adjusted Weekday
 Daily Traffic Volume

Source: Maricopa Association of Governments
 EMME2 Model



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.35
2020 Traffic Volumes - Option 4



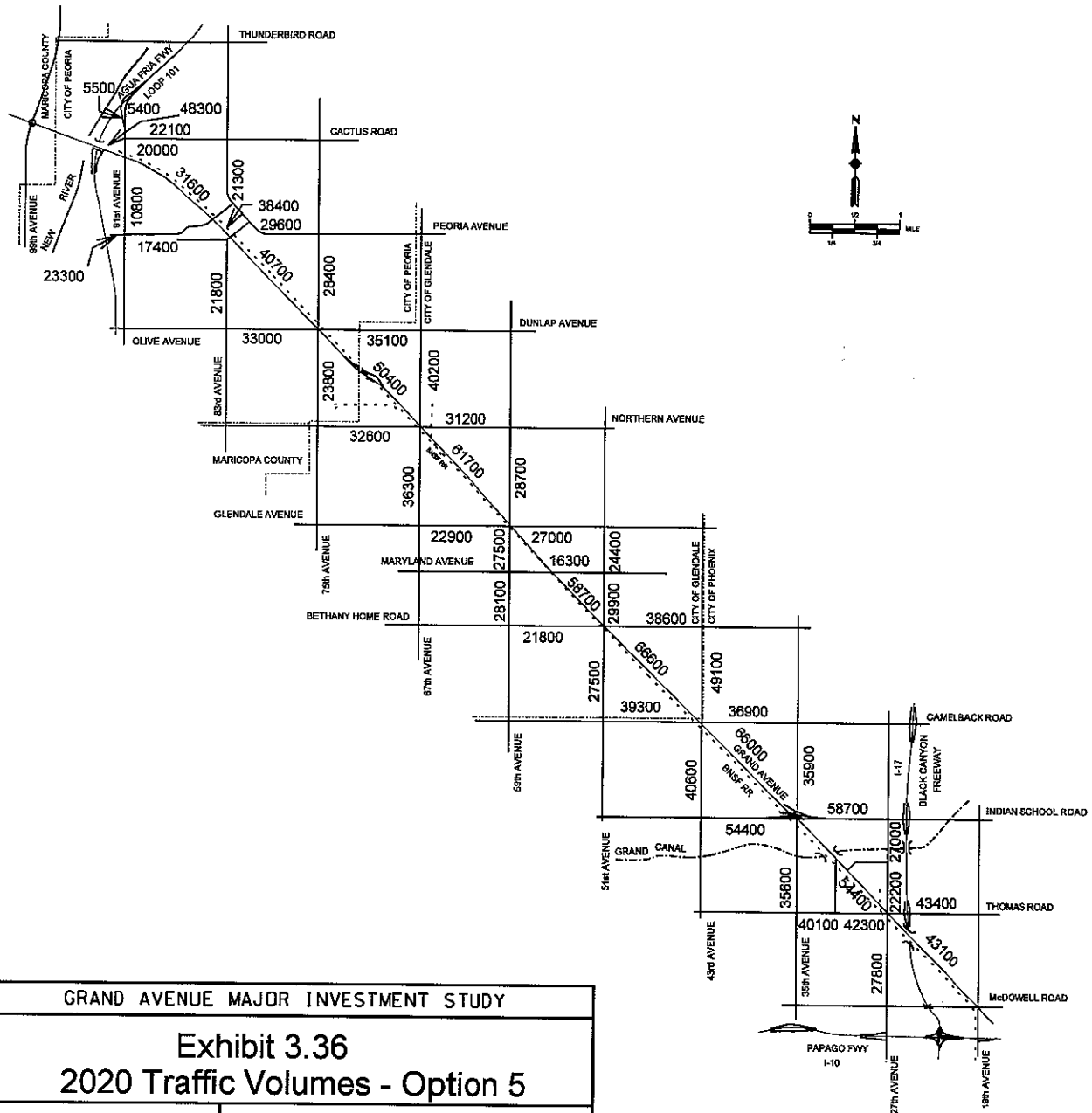
URS Greiner Woodward Clyde

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BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

LEGEND

36000 2020 Adjusted Weekday
Daily Traffic Volume

Source: Maricopa Association of Governments
EMME2 Model



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.36
2020 Traffic Volumes - Option 5



URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

LEGEND

36000 2020 Adjusted Weekday
Daily Traffic Volume

Source: Maricopa Association of Governments
EMME2 Model

Exhibit 3.37
Adjusted Daily Weekday Traffic Volumes on Overpasses in Option 4

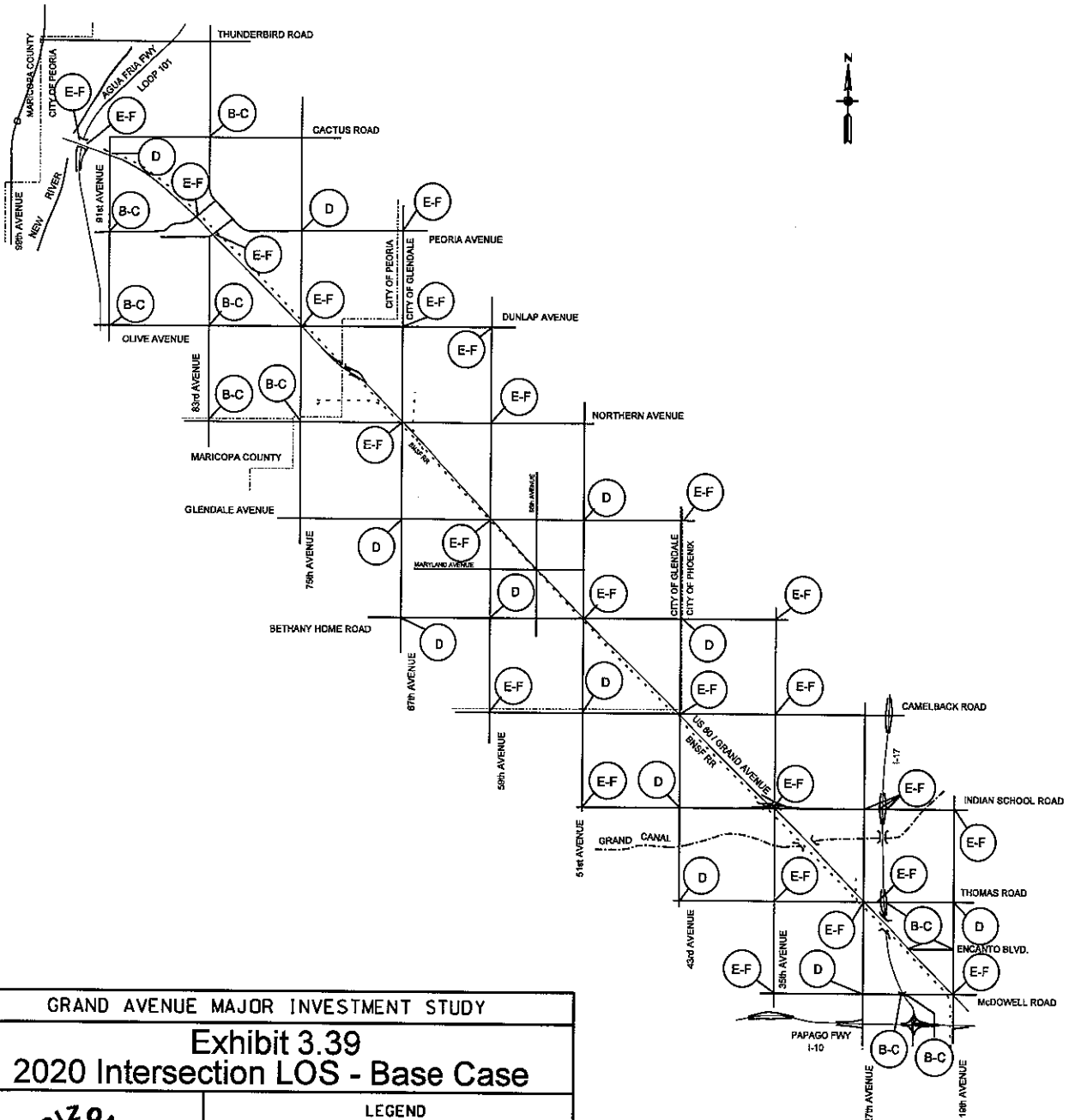
<i>Location</i>	<i>Daily Weekday Volume</i>
Grand over 27 th / Thomas	48,500
Camelback Road	39,200
51 st Avenue	30,600
Maryland Avenue	7,800
Grand under 59 th / Glendale	35,100
67 th Avenue	36,700
Olive Avenue	32,800
Loop 101 Connection on-ramp	5,900
Loop 101 Connection off-ramp	5,600

Source: MAG EMME2 Model Runs using J2 socio-economic database.

Exhibit 3.38
Adjusted Daily Weekday Traffic Volumes on Overpasses in Option 5

<i>Location</i>	<i>Daily Weekday Volume</i>
Grand over 27 th / Thomas	47,500
Grand over 43 rd / Camelback	59,900
Grand over 51 st / Bethany Home	56,000
Maryland Avenue	16,300
Grand under 59 th / Glendale	53,000
Grand over 67 th / Northern	50,200
Grand over 75 th / Olive	37,200
Loop 101 Connection on-ramp	5,400
Loop 101 Connection off-ramp	5,500

Source: MAG EMME2 Model Runs using J2 socio-economic database.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.39
2020 Intersection LOS - Base Case

LEGEND

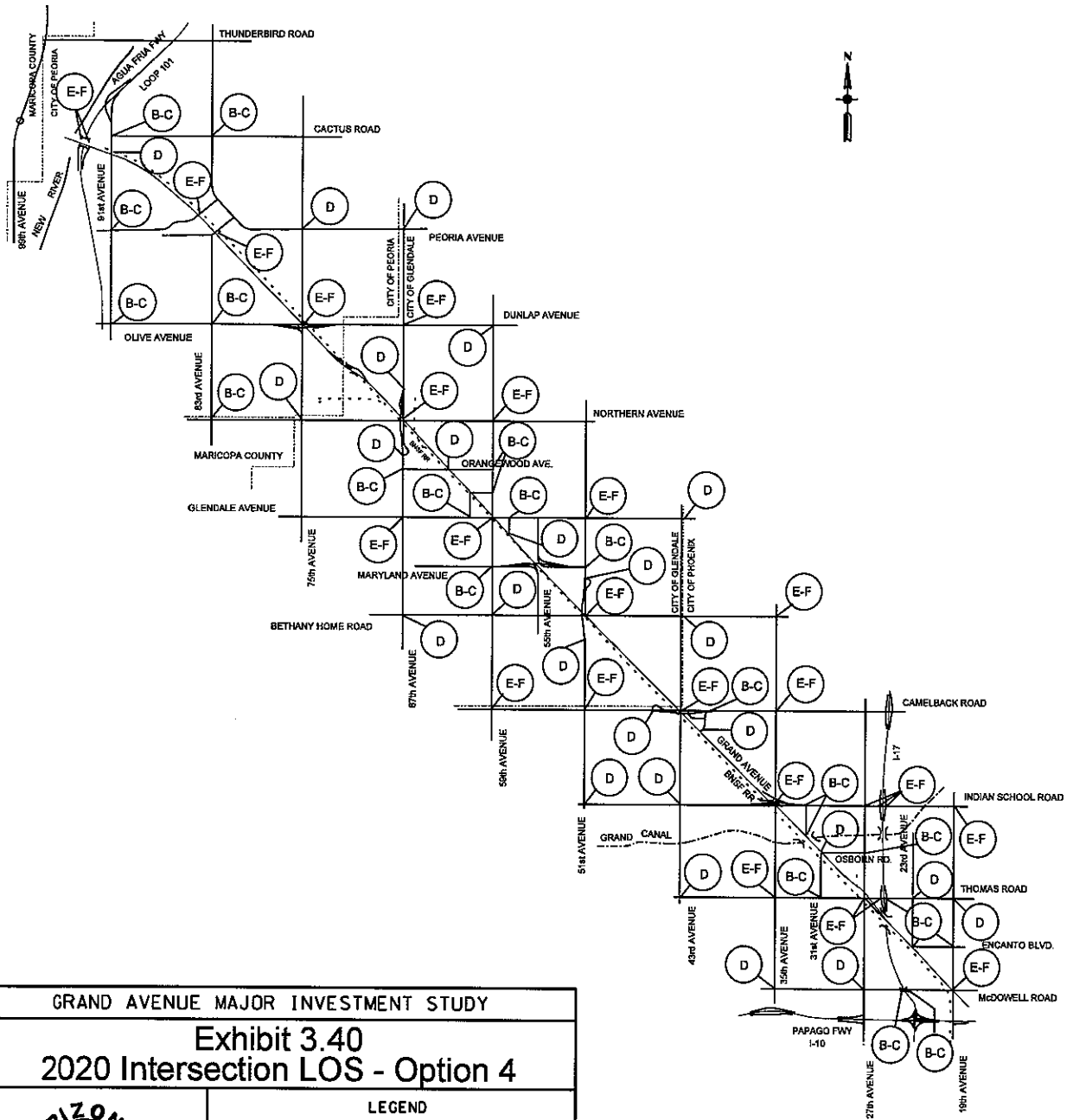
(B-C) Intersection Level of Service
(2020 P.M. Peak Hour)



URS Greiner Woodward Clyde

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Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

Source: Maricopa Association of Governments EMME2
Model using J2 Socioeconomic Database



GRAND AVENUE MAJOR INVESTMENT STUDY

**Exhibit 3.40
2020 Intersection LOS - Option 4**



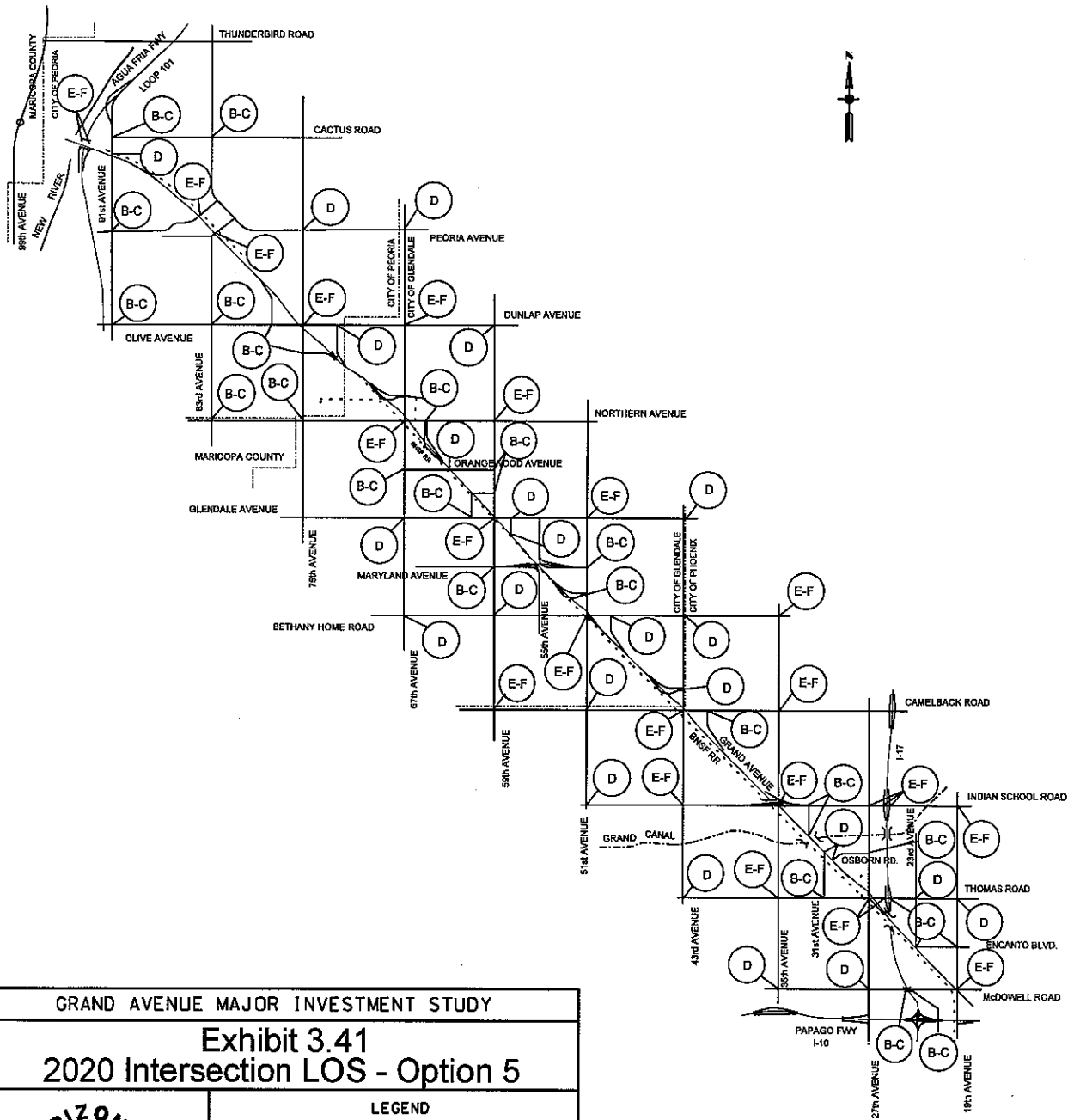
URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

LEGEND

(B-C) Intersection Level of Service
(2020 P.M. Peak Hour)

Source: Maricopa Association of Governments EMME2
Model using J2 Socioeconomic Database



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 3.41
2020 Intersection LOS - Option 5



URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

LEGEND

(B-C) Intersection Level of Service
(2020 P.M. Peak Hour)

Source: Maricopa Association of Governments EMM2
Model using J2 Socioeconomic Database

Chapter 4.0

SOCIO-ECONOMIC CONDITIONS

4.0 SUMMARY

Determination of existing land use patterns and socioeconomic factors have been completed in this Grand Avenue MIS in order to establish a baseline of existing conditions on which to evaluate the potential impacts that may occur due to the ultimate construction of major improvements along Grand Avenue. This chapter provides a summary of the existing socio-economic conditions within the study area.

Land use factors identified for this study include existing land use, general plan land use and identification of business types. Existing and projected population and employment within the study area are also presented in this chapter. The study area encompasses portions of the jurisdictions of Phoenix, Peoria and Glendale. Title VI Environmental Justice factors are also analyzed for the study area. Below is a brief summary of the existing socio-economic conditions presented in this chapter.

Land Use and Business Types

The study area encompasses a total of 6,154 acres. Residential (29%) and industrial land uses (28%) comprise the greatest portions of the study area. The remaining portions of the study area are comprised of agriculture (12%), commercial (8%), public / quasi-public (9% including parks and recreation / open space), undeveloped (9%) and roads (5%).

Land uses along Grand Avenue are primarily occupied by industrial / commercial entities such as: distribution warehousing, manufacturing, trucking / transportation, storage units, vehicle sales and repair, retail, entertainment and business complexes. The railroad along the southern edge of Grand Avenue is associated with the industrial land use.

The existing and developing residential areas consist of single and multi-family development. Schools, parks and churches are part of this generalized land use. These uses are predominantly in the northern portion of the corridor.

Agricultural and undeveloped land uses represent a small portion of the existing land uses within the study area. Agricultural lands contain citrus and various rotations of cotton and alfalfa. Undeveloped parcels occur sporadically throughout the corridor particularly along the northern reach of the study corridor. The Grand Canal, whose water management is under the jurisdiction of the Salt River Project (SRP), and BNSF right-of-way are notable land uses within the study corridor.

Zoning classifications within the study area include various industrial (31%), commercial (13%), residential (53%) and public / quasi-public (3% including parks and recreation / open space) designations in the cities of Phoenix, Glendale and Peoria. *The Land Use Element of the City of*

Phoenix General Plan indicates primarily industrial and commercial development within the Grand Avenue study area. The City of Glendale plans for continued commercial, industrial, and residential development. *The City of Peoria General Plan* indicates primarily community commercial and low-density residential development within the Grand Avenue Corridor.

Population and Employment

Each city within the study area is projected to continue to experience growth through the year 2020. Within the study area, and since 1995, population in Phoenix is projected to increase 6%, Glendale 29% and Peoria 44%. The overall population in the study area is expected to increase from 111,700 persons in 1995 to 138,500 persons in 2020, an increase of 24%.

Employment is also expected to experience growth comparable to that of the population. The percent growth in employment within the corridor between 1995 and 2020 is predicted to be substantially less (31%) than the 75% expected in Maricopa County. Employment in the study area is expected to increase from 71,000 jobs in 1995 to 92,700 jobs in 2020. The local economy has long been based on industry. The area is expected to continue to experience economic and employment growth along with the remainder of the metropolitan area.

Title VI Environmental Justice

Socio-economic factors have been identified and addressed in order to determine the potential for disproportionately high and/or adverse human health or environmental effects on minority populations and low-income populations as required by Title VI of the Civil Rights Act of 1964 and presidential executive order (No. 12898). The study area has a higher percentage of minority populations, low-income populations, female head of households, persons without a high school education, and households with no automobile than the Maricopa County average. The study area also has a slightly higher than average population with mobility disabilities. Several TAZs within the study area have significantly larger percentages than the Maricopa County average. These areas are of concern and should be analyzed further during future environmental assessments.

4.1 EXISTING LAND USE

Existing land use within the Grand Avenue Corridor between Loop 101 and I-17 was determined via a windshield survey conducted in February 1999. Land uses were collected for an area one-quarter mile on each side of Grand Avenue and a one-half mile radius around each major intersection. This area will be referred to as the study area for the analysis of existing land use. Existing land use was divided into 19 categories. These land use categories are listed and defined in Exhibit 4.1. The existing land use data were input into geographic information system (GIS) coverage for analysis and mapping purposes.

The breakdown of acreage and percentage of land within each of the defined land use categories is summarized in tabular form in Exhibit 4.2 and graphically illustrated in Exhibits 4.3A through 4.3C. The existing land use is also shown by city in the exhibits.

As shown in Exhibit 4.2, there are approximately 6,154 acres of land within the Grand Avenue corridor study area. The greatest number of acres falls in the category of heavy industrial land

use. There are 1,102 acres of heavy industrial land use, comprising 18% of the total study area land. The study area total of all industrial land use is 1,739 acres, which is 28% of the study area. This percentage is matched by the total residential acres, which comprise 1,778 acres (29%) of the total study area land. Other significant land use categories are commercial at 500 acres (8%), undeveloped land at 546 acres (9%) and agricultural lands at 732 acres (12%). Parks and Recreation areas comprise approximately 70 acres (1.0%) within the study area. In addition, the study area contains 37 acres (24 parcels) of developed land with structures that have been abandoned. These parcels represent potential redevelopment areas.

A total of 1,889 acres of the study area are within the City of Peoria. Of these acres, 176 acres (9%) comprise industrial land uses, 579 acres (31%) contain residential land uses, 139 acres (7%) have commercial land uses, 428 acres (23%) are devoted to agriculture, and 251 acres (13%) are undeveloped. The remaining acres are dedicated to public uses.

A total of 2,485 acres of the study area are within the City of Glendale. Of these acres, 798 acres (32%) house industrial land uses, 738 acres (30%) accommodate residential development, 189 acres (8%) contain commercial land uses, 304 acres (12%) comprise agricultural land use, and 107 acres (4%) are undeveloped. The remaining acres are dedicated to public uses.

There are approximately 1,779 acres of the study area within the City of Phoenix. Of these acres, 765 acres (43%) comprise industrial land uses, 460 acres (26%) comprise residential land uses, 172 acres (10%) comprise commercial land uses, and 188 acres (11%) are undeveloped. The remaining acres are dedicated to public uses.

The existing land uses within the study area were also compared to the land uses within Maricopa County as a whole. Countywide existing land uses were obtained from the July 1995 MAG Land Use Coverage GIS Database supplied by MAG. The majority of existing land in Maricopa County is undeveloped (89%). Within this category, most of the undeveloped land is vacant (51%), with open space (31%) and agriculture (7%) also comprising significant components. Residential land use in Maricopa County consists of about 5% of the total land area, while commercial uses comprise only 1% of the total.

Exhibit 4.1 Land Use Definitions

Residential Land Uses

Density – Number of dwelling units per acre in a residential district.

Low Density Residential (LDR) – Residential districts with 1 to 5 dwelling units per acre (DU/AC). A residential lot within this category will range from 8,500 square feet (sf) to 43,560 sf.

Medium Density Residential (MDR) – Residential districts with 6 to 9 DU/AC. A residential lot within this category will range from 4,840 sf to 7,260 sf.

High Density Residential (HDR) – Residential districts with greater than 10 DU/AC. Typically, residential units within this land use designation are non-traditional detached and attached homes such as townhouses, mobile home parks and multi-family apartment complexes.

Commercial Land Uses

Community Commercial (CC) – Marketplaces that serve a geographic area from 3 to 5 miles. Typical sites range from 10 to 40 acres. These marketplaces may feature an anchor tenant such as a high-volume grocery or retail “superstore” outlet. Other business within the community commercial designation include, but are not limited to, adult businesses, night clubs restaurants, dining and entertainment services, mixed single retail services, strip mall retail services, personal services, and mortuaries.

Neighborhood Commercial (NC) – Neighborhood-based commercial uses that serve a neighborhood market area of up to 2 miles. Typical sites range from 2.5 to 10 acres. These marketplaces feature tenants such as a grocery stores, clustered retail, personal services, and restaurant uses. Other businesses within a neighborhood commercial designation include, but are not limited to, banks and financial services, convenience retail, beauty and barber services, gas stations and liquor stores.

Motor Vehicle Sales (MVS) – A site where automobiles, trucks, recreational vehicles, motorcycles, boats and/or other single user and/or passenger, motor driven vehicles are sold. Accessory services, such as vehicle maintenance and repair commonly associated with motor vehicle sales are also included in this category.

Hotel / Motel (HM) – A site and a building or group of buildings containing guestrooms or dwelling units. Lodging is open and offered to the guests for compensation. Some or all of the units may have separate entrances leading directly from the outside of the building to the parking spaces provided. Motels typically accommodate motor vehicle travelers.

General Office (GO) – A site and building where business activities such as administrative, clerical, professional, or services sales are conducted. Businesses within the general office designation include, but are not limited to, insurance companies, real estate sales offices, professional offices, medical, dental and veterinary offices, and multi-office complexes.

Business Park (BP) – A tract of land that has been planned and developed as an integrated facility for a number of separate commercial office buildings and supporting ancillary uses. Business activities typically found within a business park environment include administrative, professional and supportive retail sales. Grouped building settings of three or more businesses or tenants are designed to be compatible with each other and feature common traffic circulation, parking, walkways, utilities, landscaped areas and signage.

Exhibit 4.1

Land Use Definitions (continued)

Industrial Land Uses

Light Industrial (LI) – A land use where activities are of a production, warehousing, or manufacturing nature that do not contribute excessive impacts such as noxious fumes, noise, semi-truck traffic, sewer, or water contaminants into the environment. Enterprises found within this land use designation include, but are not limited to, mobile home sales, warehouse-office complexes and self-storage facilities.

Heavy Industrial (HI) – A land use where enterprise activities are of a production, warehousing or manufacturing nature that may contribute impacts (unless mitigated), such as excessive noxious fumes and/or noise, heavy semi-truck traffic, and heavy sewer or water contaminants into the environment. Enterprises found within this land use designations include, but are not limited to, major distribution warehouses, heavy equipment storage yards and services facilities, mobile home manufacturing, and solid waste material recycle centers.

Heavy Rail Industrial (HRI) – A land use where activities are of a production, warehousing, or manufacturing nature that may contribute impacts (unless mitigated), such as excessive noxious fumes, noise, heavy semi-truck traffic, heavy sewer, or water contaminants in to the environment. Enterprises found within this land designation include, but are not limited to, major distribution warehouses, heavy equipment storage yards and services facilities, mobile home manufacturing and solid waste material recycle centers. In addition, Heavy Rail Industrial features a rail spur adjacent to or within the site area. These enterprises are dependent upon rail services.

Public Land Uses

Public / Quasi-Public (P) – Land uses where activities are open to and serve the general public. Admission may be gained with or without payment of a fee. Public facilities include, but are not limited to, court houses, government offices, public transit depots, public transit storage and service areas, and educational services (schools K-12). Quasi-public uses include, but are not limited to, facilities such as churches and trade schools.

Parks and Recreation (P/R) – A land use where the landscaped, open-air activities and facilities are open to the general public for the purpose of recreation or relaxation. Admission may be with or without a fee. Recreational facilities may include, but are not limited to, ball fields, hiking trails and swimming pools.

Open Space (OPEN) – A land area that is set aside for public enjoyment, or otherwise enhances the quality of the environment. These areas might include, but are not limited to, landscaped areas, natural areas, plazas with grass and trees, fountains, and public sitting areas. The term does not include parking areas, vacant or undeveloped parcels.

Other Land Uses

Agriculture (AG) – Land that is privately owned for the purpose of farm production. Animal husbandry and crop productions are typical activities within this land use designation.

Vacant, Undeveloped (V-UN) – Land use that is undisturbed. The land is not presently in use, but is typically zoned for a particular use. This land may or may not be privately held or available for sale or purchase.

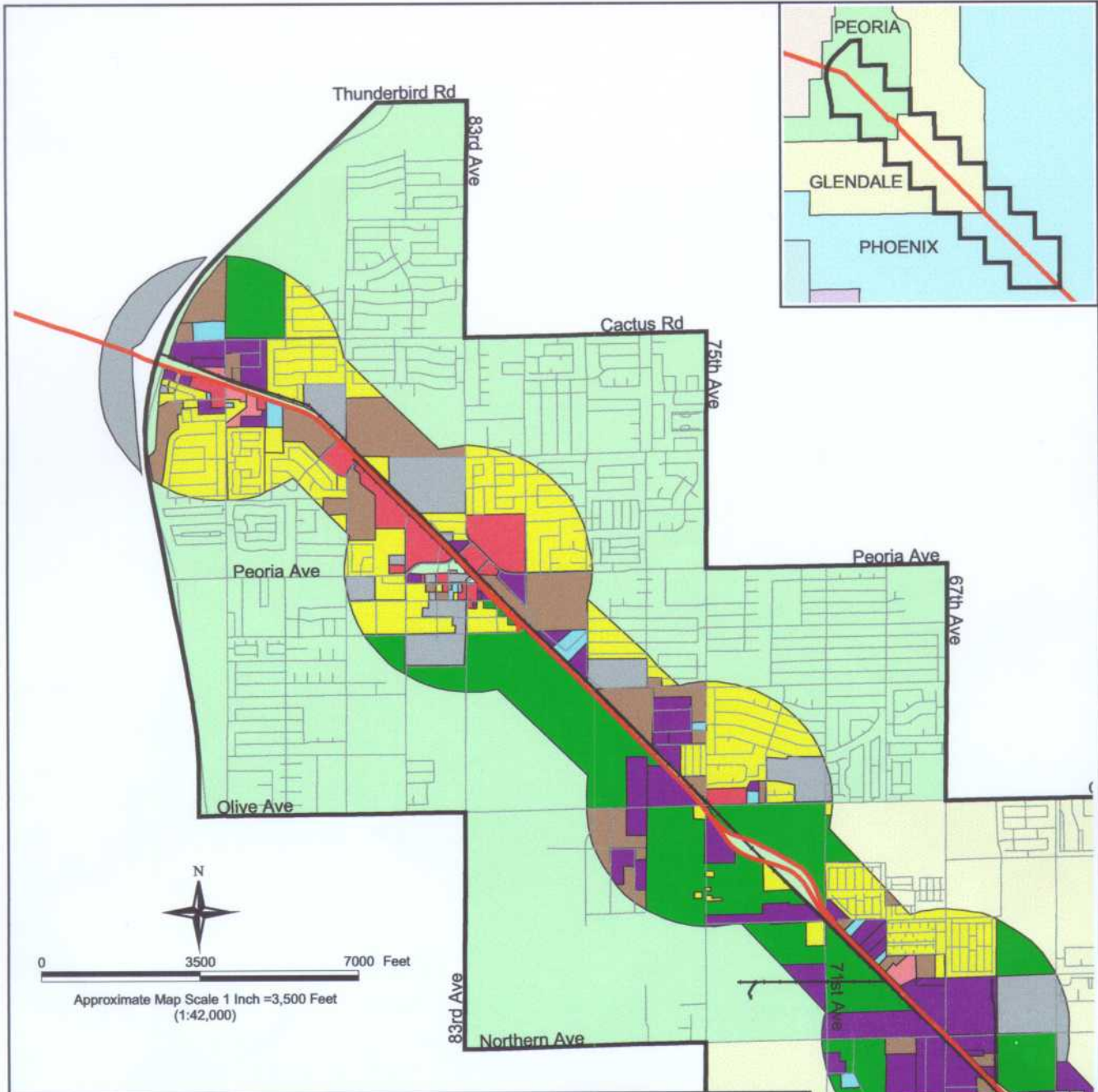
Vacant, Developed (V-DEV) – Land and buildings that have been zoned and developed for a particular use. However the tenant or owner has since abandoned the facility and boards have been placed over the building doors and windows. Typically, these areas show no sign of recent activity within or around the building.

Road – Land dedicated to roads and streets.

Exhibit 4.2
Existing Land Use Summary

Land Use Category	Peoria		Glendale		Phoenix		Total Study Area	
	Study Area Acres in Peoria	Percent of Study Area in Peoria	Study Area Acres in Glendale	Percent of Study Area in Glendale	Study Area Acres in Phoenix	Percent of Study Area in Phoenix	Study Area Acres	Percent of Study Area
Low Density Residential	106	6%	99	4%	51	3%	257	4%
Medium Density Residential	383	20%	296	12%	228	13%	907	15%
High Density Residential	90	5%	343	14%	181	10%	614	10%
Subtotal Residential	579	31%	738	30%	460	26%	1,778	29%
Community Commercial	97	5%	47	2%	106	6%	250	4%
Neighborhood Commercial	7	0%	39	2%	13	1%	59	1%
Motor Vehicle Sales	10	1%	63	3%	11	1%	85	1%
Hotel / Motel	5	0%	10	0%	15	1%	31	0%
General Office	5	0%	27	1%	22	1%	55	1%
Business Park	14	1%	3	0%	4	0%	21	0%
Subtotal Commercial	139	7%	189	8%	172	10%	500	8%
Light Industrial	57	3%	363	15%	217	12%	637	10%
Heavy Industrial	118	6%	435	18%	548	31%	1102	18%
Heavy Rail Industrial	1	0%	0	0%	0	0%	1	0%
Subtotal Industrial	176	9%	798	32%	765	43%	1,739	28%
Public / Quasi Public	118	6%	237	10%	61	3%	416	7%
Parks & Recreation	36	2%	34	1%	1	0%	70	1%
Dedicated Open Space	57	3%	2	0%	7	0%	66	1%
Subtotal Public, Parks, Open	210	11%	272	11%	68	4%	551	9%
Agriculture	428	23%	304	12%	0	0%	732	12%
Subtotal Agriculture	428	23%	304	12%	0	0%	732	12%
Vacant Undeveloped	251	13%	107	4%	188	11%	546	9%
Vacant Developed	4	0%	7	0%	26	1%	37	1%
Subtotal Available Land	255	13%	114	5%	214	12%	583	9%
Road	102	5%	69	3%	100	6%	271	4%
Subtotal Road	102	5%	69	3%	100	6%	271	4%
Total	1,889	100%	2,486	100%	1,779	100%	6,154	100%

Source: BRW Inc., March, 1999



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 4.3A

Existing Land Use (Peoria Section)

Legend

Grand Avenue	Agriculture	Medium Density Residential
Street	Business Park	Motor Vehicle Sales
Railroad	Hotel/Motel	Community Commercial
Study Boundary	General Office	Neighborhood Commercial
Glendale	Heavy Industrial	Open Space
Peoria	Heavy Rail Industrial	Parks and Recreation
	Light Industrial	Public/Quasi Public
	High Density Residential	Vacant Developed
	Low Density Residential	Vacant Undeveloped

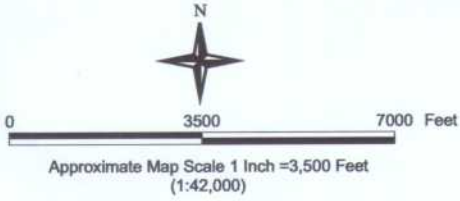
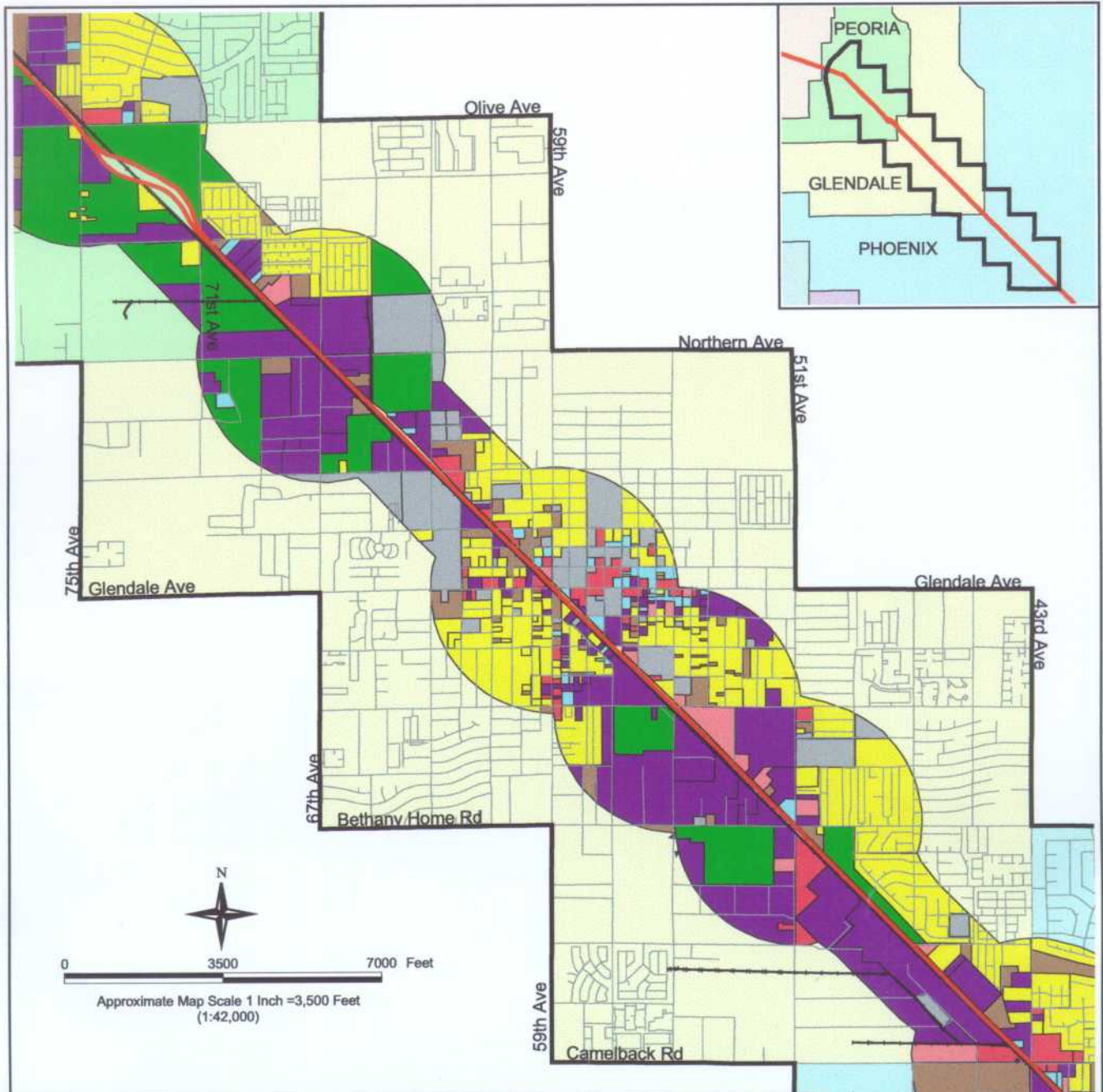


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 Partners for Strategic Action, Inc.

Source: BRW (1999)

Arizona Central NAD 27 Feet

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GRAND AVENUE MAJOR INVESTMENT STUDY

**Exhibit 4.3B
Existing Land Use (Glendale Section)**

Legend		
Grand Avenue	Agriculture	Medium Density Residential
Street	Business Park	Motor Vehicle Sales
Railroad	Hotel/Motel	Community Commercial
Study Boundary	General Office	Neighborhood Commercial
Glendale	Heavy Industrial	Open Space
Peoria	Heavy Rail Industrial	Parks and Recreation
Phoenix	Light Industrial	Public/Quasi Public
	High Density Residential	Vacant Developed
	Low Density Residential	Vacant Undeveloped

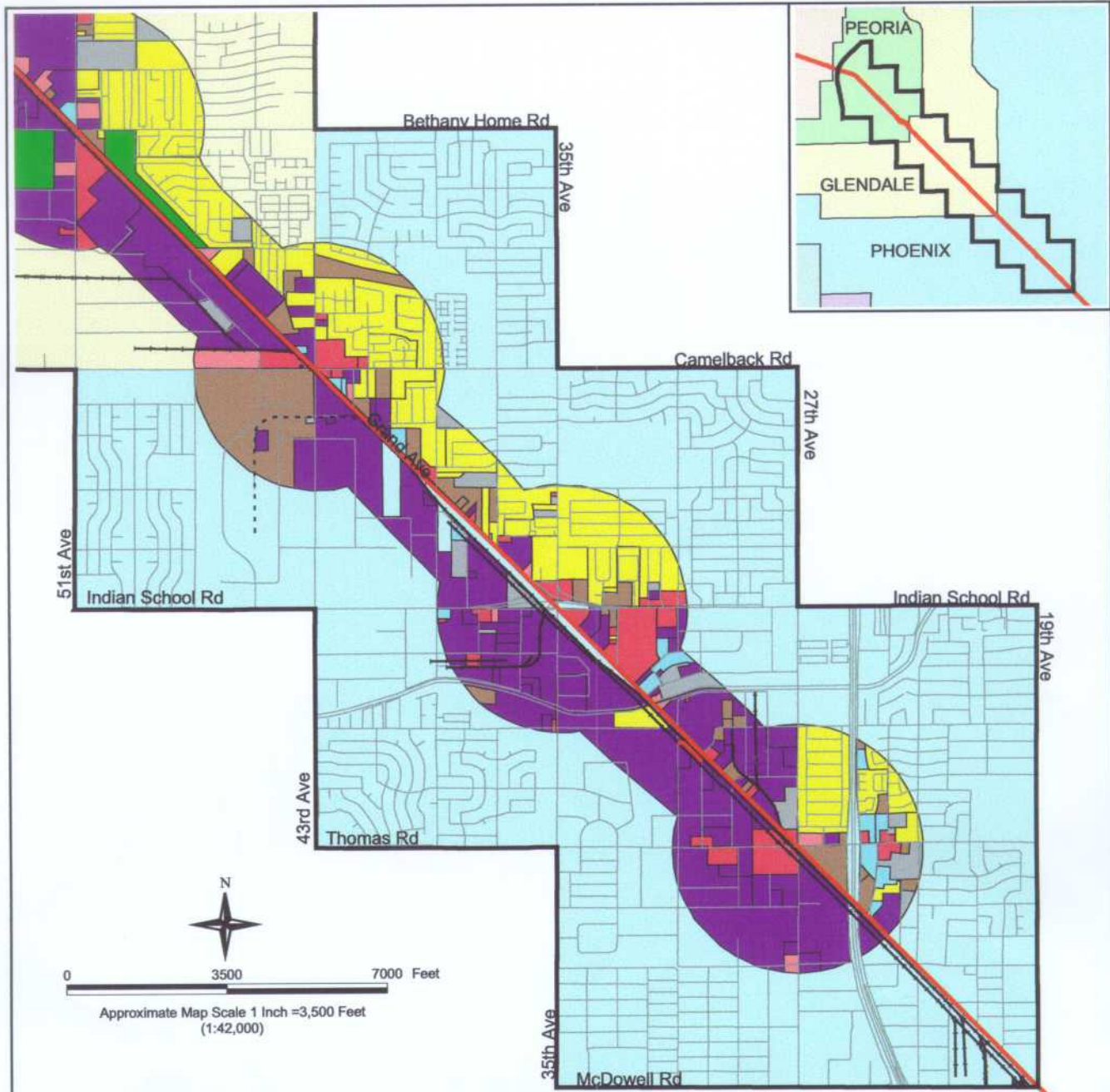
ARIZONA
DEPARTMENT OF TRANSPORTATION

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Source: BRW (1999)

Arizona Central NAD 27 Feet

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GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 4.3C

Existing Land Use (Phoenix Section)

Legend

Grand Avenue	Agriculture	Medium Density Residential
Street	Business Park	Motor Vehicle Sales
Railroad	Hotel/Motel	Community Commercial
Study Boundary	General Office	Neighborhood Commercial
Glendale	Heavy Industrial	Open Space
Peoria	Heavy Rail Industrial	Parks and Recreation
Phoenix	Light Industrial	Public/Quasi Public
	High Density Residential	Vacant Developed
	Low Density Residential	Vacant Undeveloped



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Source: BRW (1999)

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4.2 GENERAL PLAN

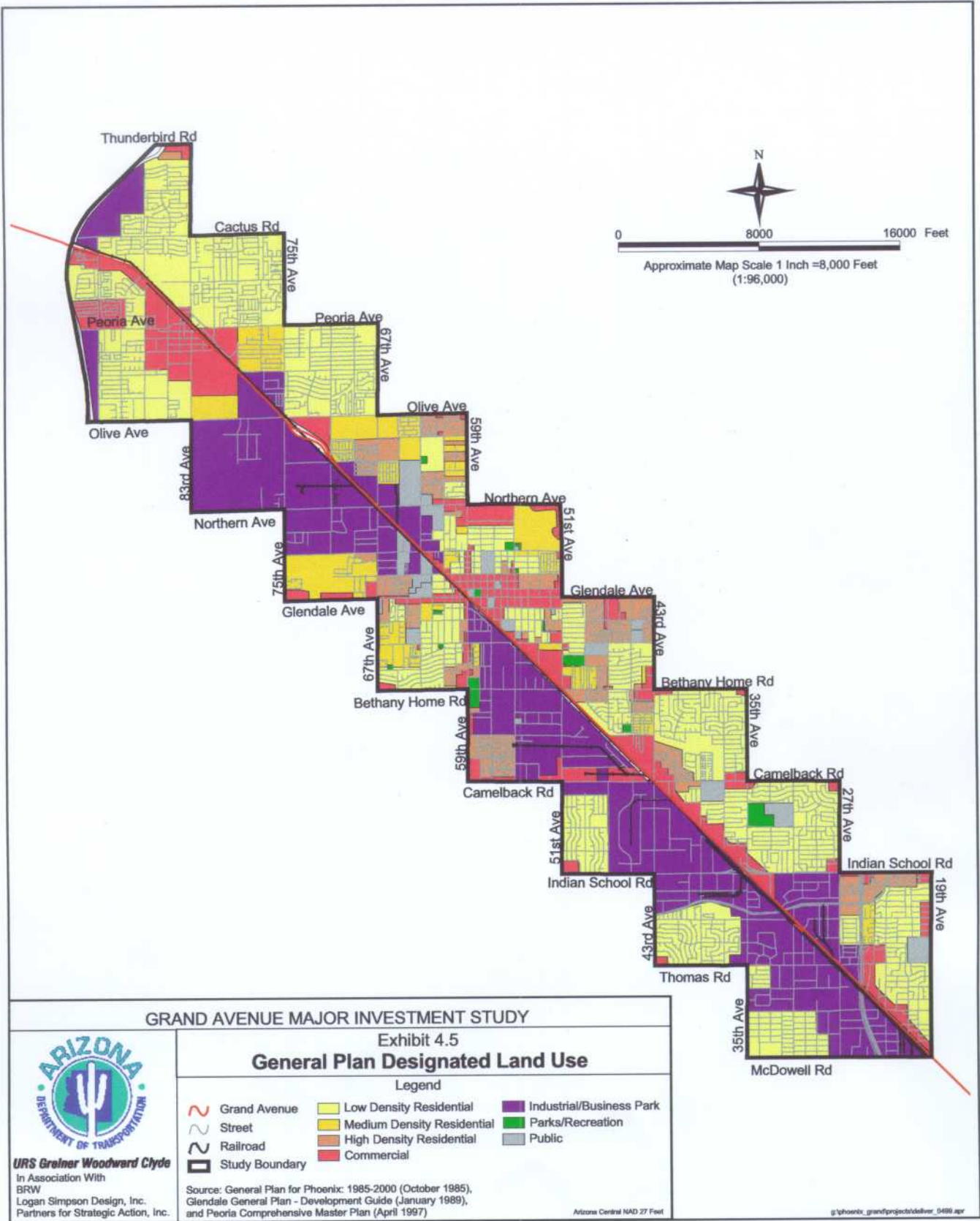
General Plan land uses were identified for the study area from the General Plans of Phoenix, Glendale and Peoria. General Plan land use designations include low, medium and high density residential, commercial, industrial, public / quasi-public and parks / open space. The business type data were input into a GIS coverage for analysis and mapping purposes. The breakdown of acreage and percentage of land within each of the defined general plan land use categories is summarized in tabular form in Exhibit 4.4 and graphically illustrated in Exhibit 4.5. The existing land use is also shown by city in the exhibits.

Within the study area, 52% of the land is designated for residential purposes by the cities' general plans. Land designated by the respective general plans for residential purposes break down in the following manner: Peoria 56%, Glendale 50% and Phoenix 50%. The next highest general plan land use designation is industrial / business park with 31% of the land designated as such. The respective cities industrial designations include 26% of the land in Peoria and Glendale and 40% of the land in Phoenix. The cities have designated 13% of the total land within the study area for commercial purposes including: Peoria 15 %, Glendale 15%, and Phoenix 8%.

Exhibit 4.4
General Plan Land Use Summary

General Plan Land Use Category	Peoria		Glendale		Phoenix		Total Study Area	
	Study Area Acres in Peoria	Percent of Study Area in Peoria	Study Area Acres in Glendale	Percent of Study Area in Glendale	Study Area Acres in Phoenix	Percent of Study Area in Phoenix	Study Area Acres	Percent of Study Area
Low Density Residential	2,560	53%	1,051	18%	2,579	45%	6,191	38%
Medium Density Residential	243	5%	1,037	18%	41	1%	1,322	8%
High Density Residential	13	0%	914	16%	238	4%	1,165	7%
Subtotal Residential	2,817	58%	3,002	51%	2,859	50%	8,677	53%
Subtotal Commercial	732	15%	896	15%	451	8%	2,080	13%
Subtotal Industrial	1,283	27%	1,587	27%	2,286	40%	5,156	31%
Subtotal Public/Quasi Public	-	0%	320	5%	125	2%	445	3%
Subtotal Parks & Open Space	-	0%	78	1%	39	1%	117	1%
Total	4,832	100%	5,883	100%	5,760	100%	16,475	100%

Source: BRW Inc, March 1999



The general plan land uses within the study area were also compared to the general plan uses within Maricopa County and the three cities as a whole. Countywide and citywide general plan land uses were obtained from the July 1995 General Plan Land Use Coverage GIS Database supplied by MAG. The GIS coverage show that 3,206,550 acres (54%) of the land in Maricopa County is proposed for residential development with the cities of Peoria, Glendale and Phoenix at 49%, 57% and 67%, respectively. Land designated industrial in Maricopa County is calculated to be only 1% of the planned land designation, while commercial is at 3%. A much higher percentage of the land within the study area is designated for industrial and commercial uses than for the County as a whole, thus a lower percentage of land is designated as residential.

4.3 BUSINESS TYPES

Existing business types within the Grand Avenue Corridor between Loop 101 and I-17 were determined via a windshield survey conducted in February 1999. Business types were collected for an area one-quarter mile on each side of Grand Avenue and a one-half mile radius around each major intersection. This area will be referred to as the study area for the analysis of business types. Existing land use was divided into 28 categories. These land use categories are listed and defined in Exhibit 4.6. The business type data were input into a GIS coverage for analysis and mapping purposes.

The breakdown of acreage and percentage of land within each of the defined business type categories is summarized in tabular form in Exhibit 4.7. The business types are graphically illustrated in Exhibits 4.8A through 4.8C. The existing land use is also shown by city in the exhibits.

The Grand Avenue corridor land use by business is predominately that of industrial warehousing and distribution. This category represents 15% of the study area Grand Avenue corridor business. Percentage of land use in other industrial business type uses, such as equipment storage, manufacturing, rail dependent, and manufactured home sales, each represent 10% of the businesses in the area.

In the portion of the study area within the City of Peoria, shopping center business represent 14% of the Peoria land commercial or industrial land area; however, industrial businesses such as equipment storage and manufacturing rank as high or higher, at 27% and 14%, respectively.

The business type, equipment storage, is the major business type identified within the study area of the City of Glendale. Other major business types include manufacturing at 14% and office warehousing at 12%.

The City of Phoenix portion of the study area has the greatest percentage of warehouse distribution land use, with 27% of the business land use in this category. Twenty-two percent of the business land use is in the sale of manufactured homes sales and 11% is in combination office warehouse facilities.

Exhibit 4.6

Business Type Definitions

Commercial Business Types

Adult Business / Nightclub – Adult Business is an enterprise that specializes in the sale of nude and sexually explicit material or that offers nude or partially nude entertainment. A nightclub is a commercial establishment dispensing alcoholic beverages for consumption on the premises and in which dancing is permitted.

Automobile Services – A commercial enterprise that specializes in the sale of new or used auto parts such as tires or performs repairs and maintenance of automobiles such as auto painting and detailing, lubrication, tune-up services. This definition does not include gas stations.

Automobile, Truck, RV and Boat Sales – An agency or dealer that specializes in the sale of new or used motor vehicles. Accessory services, such as vehicle maintenance, may also be provided.

Bank / Financial – Commercial enterprises that perform financial transactions such as receiving, investing, managing and/or lending money. Examples are credit unions, brokerage houses, federal and state banks.

Beauty / Cosmetics – Retail enterprises that provide a variety of personal care services such as hair cutting, styling, manicures, facials, message, and hair removal as well as sells hair and beauty products.

Convenience Services – Retail grocery markets that are easily accessible and often located at a roadway intersections. The retail enterprise specializes in the sale of snack food, grocery and impulse items and may sell gas.

Dining & Entertainment – An establishment where the primary business is serving food to the public for consumption on the premises. The restaurant may or may not offer entertainment during the meal.

Gas Station – A retail enterprise that specializes in the sale of automobile fuel. This establishment may or may not include service bays that are used for automobile maintenance and repair services.

Hotel / Motel – A building or group of buildings containing guestrooms or dwelling units. Lodging is open and offered to the public transient guests for compensation. Some or all of the units may have separate entrances leading directly from the outside of the building to the parking spaces provided. Motels typically accommodate automobile transients.

Insurance Company – An office service specializing in the management and sale of insurance commodities. Examples of insurance commodities are life, automobile and homeowner insurance.

Liquor Store – A retail market that specializes in the sale of bottled alcoholic beverages for off-premise consumption.

Medical, Dental or Veterinary Services – Medical and dental services include the diagnosing, treating and prevention of disease found in humans. Veterinary services include the diagnosing, treating and prevention of disease found in small animals. Animals treated include household pets, but do not usually include livestock. A physician performs the medical services. The office or clinic in which the services are performed is a stand-alone structure occupying an individual parcel of land.

Exhibit 4.6
Business Type Definitions (continued)

Commercial Business Types (continued)

Mixed Retail and Downtown Services – A pattern of land use where retail, office, restaurants, and other commercial enterprises occupy the same building or group of abutting buildings. The pattern of land use is such that it is difficult to ascertain where one commercial enterprise ends and another begins. For example, retail store may occupy the ground floor of a building, while office and residential apartments occupy the upper stories.

Mortuary – A business enterprise where a mortician prepares and stores human corpses for burial. The mortuary may or may not be directly associated with land that is used for burial purposes such as a graveyard.

Real Estate Sales – An office service specializing in the management and/or sale of undeveloped land and real property.

Shopping Center – A large tract of land that has been designed for and is occupied by a group of compatible retail stores, including one or more major anchor tenants that draw a large number customers from the surrounding communities. Smaller retail establishments within the center benefit from the larger customer draw of the anchor tenant. The center is planned and designed for the site on which it is built. Off-street parking, pedestrian walkways, landscaped areas and/or plazas are provided on the property as an integral part of the unit design.

Single Retail Services – An enterprise that purchases goods for resale to the public. A single retail service describes a circumstance where one individual enterprise occupies the entire building and associated customer parking lot.

Strip Retail Center – A linear designed building and associated parking which is typically adjacent to and facing the street right-of-way. The building is occupied by a variety of abutting small retail stores with only party walls separating them from each other. An example of this land use is the Tamarak Plaza.

Technical and Professional Offices – A wide variety of service enterprises that occupy an office as a work place environment. Technical offices may include, but are not limited to those occupied by engineers, and computer service technicians. Professional services may include, but are not limited to those occupied by attorneys, administrative services or other consultant services.

Multi-Office Complex – A large tract of land that has been planned and developed as an integrated facility for a number of separate office buildings and supporting ancillary uses. Special design attention has been given to traffic circulation, parking, utility needs, aesthetics, landscaping, and compatibility.

Exhibit 4.6
Business Type Definitions (continued)

Industrial Business Types

Distribution / Warehouse – A large enterprise specializing in the storage, wholesale and distribution of manufactured products, supplies, and equipment. The building is generally a large stand-alone building constructed of metal or concrete masonry units. No retail operations are conducted on the premises.

Equipment Storage – Sites primarily used for the storage; repair and maintenance of used equipment such as farm machinery, semi trucks, and/or other miscellaneous machinery.

Manufacturing – The fabrication or assembling of raw or unfinished materials into finished or partially finished products by hand or with the use of machinery.

Manufactured (Mobile) Home Sales – Land use that is primarily engaged in the sale and storage of fully assembled, prefabricated homes, set on a temporary foundation, within a dealer's sales lot. These homes can be viewed and purchased by the public. A manufactured or mobile home is one that has been fabricated according to the standards of the US Department of Housing and Urban Development on or after June 15, 1976.

Office Warehouse Complex – Land and building that have been designed primarily as small to medium sized warehouses. Typically, each tenant within the building or group of buildings is provided with one semi-truck bay door, where goods are delivered, and a separate, adjacent personnel-door entrance into the office area. A snack food, vending machine wholesaler, or a small welding contractor is an example of a business that might utilize an office / warehouse complex. Wholesale operations are typical, however retail operations may or may not be conducted on the premises.

Rail Dependant Businesses – Industry, manufacturing and fabrication that receive delivery of goods directly from railroad boxcars, via a rail spur within the enterprise site boundary.

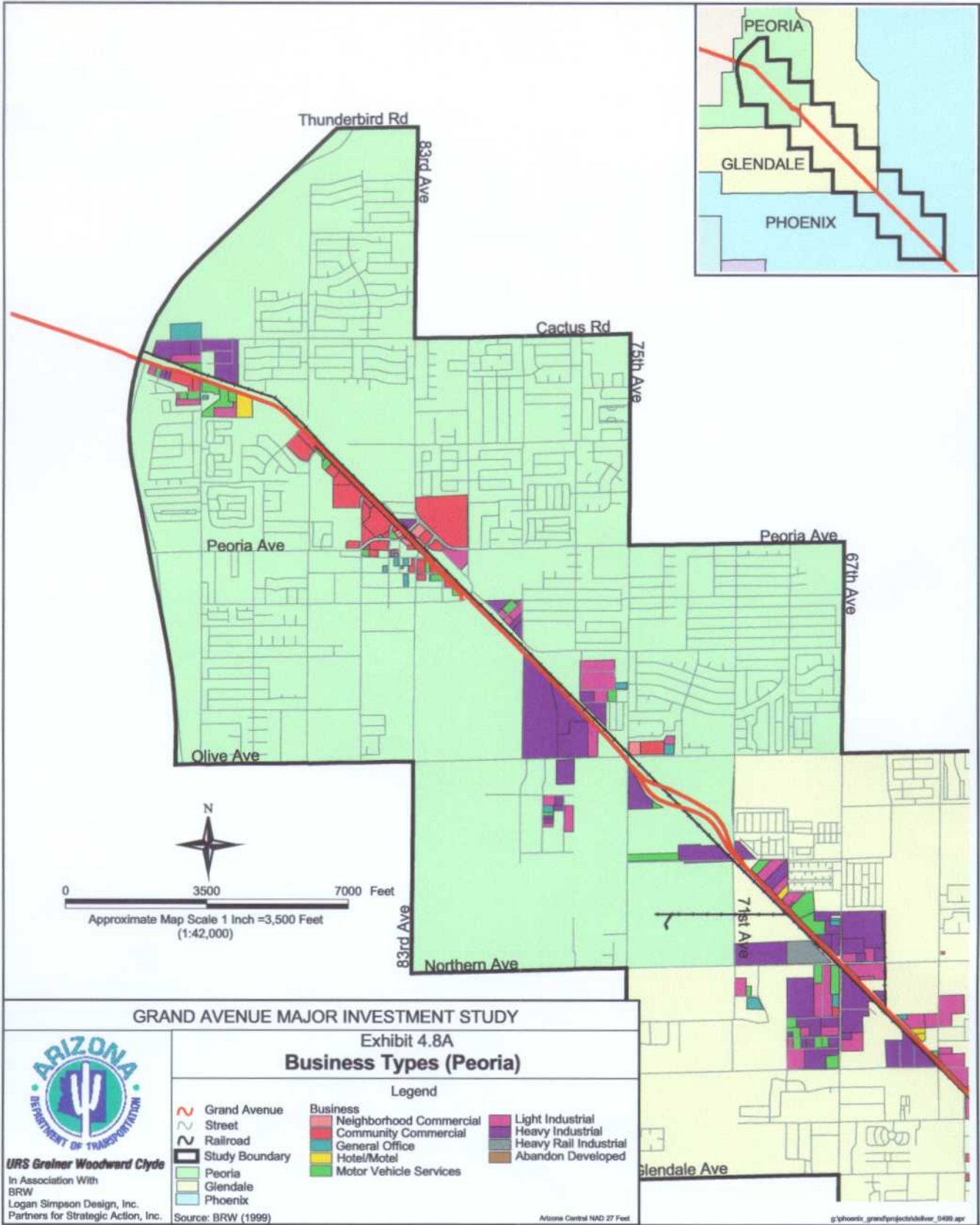
Recycling Centers – An enterprise specializing in the separation and processing of recoverable resources, such as newspapers, glassware, metal cans or other discarded solid waste materials. The facility is not a junkyard, rather it is a facility where used items are treated, flattened, crushed or bundled and shipped to other manufacturers for reprocessing into new, usable goods.

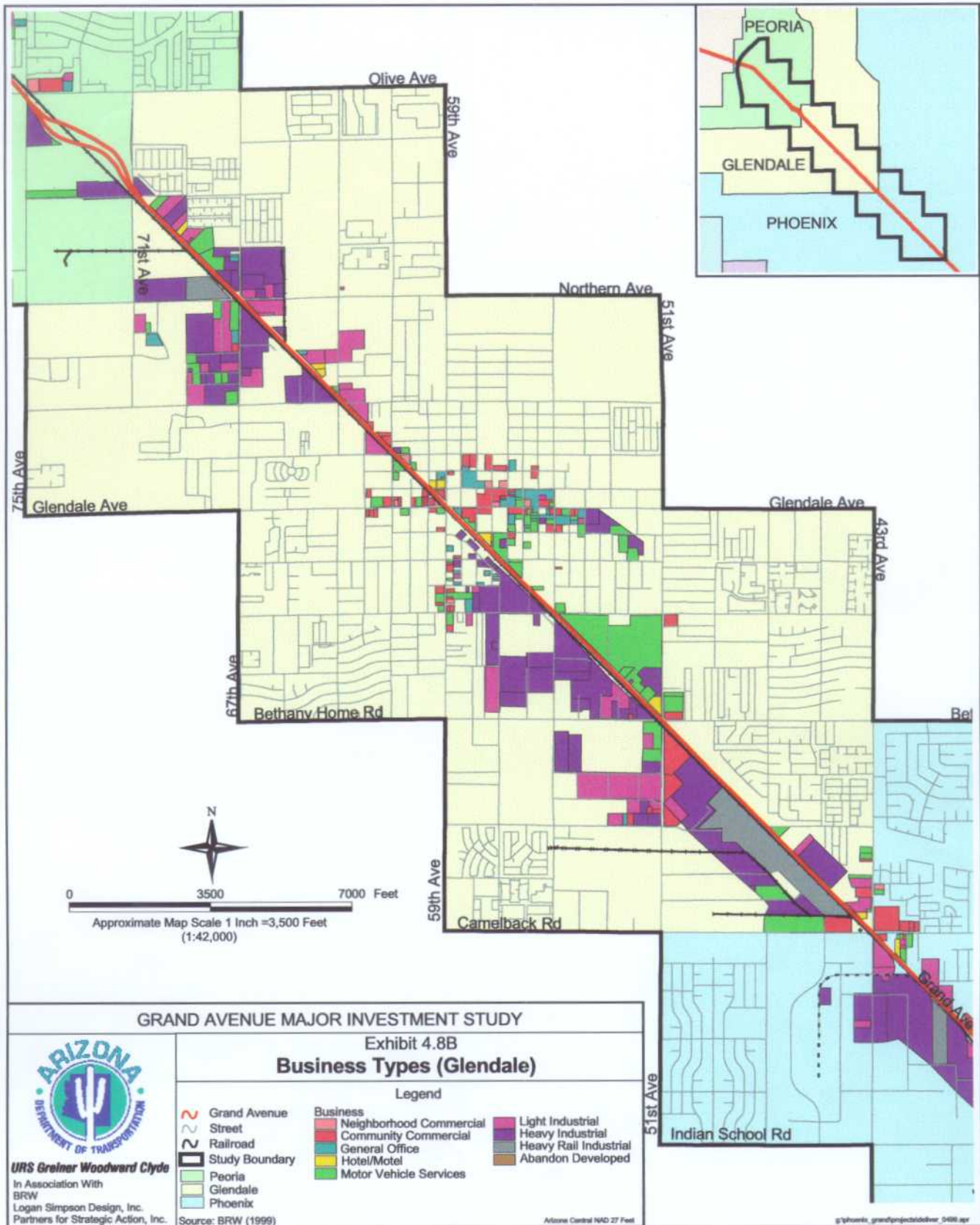
Self Storage, Mini-Storage Units – A building or buildings consisting of individual, small, and self-contained garages or units that are leased or owned for the storage of business and household goods. The compound is fenced and features controlled access to the entrances of the storage units.

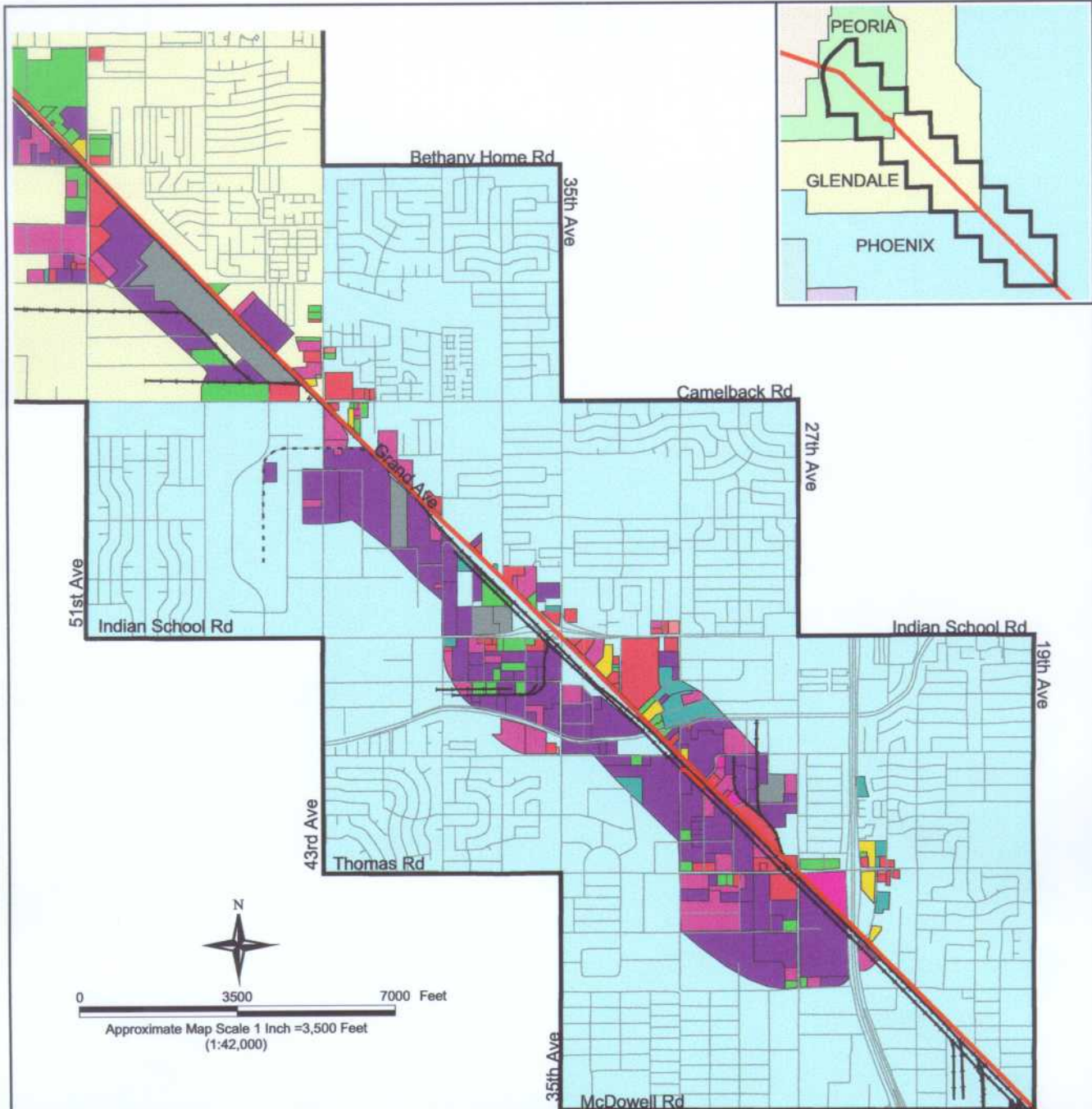
Exhibit 4.7
Business Type Summary

Business Type	Peoria		Glendale		Phoenix		Total Study Area	
	Study Area Acres in Peoria	Percent of Study Area in Peoria	Study Area Acres in Glendale	Percent of Study Area in Glendale	Study Area Acres in Phoenix	Percent of Study Area in Phoenix	Study Area Acres	Percent of Study Area
Commercial								
Adult Business / Nightclub	0	0%	1	0%	11	1%	12	1%
Auto, Truck, RV and Boat Sales	17	5%	72	8%	27	3%	116	6%
Automotive Services	11	4%	93	10%	16	2%	120	6%
Bank / Financial	0	0%	3	0%	2	0%	5	0%
Beauty / Cosmetics	0	0%	0	0%	0	0%	0	0%
Convenience	4	1%	2	0%	1	0%	7	0%
Dining & Entertainment	9	3%	11	1%	10	1%	30	1%
Gas Station	1	0%		0%	3	0%	4	0%
Hotel / Motel	5	2%	9	1%	18	2%	32	2%
Insurance Company	0	0%	0	0%	0	0%	0	0%
Liquor Store	0	0%	0	0%	0	0%	0	0%
Medical, Dental, Veterinary	0	0%	1	0%	2	0%	2	0%
Mixed Retail & Downtown	5	2%	17	2%	0	0%	22	1%
Mortuary	0	0%	0	0%	0	0%	0	0%
Multi Office Complex	7	2%	5	1%	5	1%	16	1%
Real Estate Sales	0	0%	0	0%	0	0%	0	0%
Shopping Centers	46	14%	0	0%	36	4%	81	4%
Single Retail	3	1%	33	4%	27	3%	62	3%
Strip Centers	25	8%	14	2%	14	2%	52	3%
Technical and Professional Office	7	2%	26	3%	33	4%	66	3%
Subtotal Commercial	140		287		202		629	
Industrial								
Distribution / Warehouse	5	2%	86	10%	220	27%	311	15%
Equipment Storage	87	27%	162	18%	47	6%	296	15%
Manufactured (Mobile) Home Sales	0	0%	26	3%	181	23%	207	10%
Manufacturing	45	14%	128	14%	10	1%	184	9%
Office/Warehouse Complex	31	10%	109	12%	84	10%	223	11%
Rail Dependant Business		0%	76	9%	27	3%	104	5%
Recycling Centers	1	0%	8	1%	1	0%	10	0%
Self Storage, Mini Storage Units	16	5%	15	2%	28	3%	58	3%
Subtotal Industrial	185		610		599		1,393	
Total Corridor Acres	324		897		801		2,022	

Source: BRW Inc, March 1999







GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 4.8C

Business Types (Phoenix Section)

Legend

- | | | |
|----------------|-------------------------|-----------------------|
| Grand Avenue | Business | Light Industrial |
| Street | Neighborhood Commercial | Heavy Industrial |
| Railroad | Community Commercial | Heavy Rail Industrial |
| Study Boundary | General Office | Abandon Developed |
| Peoria | Hotel/Motel | |
| Glendale | Motor Vehicle Services | |
| Phoenix | | |

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Source: BRW (1999)

Arizona Central NAD 27 Feet

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4.4 EXISTING AND PROJECTED POPULATION

The population of an area is the sum total of all people reported by census, who live within the described area. For statistical purposes, the study area has been defined by the traffic analysis zones (TAZ) used by MAG. There are 36 TAZs within the study area. Existing and projected population were obtained from the *Maricopa Association of Governments Socio-economic Projections of June 1997*. The TAZs are shown in Exhibit 4.9. The existing and projected population for the study area is summarized in Exhibit 4.10. Population densities are illustrated in Exhibit 4.11.

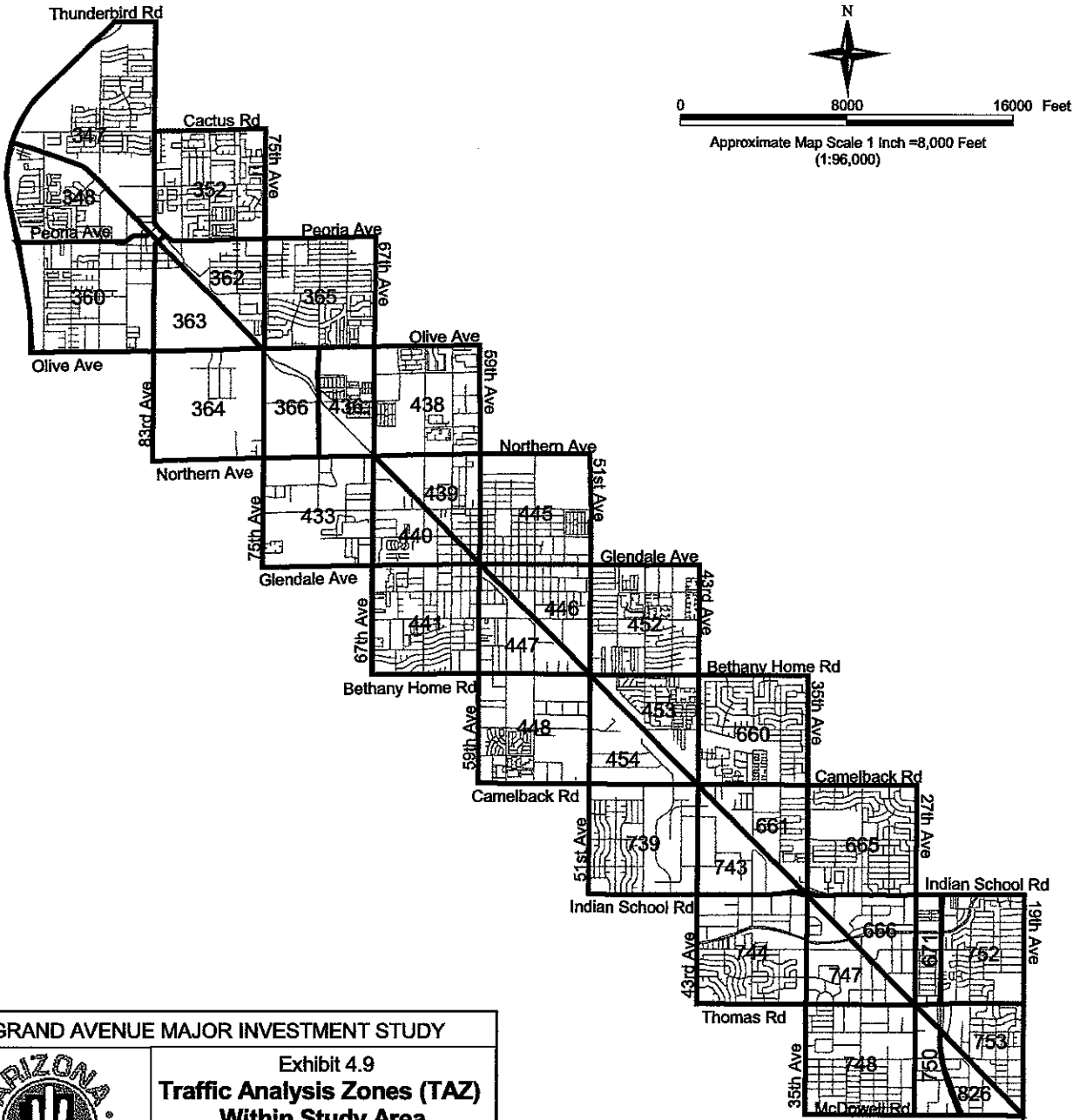
The population within Maricopa County is expected to grow by almost 2 million persons from 2.48 million to 4.42 million by 2020, an increase of 79%. Each city within the Grand Avenue study area is also expected to experience significant growth through the year 2020. Population growth in the City of Peoria is projected to increase 142%, followed by Glendale and Phoenix at 62% and 56%, respectively.

The population within the study area was 111,726 in 1995 and is projected to grow to 138,480 (24%) by the year 2020. The greatest percentage increase in population will occur in the City of Peoria. Peoria's study area population is projected to increase by 10,754 (44%). The study area within the cities of Glendale and Phoenix anticipate a population increase of 13,676 (29%) and 2,324 (6%), respectively.

As shown in Exhibit 4.10, the City of Peoria's study area population density was 4.85 persons per acre in 1995. Within Glendale, it was 7.86 per acre, and within Phoenix, it was 6.56 per acre. Overall density in the study area was 6.52 persons per acre. The increase in population will increase the density of population in the study area to 8.08 persons per acre. With the increase of population projected for the portion of the study area within each of the cities, the year 2020 densities will break down in the following manner: Peoria at 6.99, Glendale at 10.13, and Phoenix 6.95 persons per acre.

For each of the cities, the population densities are greater than those of the individual cities as a whole. The study area figures compared to the cities as a whole show that the densities per acre, in 1995 are Peoria with 1.02, Glendale with 5.22, and Phoenix with 3.81 persons per acre.

The greatest population changes are expected in Peoria and Glendale. Exhibit 4.10 reveals that the area within the City of Peoria between the Loop 101 Freeway to 83rd Avenue and Grand Avenue to Thunderbird Road (TAZ 347) is anticipated to increase in population by 175%. Currently, this area is designated by the City General Plan as low density residential with some commercial and industrial. The area in Glendale that is anticipated to experience the greatest population increase over the 25-year period is along Grand Avenue between Glendale and Northern Avenues (TAZ 433). Nearly half of this area is designated by the City General Plan for industrial purposes while the remainder is designated as medium density residential and commercial. Existing land use mapping in this area, along the Grand Avenue corridor, reveals that light industrial is a prevalent use and that much of the land is undeveloped or in agricultural uses. Only modest growth is expected in Phoenix within the study area.



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Exhibit 4.9
Traffic Analysis Zones (TAZ)
Within Study Area

Legend

- Street
- Traffic Analysis Zone

Sources: Maricopa Association of Governments

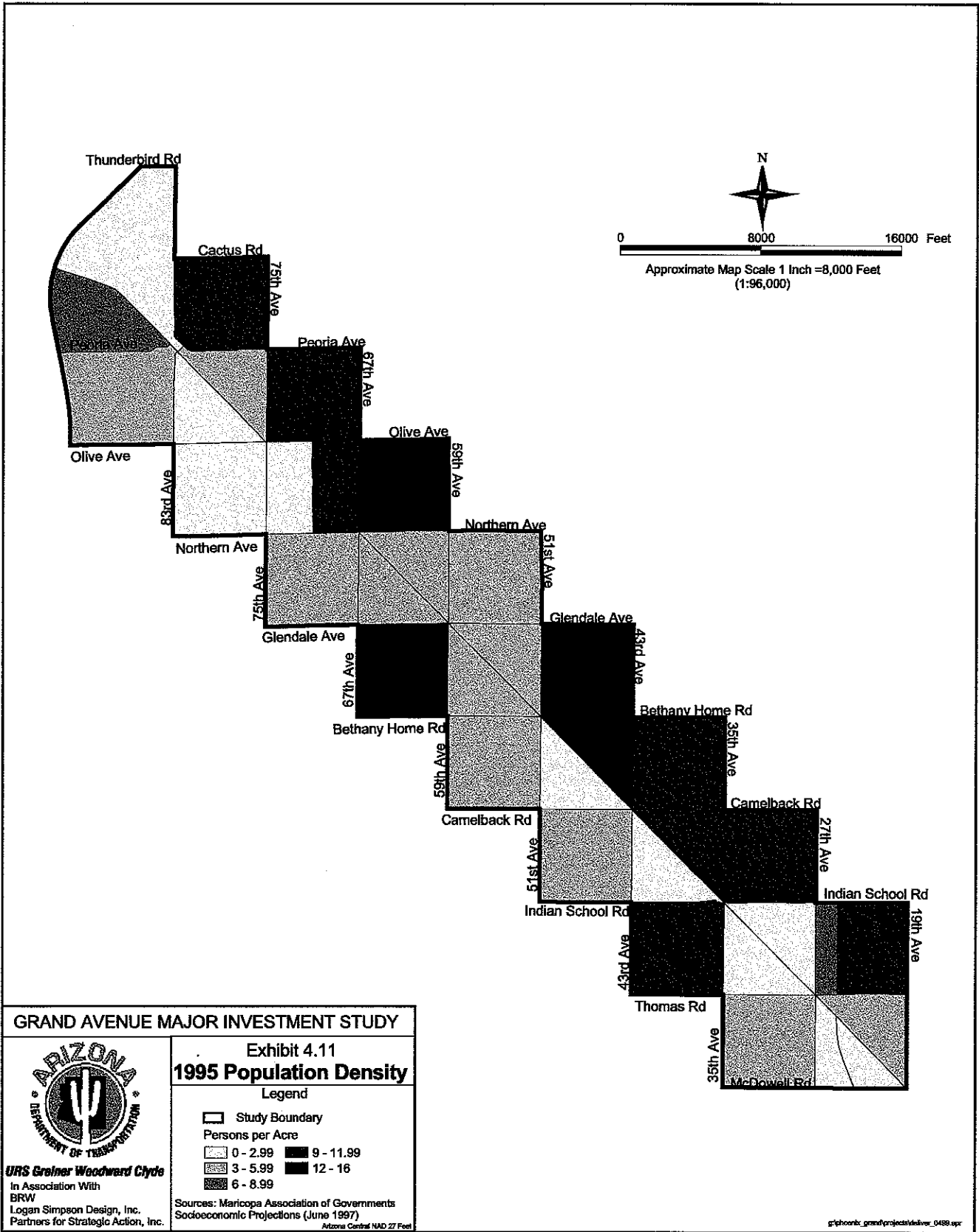
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Exhibit 4.10 Existing and Projected Population

TAZ	Acres	1995 Resident Population	1995 Population Density	2020 Resident Population	2020 Population Density	Absolute Change	Percent Change
Peoria							
347	906	1,728	1.91	4,750	5.24	3,022	175%
348	483	4,276	8.86	4,800	9.94	524	12%
352	636	6,049	9.51	7,763	12.20	1,714	28%
360	753	4,028	5.35	7,795	10.36	3,767	94%
362	317	1,664	5.26	2,241	7.08	577	35%
363	327	158	0.48	158	0.48	-	0%
364	643	158	0.25	158	0.25	-	0%
365	643	6,271	9.75	7,403	11.51	1,132	18%
366	318	42	0.13	60	0.19	18	43%
Peoria Subtotal	5,025	24,374	4.85	35,128	6.99	10,754	44%
Glendale							
433	639	1,985	3.11	7,454	11.66	5,469	276%
436	322	3,132	9.74	4,811	14.96	1,679	54%
438	611	9,288	15.20	11,849	19.40	2,561	28%
439	309	1,710	5.53	1,726	5.58	16	1%
440	312	1,479	4.74	1,540	4.94	61	4%
441	621	7,817	12.59	8,083	13.02	266	3%
445	650	3,256	5.01	4,576	7.04	1,320	41%
446	323	1,393	4.31	1,393	4.31	-	0%
447	326	1,225	3.76	1,226	3.76	1	0%
448	649	3,474	5.35	3,692	5.69	218	6%
452	634	8,506	13.42	9,878	15.58	1,372	16%
453	320	3,983	12.45	4,681	14.63	698	18%
454	315	182	0.58	197	0.62	15	8%
Glendale Subtotal	6,031	47,430	7.86	61,106	10.13	13,676	29%
Phoenix							
660	640	7,172	11.21	7,639	11.94	467	7%
661	323	3,354	10.38	3,509	10.85	155	5%
665	636	6,500	10.21	6,535	10.27	35	1%
666	319	263	0.82	281	0.88	18	7%
671	148	997	6.72	1,509	10.16	512	51%
739	637	3,656	5.74	3,692	5.80	36	1%
743	316	683	2.16	685	2.17	2	0%
744	642	6,084	9.47	6,768	10.54	684	11%
747	317	300	0.95	317	1.00	17	6%
748	803	3,986	4.96	4,322	5.38	336	8%
750	246	-	0.00	-	0.00	-	0%
752	478	5,179	10.83	5,226	10.93	47	1%
753	324	1,748	5.39	1,763	5.44	15	1%
826	252	-	0.00	-	0.00	-	0%
Phoenix Subtotal	6,082	39,922	6.56	42,246	6.95	2,324	6%
Total Study Area	17,138	111,726	6.52	138,480	8.08	26,754	24%
City of Peoria	74,880	76,058	1.02	183,815	2.45	107,757	142%
City of Glendale	36,160	188,610	5.22	305,164	8.44	116,554	62%
City of Phoenix	302,858	1,154,139	3.81	1,795,539	5.93	641,400	56%
Maricopa County	5,902,056	2,528,700	0.43	4,516,100	0.77	1,987,400	79%

Source: MAG Socio-economic Projections, June 1997 & Arizona Department of Commerce Community Profiles



4.5 LABOR FORCE / EMPLOYMENT

Employment is a significant factor that influences travel behavior in the study area. The labor force is defined as those persons who are older than 16 years of age and are available for employment and live within the area described. Existing and project employment were obtained from the *Maricopa Association of Governments Socio-economic Projections of June 1997* and were provided by TAZs for the study area. The existing and projected employment for the study area is summarized in Exhibit 4.12. Employment densities are illustrated in Exhibit 4.13.

Expected growth in employment is comparable to that of the population. Employment is expected to increase in Maricopa County from 1995 to 2020, from 1,264,800 to 2,212,889 (75%), which amounts to 948,089 more jobs over the 25-year period. Based on comparable increases in both population and employment, work-related prospects should remain stable.

Employment density within the study area is expected to increase by the year 2020, bringing the persons employed per acre in the study area from 4.14 per acre to 5.41. Overall study area growth is calculated to be 30.6% with an absolute increase in employment of 21,699 jobs.

Within the study area, the greatest employment density increase among the three individual cities is expected to be Peoria, with an increase from 1.46 to 2.8 persons employed per acre. While employment is expected to increase in the study area by 91% (or 6,719 persons employed), this is significantly lower than the overall City of Peoria anticipated employment increase of 209%. The TAZ within the study area and Peoria that is expected to increase in employment by the greatest percentage (728%) lies between 83rd Avenue, 75th Avenue, Grand Avenue and Olive Avenue (TAZ 363). No population change is anticipated in this area and the City General Plan has designated this area for light industrial and commercial purposes. Several other TAZs in the City of Peoria study area are anticipated to see a significant increase in employment as well.

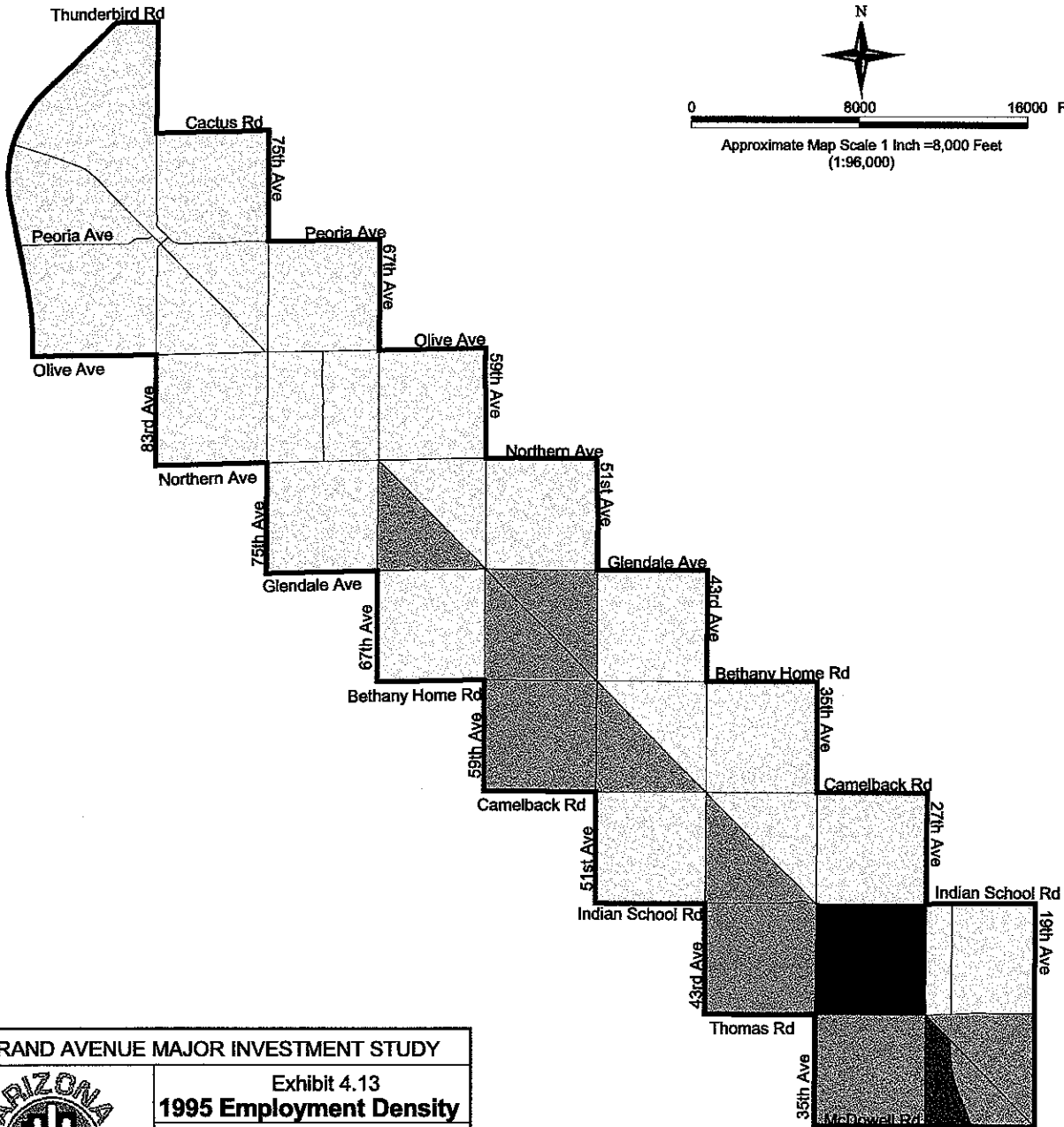
As a whole, the City of Glendale is expected to experience employment density increases from 1.74 to 3.18 persons employed per acre. This represents an absolute increase in employment of 52,288 persons employed (or 83%). The study area within the City of Glendale is anticipated to experience an increase in employment of 10,606 jobs (or 45%). TAZs within Glendale study area that are predicted to increase by the greatest percentage lie between the Glendale Avenue, 59th Avenue, Northern Avenue and Olive Avenue (TAZ 436 and 438). The majority of this area is designated by the City General Plan for residential purposes, however, areas adjacent to Grand Avenue are designated industrial and a large portion of the land is designated for public uses as well.

The TAZ within Phoenix that is predicted to increase in employment by the greatest percentage is between Indian School Road, Camelback Road, 43rd Avenue, and 51st Avenue (TAZ 739). Increase in absolute numbers of people employed is expected to be 3,103 (or 221%). This area is designated by the City General Plan as industrial near Grand Avenue, with low density residential and commercial in the southwest quarter. The City of Phoenix as a whole is projected to increase employment by 31% in the 25-year period. This represents a total increase in jobs of 209,097 jobs, which is the greatest number in job increase among the three cities.

Exhibit 4.12 Existing and Projected Employment

TAZ	Acres	1995 Labor Force	1995 Employment Density	2020 Labor Force	2020 Employment Density	Absolute Change	Percent Change
Peoria							
347	906	412	0.45	1,394	1.54	982	238.3%
348	483	1,591	3.30	1,877	3.89	286	18.0%
352	636	317	0.50	332	0.52	15	4.7%
360	753	1,168	1.55	2,552	3.39	1,384	118.5%
362	317	1,213	3.83	1,759	5.56	546	45.0%
363	327	378	1.16	3,130	9.59	2,752	728.0%
364	643	1,023	1.59	1,028	1.60	5	0.5%
365	643	620	0.96	659	1.02	39	6.3%
366	318	638	2.01	1,348	4.24	710	111.3%
Peoria Subtotal	5,025	7,360	1.46	14,079	2.80	6,719	91.3%
Glendale							
433	639	2,146	3.36	2,815	4.40	669	31.2%
436	322	669	2.08	1,413	4.39	744	111.2%
438	611	1,788	2.93	4,108	6.72	2,320	129.8%
439	309	514	1.66	828	2.68	314	61.1%
440	312	1,585	5.08	2,524	8.09	939	59.2%
441	621	1,359	2.19	1,490	2.40	131	9.6%
445	650	3,122	4.81	4,608	7.09	1,486	47.6%
446	323	2,155	6.66	2,301	7.12	146	6.8%
447	326	2,271	6.96	3,253	9.97	982	43.2%
448	649	3,974	6.12	6,591	10.15	2,617	65.9%
452	634	1,894	2.99	2,145	3.38	251	13.3%
453	320	576	1.80	583	1.82	7	1.2%
454	315	1,648	5.23	1,648	5.23	-	0.0%
Glendale Subtotal	6,031	23,701	3.93	34,307	5.69	10,606	44.7%
Phoenix							
660	640	903	1.41	964	1.5	61	6.8%
661	323	1,044	3.23	1,244	3.8	200	19.2%
665	636	908	1.43	955	1.5	47	5.2%
666	319	5,236	16.42	5,540	17.4	304	5.8%
671	148	410	2.76	413	2.8	3	0.7%
739	637	1,402	2.20	4,505	7.1	3,103	221.3%
743	316	2,850	9.03	2,864	9.1	14	0.5%
744	642	4,979	7.75	5,093	7.9	114	2.3%
747	317	6,306	19.90	6,332	20.0	26	0.4%
748	803	7,160	8.92	7,450	9.3	290	4.1%
750	246	3,476	14.15	3,490	14.2	14	0.4%
752	478	1,482	3.10	1,488	3.1	6	0.4%
753	324	1,875	5.78	1,949	6.0	74	3.9%
826	252	1,926	7.63	2,044	8.1	118	6.1%
Phoenix Subtotal	6,082	39,957	6.57	44,331	7.29	4,374	10.9%
Total Study Area	17,138	71,018	4.14	92,717	5.41	21,699	30.6%
City of Peoria	74,880	14,867	0.20	45,993	0.61	31,126	209.4%
City of Glendale	36,160	62,802	1.74	115,090	3.18	52,288	83.3%
City of Phoenix	302,858	664,878	2.20	873,975	2.89	209,097	31.4%
Maricopa County	5,902,056	1,264,800	0.21	2,212,889	0.37	948,089	75.0%

Source: MAG Socioeconomic Projections, June 1997 & Arizona Department of Commerce Community Profiles



GRAND AVENUE MAJOR INVESTMENT STUDY



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**Exhibit 4.13
 1995 Employment Density**

Legend

	Study Boundary
Persons Employed per Acre	
	0 - 4.99
	5 - 9.99
	10 - 14.99
	>15

Sources: Maricopa Association of Governments
 Socioeconomic Projections (June 1997)

Arizona Central NAD 22 Feet

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4.6 TITLE VI ENVIRONMENTAL JUSTICE

The basic provisions of Title VI of the Civil Rights Act of 1964 and Executive Order 12898 require Federal agencies to ensure that their actions do not exclude persons and populations from participation, deny persons and populations of the benefits of the proposed action / activities, or subject persons and populations to discrimination because of race, color or national origin. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," reaffirms the principles of Title VI and related statutes. The Executive Order requires the consideration of low income, as well as/or in addition to, minority, disabled, women and elderly populations. To facilitate the analysis, the study area was divided into 36 TAZs and compared and contrasted with data for Maricopa County in order to assess whether minority or low-income populations are disproportionately represented within the study corridor. In addition to environmental justice populations, automobile ownership and education attainment statistics were analyzed for the MIS. Data were obtained from the *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997* and from ADOT GIS 1990 Census database.

ADOT Environmental Planning Section (EPS) guidelines stipulate that data identifying protected minority populations living within the study area be compared and contrasted with the countywide data for these populations. TAZ-level data for the study area have been compared with Maricopa County. An examination of corridor-level data relative to the county provides a baseline for determining whether protected populations are represented as distinct populations with the study. According to FHWA guidelines, for a minority or low-income population to be considered as a distinct population, they must comprise greater than 50 % of the population.

4.6.1 Minority Populations

The minority population describes the ethnic background for each person within the population and includes individuals whom are African American, Hispanic, Asian American, Native American, or Alaskan Native. Population ethnicity was obtained from *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997, Table 2E*. Exhibit 4.14 summarizes the population of those individuals, within the study area, who are minority. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale and Phoenix. Exhibit 4.15 graphically displays the percentage of population within the study area by TAZ that are minority.

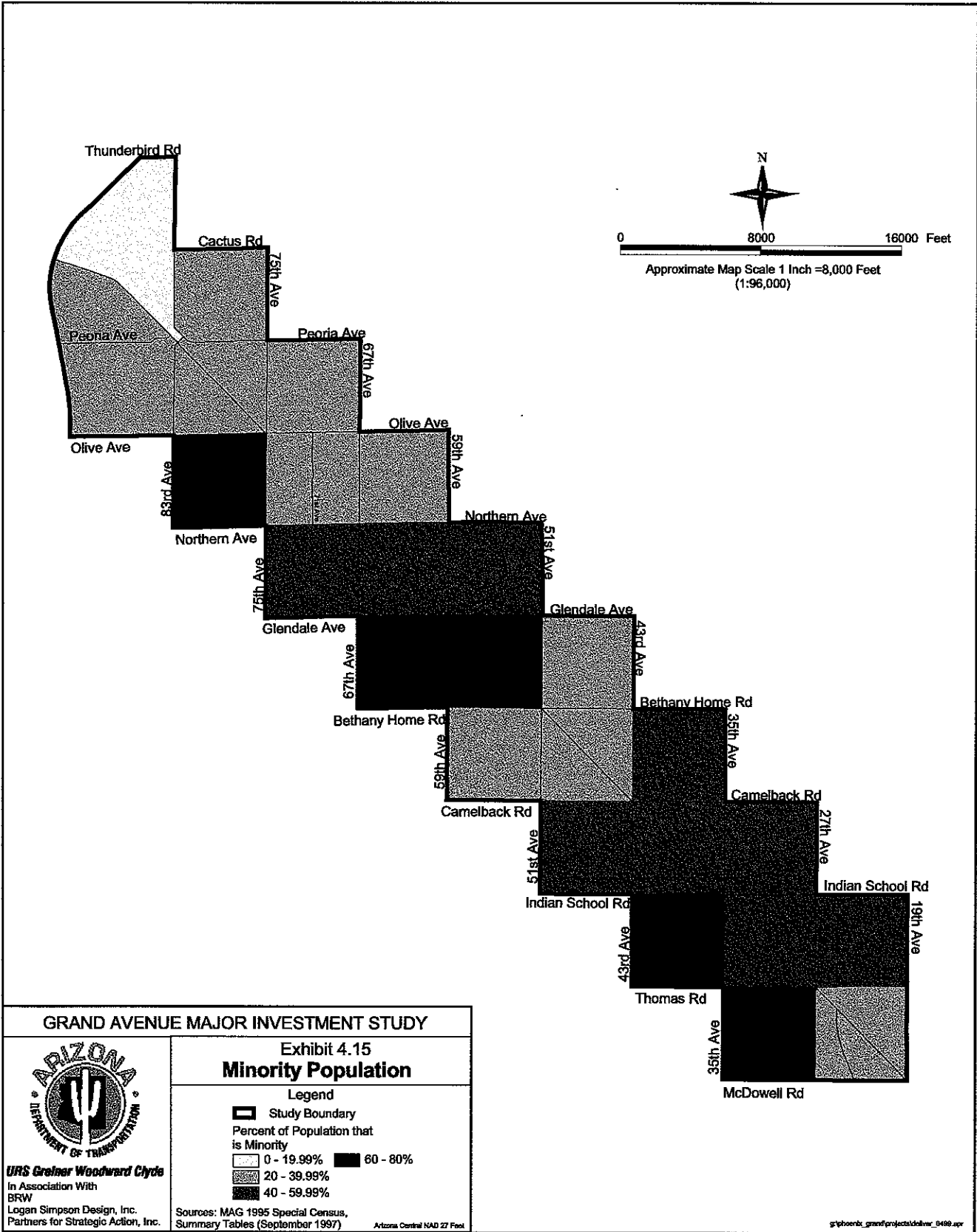
According to the *MAG 1995 Special Census Summary Table 2E*, out of the total population of 2,551,765 reporting persons, 716,918 individuals were reported as minority within Maricopa County. This represents a 28% minority population for Maricopa County. The majority race population in Maricopa County is non-Hispanic-white, reporting a population of 1,834,847 (72%). The Hispanic ethnic background is the next highest reported population number with 522,487 Hispanic individuals (20%) reported.

Exhibit 4.14
Minority Populations Summary

TAZ	Tract	Non-Hispanic					Hispanic	Total of Reporting Population	Total Minority Population	Percent Minority
		White	Black/ African American	American Indian/ Eskimo/ Aleut	Asian/ Pacific Islander	Other Race				
Peoria										
347	71507	2,217	92	14	72	11	354	2,760	543	20%
358	71909	337	7	1	2	-	4	351	14	4%
365	71904	4,771	189	49	90	66	1,794	6,959	2,188	31%
360	71906	2,670	130	14	66	31	1,271	4,182	1,512	36%
348	71908	2,828	129	75	52	30	1,217	4,331	1,503	35%
352	71910	4,354	192	30	63	59	1,805	6,503	2,149	33%
362/363	71911	1,558	52	11	68	10	401	2,100	542	26%
364	92704	59	-	4	-	-	107	170	111	65%
Peoria Subtotal		18,794	791	198	413	207	6,953	27,356	8,562	31%
Glendale										
366/436/438	92304	7,095	509	165	308	95	1,853	10,025	2,930	29%
445	92500	1,514	51	33	22	19	1,844	3,483	1,969	57%
439/440	92600	1,558	83	43	27	17	1,435	3,163	1,605	51%
433	92705	1,309	191	47	37	24	767	2,375	1,066	45%
441	92800	3,794	527	131	62	62	4,949	9,525	5,731	60%
446/447	92900	600	105	58	30	19	1,981	2,793	2,193	79%
452	93000	5,205	624	171	132	68	2,439	8,639	3,434	40%
448/453/454	93101	4,325	691	210	144	31	1,671	7,072	2,747	39%
Glendale Subtotal		25,400	2,781	858	762	335	16,939	47,075	21,675	46%
Phoenix										
660	107100	4,667	662	251	293	106	1,823	7,802	3,135	40%
665	109100	3,266	240	118	251	80	3,143	7,098	3,832	54%
661/743	109200	1,629	226	143	138	52	1,613	3,801	2,172	57%
739	109300	1,757	168	62	83	52	1,879	4,001	2,244	56%
744	110100	1,715	289	124	130	31	3,492	5,781	4,066	70%
666/747	110200	225	10	21	1	15	126	398	173	44%
671/752	110300	2,777	323	321	326	106	2,731	6,584	3,807	58%
750/753/826	112000	1,107	49	20	22	16	515	1,729	622	36%
748	112100	759	62	38	37	9	2,802	3,707	2,948	80%
Phoenix Subtotal		17,902	2,029	1,098	1,281	467	18,124	40,901	22,999	56%
Study Area Total		62,096	5,601	2,154	2,456	1,009	42,016	115,332	53,236	46%
Percent		54%	5%	2%	2%	1%	36%	100%		
City of Peoria		59,181	1,698	367	1,203	430	11,686	74,565	15,384	21%
City of Glendale		1,311,223	7,658	1,953	4,133	1,555	36,093	182,615	51,392	28%
City of Phoenix		741,453	56,922	17,807	21,230	8,921	303,084	1,149,417	407,964	36%
Maricopa County		1,834,847	88,923	38,735	48,966	17,807	522,487	2,551,765	716,918	28%

Source: MAG 1995 Special Census, Summary Tables, Table 2E, September 1997

Note: Total population may differ from other tables. These populations are based on census tract area data.



The percent of reported minority population for the study area, as a whole is 46% with 53,236 individuals reported as minority. The greatest ethnic population reported was White, with 62,096 (54%) reporting. As was true for the whole of Maricopa County, the next highest reported population was Hispanic, with a population of 42,016 (36%) reported. Study area race statistics were reported as follows: Black / African American at 5,601 individuals (5%); American Indian, Eskimo, Aleut at 2,154 individuals (2%); Asian, Pacific Islander were reported at 2,456 individuals (2%) and Other was reported at 1,009 individuals (1%).

Of the three study area cities, the greatest reported total minority population was in the study area of the City of Phoenix with 22,999 individuals or 56%. From within the study area portion of the City of Glendale, a total of 21,675 (46%) individuals were reported as minority. The study area within the City of Peoria reported 31% as minority (or 8,562 individuals).

The population of the study area is characterized by higher than typical minority populations. There are TAZ areas, within the study area, where the minority population exceeds 70%. These areas are in the City of Phoenix identified north and south of Thomas Road, between 27th and 43rd Avenue (TAZ 748, 744) and in the City of Glendale between 59th Avenue, 51st Avenue, Bethany Home Road and Glendale Avenue (TAZ 446/447).

4.6.2 Elderly Populations

Elderly refers to individuals older than 60 years of age. Elderly population data were obtained from *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997, Tables 2E and 2F*. Exhibit 4.16 summarizes the population of those individuals, within the study area, who are 60 years of age or older. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale, and Phoenix. Exhibit 4.17 graphically displays the percentage of population within the study area by TAZ that are elderly.

According to the 1995 Special Census, there were 321,834 individuals in Maricopa County who were 60 years of age or older. This is 12.6% of the total reporting population. The percentage of total population that is elderly in Peoria, Glendale, and Phoenix is 20%, 11%, and 12%, respectively.

Within the study area, the 1995 elderly population was 12.9% of the total population, which closely approximates that of Maricopa County. The breakdown by city in the study area is Peoria at 10.3%, Glendale at 14.2% and Phoenix at 12.9% elderly population. No extraordinary elderly population densities are revealed within any individual TAZ. The highest percentage is in TAZ 750/753/826 (in Phoenix) with 23% elderly.

4.6.3 Low Income Populations

Poverty Status for this MIS was defined as the 1995 segment of the population of households earning an annual income that is equal to or less than the following:

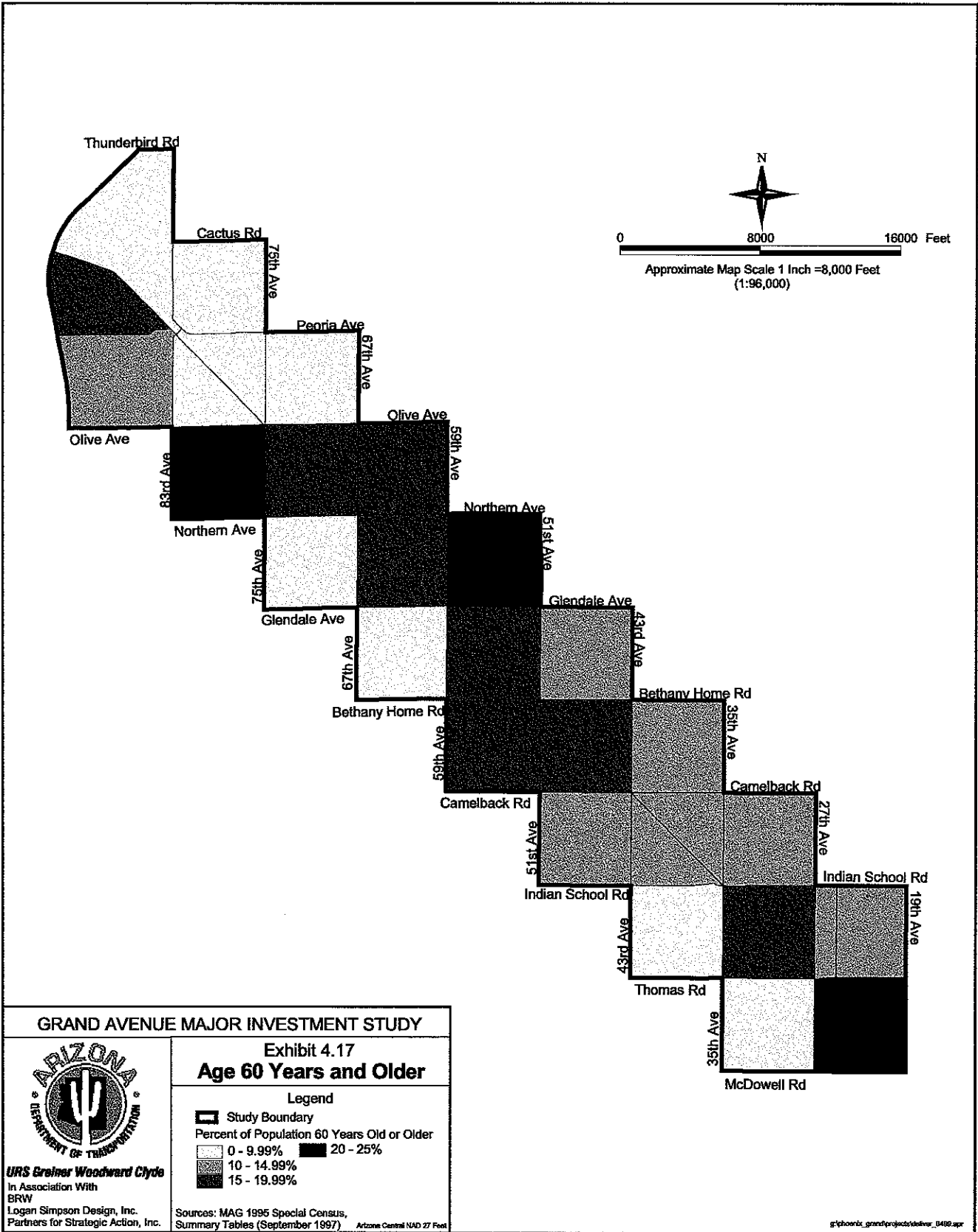
- ◆ One person earning \$7,740, or less
- ◆ Two people earning \$10,360 or less
- ◆ Three people earning \$12,980 or less
- ◆ Four or more people earning \$15,600 or less

(Source: MAG 1995 Special Census Summary Table 6, Appendix A-1 and A-2)

Exhibit 4.16
Elderly Populations Summary

TAZ	Tract	60-74	74-84	Over 84	Total Over 59	Total TAZ Population	Percent 60 Years or Older
Peoria							
347	71507	89	32	29	150	2,760	5.4%
358/360	71906/09	499	258	97	854	5,479	15.6%
365	71904	403	125	22	550	6,959	7.9%
348	71908	350	159	49	558	3,385	16.5%
352	71910	389	142	32	563	6,503	8.7%
362/363	71911	85	19	10	114	2,100	5.4%
364	92704	22	12	0	34	170	20.0%
Peoria Subtotal		1,837	747	239	2,823	27,356	10.3%
Glendale							
366/436/438	92304	605	586	377	1,568	10,025	15.6%
445	92500	426	232	72	730	3,483	21.0%
439/440	92600	295	144	63	502	3,163	15.9%
433	92705	97	22	20	139	2,375	5.9%
441	92800	605	178	69	852	9,525	8.9%
446/447	92900	293	101	60	454	2,793	16.3%
452	93000	861	297	79	1,237	8,639	14.3%
448/453/454	93101	766	319	141	1,226	7,072	17.3%
Glendale Subtotal		3,948	1,879	881	6,708	47,075	14.2%
Phoenix							
660	107100	807	174	62	1,043	7,802	13.4%
665	109100	705	268	77	1,050	7,098	14.8%
661/743	109200	320	76	34	430	3,801	11.3%
739	109300	369	103	23	495	4,001	12.4%
744	110100	413	98	25	536	5,781	9.3%
666/747	110200	46	13	14	73	398	18.3%
671/752	110300	525	319	93	937	6,584	14.2%
750/753/826	112000	254	122	22	398	1,729	23.0%
748	112100	228	73	29	330	3,707	8.9%
Phoenix Subtotal		3,667	1,246	379	5,292	40,901	12.9%
Study Area Total		9,452	3,872	1,499	14,823	115,332	12.9%
City of Peoria							
		8,900	3,779	2,044	14,723	74,565	19.7%
City of Glendale							
		13,336	4,799	2,058	20,193	182,615	11.1%
City of Phoenix							
		96,499	33,496	12,234	142,229	1,149,417	12.4%
Maricopa County							
		177,946	107,852	36,036	321,834	2,551,765	12.6%

Source: MAG 1995 Special Census Summary Tables, Table 2E and 2F, September 1997



Income data were obtained from *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997, Tables 6, A-1, and A-2*. Exhibit 4.18 summarizes the population of those individuals, within the study area, who are considered low income. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale, and Phoenix. Exhibit 4.19 graphically displays the percentage of population within the study area by TAZ that are considered low income.

Eighteen percent of the 1995 population within the study area lives in poverty. This is nearly twice the percentage for Maricopa County (10%) and is a greater percent than that of each city. The cities of Peoria, Glendale, and Phoenix are reported to have 6%, 11% and 13% of their respective populations living in poverty. Within the study area 10% of individuals in Peoria live in poverty, 23% in Glendale and 19% in Phoenix, all increases over citywide percentages. TAZs within the study area, where 30% or more of the population lives in poverty are within the City of Glendale, 439/440, 441, 446/447, and within the City of Phoenix, 666/747 and 748. In addition to the above socio-economic factors, TAZs 446/447 and 748 also are revealed to contain greater than 70% minority populations. TAZ 666/747 reported that 18% of its population is 60 years of age and older.

4.6.4 Mobility Disability Populations

Mobility Disability has been defined as the population of persons, 16 years of age and older, who have been identified as having a mobility limitation due to a health condition. These health conditions are further defined as having lasted for six or more months and have made it difficult to travel outside the home unassisted. Mobility Disability data were obtained from ADOT 1990 Census database. Exhibit 4.20 summarizes the population of those individuals, within the study area, who have mobility or self-care limitations. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale, and Phoenix. Exhibit 4.21 graphically displays the percentage of population within the study area by TAZ that have mobility or self-care limitations.

The 1990 Census reports that the total number of people with mobility or self-care limitations within Maricopa County totaled 93,958. This represents 6% of the population. The cities of Peoria, Glendale and Phoenix had mobility disabled populations of 35,970 (6%), 108,108 (5%) and 732,796 (6%), respectively.

The percentage of population with mobility or self-care limitation within the study area is 7%. The percentages reported of 6%, 7% and 7% are the respective percentages within the study area of Peoria, Glendale and Phoenix.

The TAZ area with the highest mobility disabled percentage is TAZ 446/447 within the City of Glendale, with a 15% mobility disability percent. TAZ areas revealing a greater than 10% mobility disabled populations were TAZ areas 445 and 446/447 in Glendale and TAZ areas 666/747 in Phoenix.

Exhibit 4.18
Low Income Populations Summary

TAZ	Tract	Under \$7,499	\$7,500 to \$9,999	\$10,000 to \$12,499	\$12,500 to \$14,999	\$15,000 to \$19,999	Reported Households	Reported Households In Poverty	Percent of Households In Poverty
Peoria									
347	71507	48	36	57	51	85	1,043	64	6.1%
358/360	71906/09	151	113	103	63	148	1,565	243	15.5%
365	71904	55	21	35	101	81	1,469	96	6.5%
348	71908	116	49	64	57	102	1,013	161	15.9%
352	71910	60	45	51	42	66	1,515	118	7.8%
362/363	71911	31	11	22	4	25	498	42	8.4%
364	92704	81	39	47	43	86	1,442	151	10.5%
Peoria Subtotal		542	314	379	361	593	8,545	875	10.2%
Glendale									
366/436/438	92304	311	169	276	215	428	3,266	449	13.7%
445	92500	127	62	84	62	87	706	209	29.6%
439/440	92600	171	84	81	70	87	834	263	31.5%
433	92705	134	54	74	89	150	1,417	240	16.9%
441	92800	364	157	190	159	245	1,946	653	33.6%
446/447	92900	188	49	70	47	68	586	255	43.5%
452	93000	281	112	130	105	227	2,051	426	20.8%
448/453/454	93101	207	122	158	134	202	1,684	322	19.1%
Glendale Subtotal		1,783	809	1,063	881	1,408	12,490	2,817	22.6%
Phoenix									
660	107100	98	63	95	103	202	2,040	200	9.8%
665	109100	161	86	112	75	120	1,232	282	22.9%
661/743	109200	89	33	61	51	81	676	129	19.1%
739	109300	68	35	53	49	105	798	138	17.3%
744	110100	155	64	99	114	172	1,260	281	22.3%
666/747	110200	34	14	18	12	19	133	48	36.1%
671/752	110300	205	97	179	118	167	1,747	330	18.9%
750/753/826	112000	56	22	36	31	55	525	78	14.9%
748	112100	90	52	68	55	70	530	204	38.5%
Phoenix Subtotal		956	466	721	608	991	8,941	1,690	18.9%
Study Area Total		3,281	1,589	2,163	1,850	3,078	29,976	5,382	18.0%
City of Peoria									
		645	394	600	573	956	17,959	1,050	5.8%
City of Glendale									
		3,019	1,395	1,997	1,841	3,159	42,583	4,857	11.4%
City of Phoenix									
		20,515	9,806	14,080	13,074	20,807	260,125	34,332	13.2%
Maricopa County									
		38,822	19,613	28,704	27,301	45,103	608,777	63,392	10.4%

Source: MAG 1995 Special Census Summary Table 6, Appendix A-1 and A-2, September 1997

Note: Federal household criteria (for households in poverty) (Individual row numbers will not add to total due criteria below)

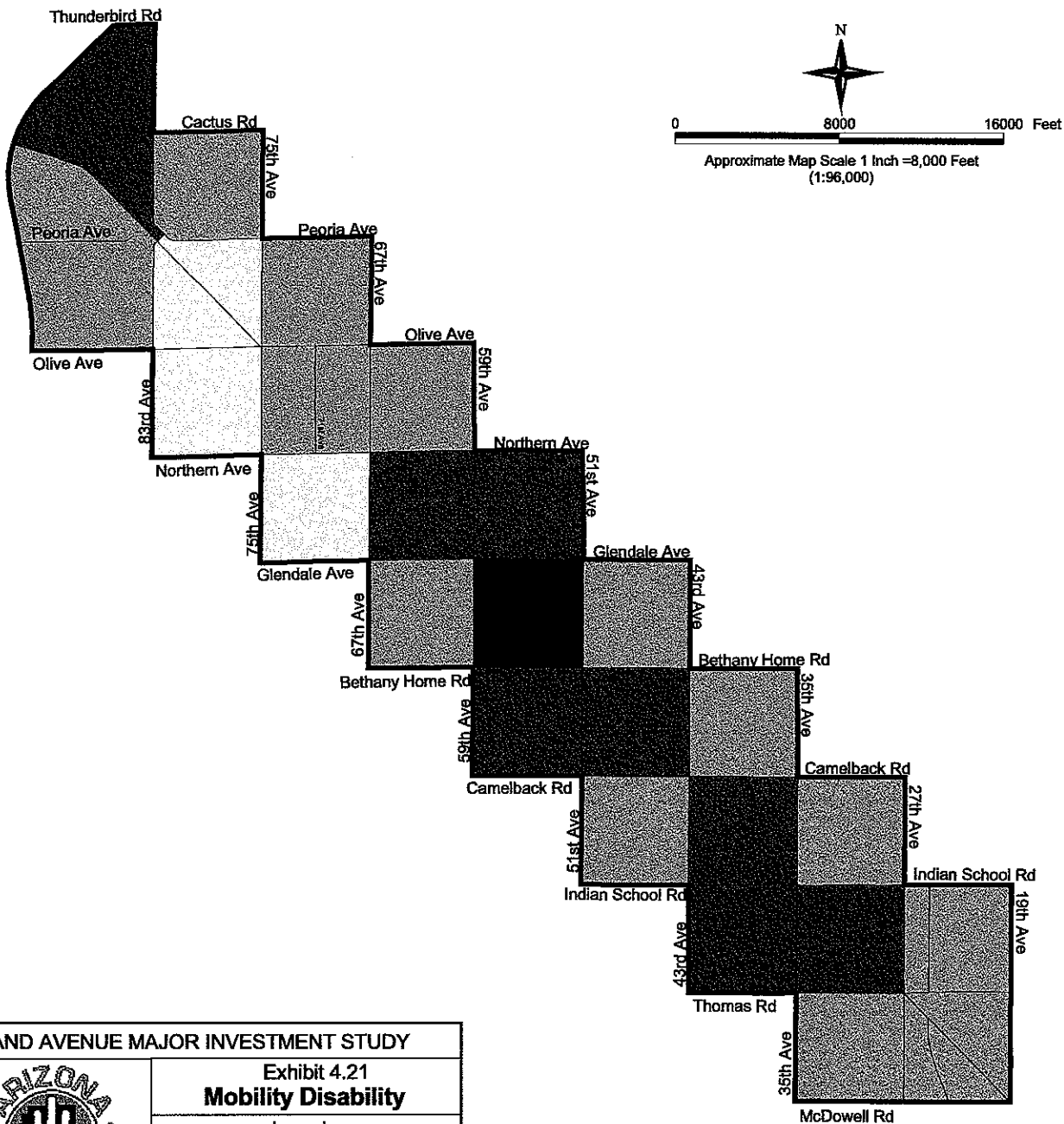
- 1) Households with one person earning less than \$7,500
- 2) Households with two people earning less than \$10,000
- 3) Households with three people earning less than \$12,500
- 4) Households with four or more people earning less than \$15,000

Exhibit 4.20
Mobility Disability Populations Summary

TAZ	Tract	With a mobility or self-care limitation	No mobility or self care limitation	Total Population	Percent with Mobility Disability
Peoria					
347	71507	139	1,270	1,409	9.9%
358/360	71906/09	278	3,237	3,515	7.9%
365	71904	207	3,819	4,026	5.1%
348	71908	194	2,548	2,742	7.1%
352	71910	172	3,289	3,461	5.0%
362/363	71911	26	697	723	3.6%
364	92704	-	91	91	0.0%
Peoria Subtotal		1,016	14,951	15,967	6.4%
Glendale					
366/436/438	92304	387	6,261	6,648	5.8%
445	92500	270	2,380	2,650	10.2%
439/440	92600	191	1,822	2,013	9.5%
433	92705	20	1,082	1,102	1.8%
441	92800	411	5,217	5,628	7.3%
446/447	92900	336	1,860	2,196	15.3%
452	93000	280	5,702	5,982	4.7%
448/453/454	93101	411	4,522	4,933	8.3%
Glendale Subtotal		2,306	28,846	31,152	7.4%
Phoenix					
660	107100	323	5,189	5,512	5.9%
665	109100	263	4,419	4,682	5.6%
661/743	109200	196	2,198	2,394	8.2%
739	109300	162	2,362	2,524	6.4%
744	110100	296	3,296	3,592	8.2%
666/747	110200	29	260	289	10.0%
671/752	110300	340	4,491	4,831	7.0%
750/753/826	112000	74	1,414	1,488	5.0%
748	112100	134	2,169	2,303	5.8%
Phoenix Subtotal		1,817	25,798	27,615	6.6%
Study Area Total		5,139	69,595	74,734	6.9%
City of Peoria		2,064	33,906	35,970	5.7%
City of Glendale		5,770	102,338	108,108	5.3%
City of Phoenix		43,107	689,689	732,796	5.9%
Maricopa County		93,958	1,506,895	1,600,853	5.9%

Source: 1990 Census Data from ADOT

Note: Mobility Disability population totals include individuals 16 years of age and older

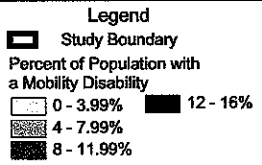


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**Exhibit 4.21
 Mobility Disability**



Sources: 1990 Census Data from ADOT
 Arizona Central NAD 27 Feet

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4.6.5 Female Head of Household

A female head of household is defined, as a household that is maintained by a female that is single. Female head of household population data were obtained from *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997, Tables 2E and 2F*. Exhibit 4.22 summarizes the number of households within the study area maintained by a female that is single. The exhibit also shows comparison households for Maricopa County and the cities of Peoria, Glendale and Phoenix. Exhibit 4.23 graphically displays the percentage of households within the study area by TAZ that are maintained by a female.

Approximately 12% of all households in 1995 in Maricopa County were maintained by a single female as the head of the household. The female head of household percentages for Peoria, Glendale, and Phoenix are reported as 9%, 12% and 14%, respectively.

The study area demonstrates a higher percentage female head of household population (14%) than that of Maricopa County. The portions of each city within the study area also demonstrate a slightly higher female head of household percentage than the percentages for the whole cities; Peoria 11%, Glendale 16%, and Phoenix 15%. TAZ 452 in Glendale has the highest percentage with almost 21% of the households maintained by a female.

4.6.6 Educational Attainment

Educational Attainment includes the populations of those people, over 25 years of age, having attained various levels or years of education. The years of education are broken down into three levels. These levels include:

1. Those who have not attained a high school education
2. Those who have graduated from high school
3. Those who have some college, a college degree or graduate degree

Education attainment data were obtained from ADOT 1990 Census database. Exhibit 4.24 summarizes the education attainment of the population within the study area. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale and Phoenix. Exhibit 4.25 graphically displays the percentage of population within the study area that does not have a high school education by TAZ.

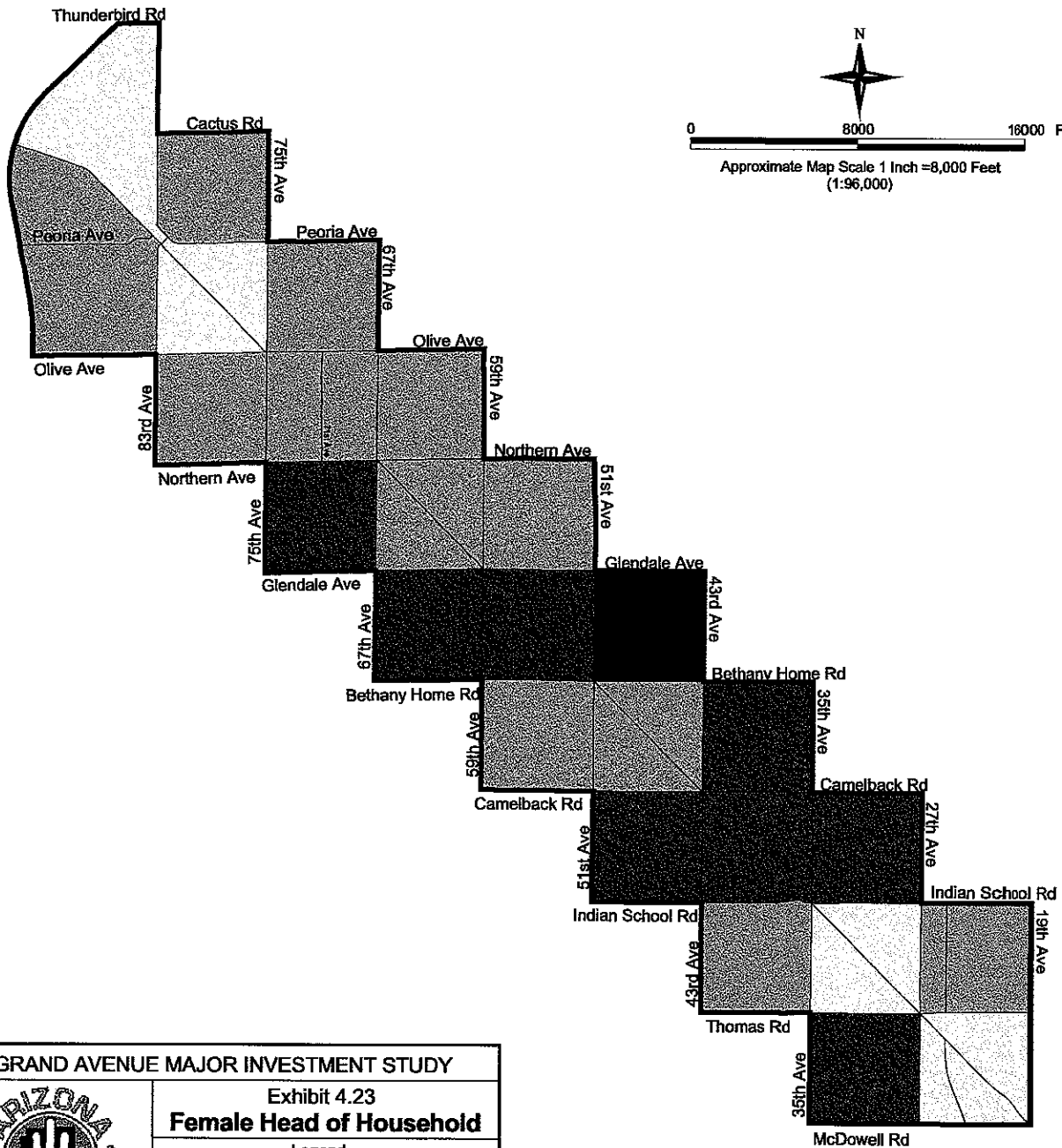
These data reveal that 27% of the population within the study area reported that they do not have a high school diploma. On the other hand, 30% report that they do have a high school diploma and 43% report that they have some college. The percentage of persons without a high school diploma is higher than the county average of 19%. The portions of each city within the study area also demonstrate a higher percentage of persons without a high school diploma than the percentages for the whole cities (see Exhibit 4.24).

Exhibit 4.22
Female Head of Household Summary

TAZ	Tract	Total Households	Female Head of Household (single parent)	Percent Female Head of Household
Peoria				
347	71507	1,306	80	6.1%
358/360	71906/09	2,307	221	9.6%
365	71904	2,257	290	12.8%
348	71908	1,619	218	13.5%
352	71910	2,118	254	12.0%
362/363	71911	656	53	8.1%
364	92704	1,945	243	12.5%
Peoria Subtotal		12,208	1,359	11.1%
Glendale				
366/436/438	92304	4,634	565	12.2%
445	92500	1,240	162	13.1%
439/440	92600	1,169	170	14.5%
433	92705	2,248	390	17.3%
441	92800	2,998	577	19.2%
446/447	92900	1,005	196	19.5%
452	93000	3,264	679	20.8%
448/453/454	93101	2,874	426	14.8%
Glendale Subtotal		19,432	3,165	16.3%
Phoenix				
660	107100	2,729	417	15.3%
665	109100	2,483	404	16.3%
661/743	109200	1,475	223	15.1%
739	109300	1,116	178	15.9%
744	110100	1,856	272	14.7%
666/747	110200	170	10	5.9%
671/752	110300	2,564	309	12.1%
750/753/826	112000	729	63	8.6%
748	112100	975	166	17.0%
Phoenix Subtotal		14,097	2,042	14.5%
Study Area Total		45,737	6,566	14.4%
City of Peoria		27,296	2,329	8.5%
City of Glendale		64,295	7,827	12.2%
City of Phoenix		421,687	57,841	13.7%
Maricopa County		957,730	110,835	11.6%

Source: MAG 1995 Special Census, Summary Tables September 1997

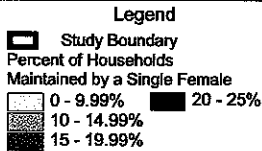
Note: Full tracts were used including enumeration districts outside study area



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Exhibit 4.23
Female Head of Household



Sources: MAG 1995 Special Census, Summary Tables (September 1997)
Arizona Central NAD 27 Feet

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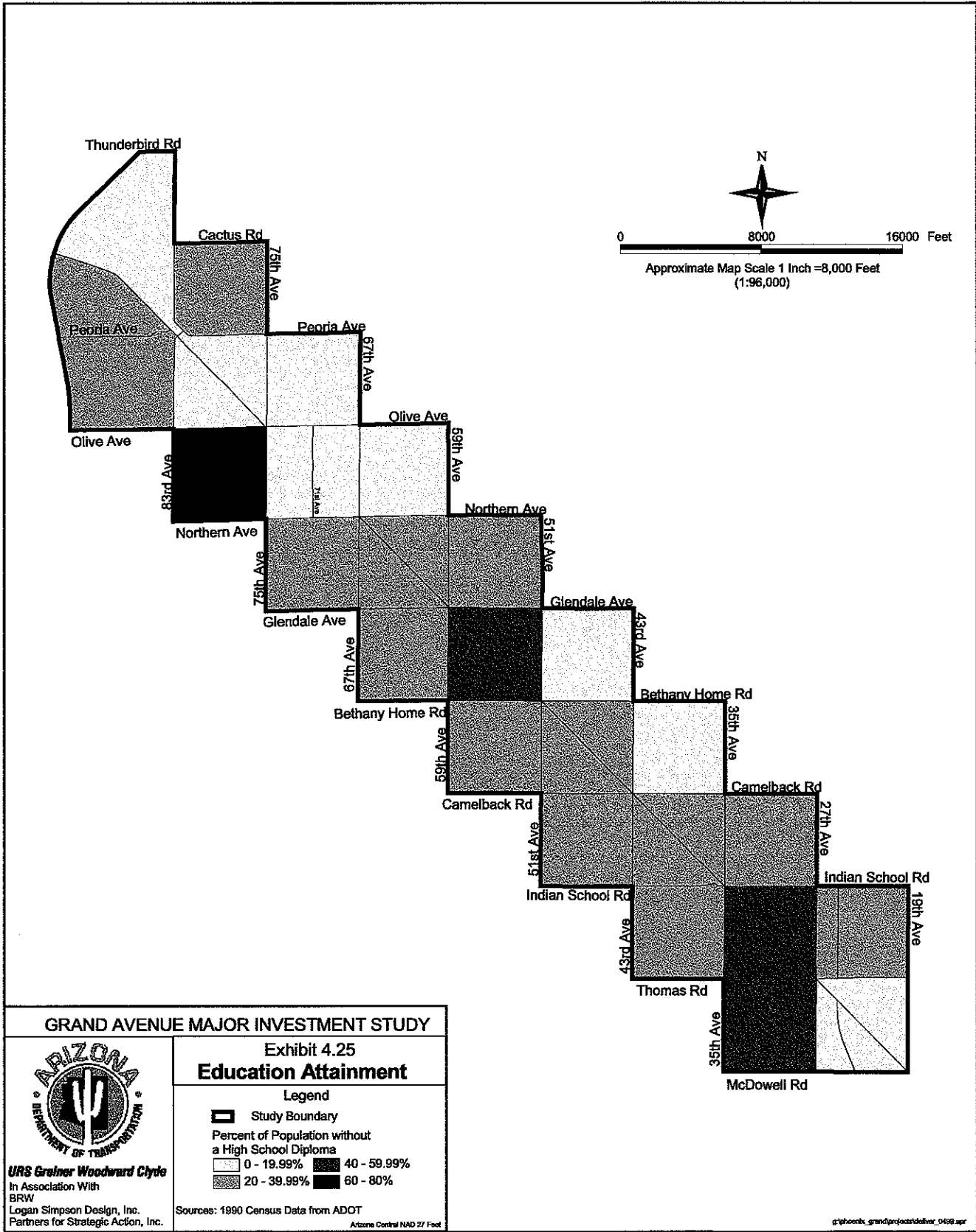
Exhibit 4.24 Education Attainment Summary

TAZ	Tract	Reported Population, 25 Years of Age or Older	Persons without a High School diploma	Percent without a High School diploma	Persons with High School Education	Percent with High School Education	Persons with Higher Education	Percent with Higher Education
Peoria								
347	71507	1,447	132	9%	463	32%	852	59%
358	71909	1,088	283	26%	455	42%	350	32%
365	71904	3,392	620	18%	1,103	33%	1,669	49%
360	71906	2,029	453	22%	629	31%	947	47%
348	71908	2,387	660	28%	724	30%	1,003	42%
352	71910	2,897	645	22%	773	27%	1,479	51%
362/363	71911	626	92	15%	220	35%	314	50%
364	92704	82	65	79%	17	21%	-	-
Peoria Subtotal		13,948	2,950	21%	4,384	31%	6,614	47%
Glendale								
366/436/438	92304	4,755	932	20%	1,345	28%	2,478	52%
445	92500	2,237	793	35%	829	37%	615	27%
439/440	92600	1,663	651	39%	397	24%	615	37%
433	92705	697	181	26%	250	36%	266	38%
441	92800	4,512	1,662	37%	1,214	27%	1,636	36%
446/447	92900	1,720	951	55%	362	21%	407	24%
452	93000	4,767	939	20%	1,525	32%	2,303	48%
448/453/454	93101	4,109	948	23%	1,266	31%	1,895	46%
Glendale Subtotal		24,460	7,057	29%	7,188	29%	10,215	42%
Phoenix								
660	107100	4,512	831	18%	1,427	32%	2,254	50%
665	109100	3,968	1,040	26%	1,338	34%	1,590	40%
661/743	109200	1,798	496	28%	441	25%	861	48%
739	109300	2,077	770	37%	729	35%	578	28%
744	110100	2,863	1,024	36%	866	30%	973	34%
666/747	110200	281	117	42%	115	41%	49	17%
671/752	110300	3,955	870	22%	1,137	29%	1,948	49%
750/753/826	112000	1,294	251	19%	339	26%	704	54%
748	112100	1,680	922	55%	426	25%	332	20%
Phoenix Subtotal		60,836	16,328	27%	18,390	30%	26,118	43%
Study Area Total		60,836	16,328	27%	18,390	30%	26,118	43%
City of Peoria								
		32,931	5,446	17%	10,034	30%	17,451	53%
City of Glendale								
		88,703	15,453	17%	24,745	28%	48,505	55%
City of Phoenix								
		613,247	130,492	21%	156,492	26%	326,263	53%
Maricopa County								
		1,344,654	248,814	19%	342,255	25%	753,585	56%

Source: 1990 Census data from ADOT.

Note: Education population totals include individuals 25 years of age and older.

Higher education includes some college with or without a degree and graduate degrees.



The TAZ areas that describes the highest percentage of the population with no high school diploma are in Peoria with TAZ 364 showing 79% without a high school diploma, in Glendale, TAZ 446/447 shows 55%, and in Phoenix, TAZ 666/747 and TAZ 748 at 42% and 55%, respectively.

4.6.7 Automobile Ownership

Data have been gathered regarding four levels of automobile ownership from the MAG 1995 Special Census Summary Tables. These include the number of households that report having no automobile, those that report having one automobile, those that report having two automobiles and those that report having three or more automobiles.

Automobile ownership data were obtained from *MAG 1995 Special Census for Maricopa County Summary Tables, September 1997, Table 18*. Exhibit 4.26 summarizes the automobile ownership within the study area. The exhibit also shows comparison populations for Maricopa County and the cities of Peoria, Glendale and Phoenix. Exhibit 4.27 graphically displays the percentage of households within the study area by TAZ that do not own an automobile.

The greatest percentages of households in Maricopa County report having two automobiles. While 37% of the population reports having two automobiles, a close second are those who report having one automobile, at 33%. Within the population of Maricopa County, 6% of the population reported having no automobile.

Within the cities of Peoria, Glendale and Phoenix, in each city, most of the population reports having two automobiles, at 43%, 39% and 35%, respectively. People who report having one automobile are shown as 29%, 30% and 33%, respectively. Of these city populations, 4% reported having no automobile in Peoria, 6% in Glendale and 7% in Phoenix.

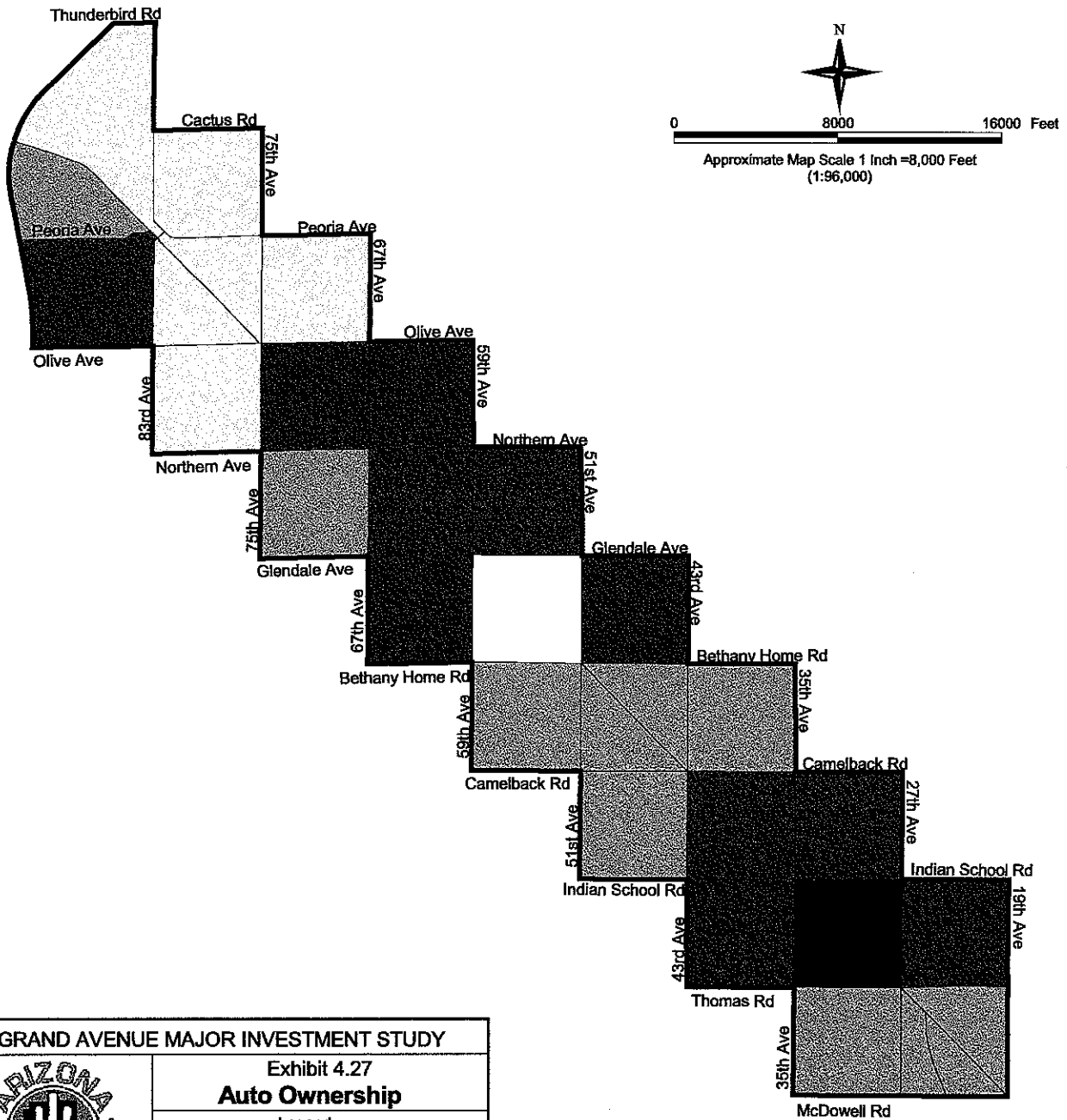
Most of the households within the study area have similar automobile ownership levels to that of the populations of each city as a whole; however, the percentage of households without an automobile is higher within the study area. Within the study area portions of the three cities, a total of 457 (5%) households report having no automobile in Peoria, 2,305 (12%) in Glendale and 1,577 (10%) in Phoenix. Overall, 10% of the households within the study area reported that they do not own automobiles.

The greatest percentage, 20%, of households with no automobile is found in TAZ 446/447 in Glendale. Other TAZs with greater than 10% of households reported not owning an automobile were TAZs 358/360 (11%) in Peoria, 366/436/438 (11%), 445 (12%), 439/440 (14%), 441(14%), 446/447 (20%) in Glendale, and 665 (12%), 661/743 (11%), 744 (11%), 666/747 (17%) and 671/752 (15%) in Phoenix.

Exhibit 4.26
Automobile Ownership Summary

TAZ	Total Housing Units	Households with No Vehicles	Percent with No Vehicle	Households with 1 Vehicle	Percent with 1 Vehicle	Households with 2 Vehicles	Percent with 2 Vehicles	Households with 3+ Vehicles	Percent with 3+ Vehicles
Peoria									
347	860	5	1%	122	14%	457	53%	146	17%
358/360	1,748	192	11%	636	36%	592	34%	205	12%
365	2,325	31	1%	694	30%	1,015	44%	389	17%
348	1,796	140	8%	662	37%	512	29%	148	8%
352	2,213	63	3%	621	28%	1,005	45%	319	14%
362/363	680	24	4%	135	20%	332	49%	115	17%
364	62	2	3%	32	52%	17	27%	6	10%
Peoria Subtotal	9,684	457	5%	2,902	30%	3,930	41%	1,328	14%
Glendale									
366/436/438	5,025	533	11%	2,159	43%	1,175	23%	215	4%
445	1,346	163	12%	593	44%	297	22%	120	9%
439/440	1,291	185	14%	489	38%	296	23%	104	8%
433	1,002	73	7%	396	40%	244	24%	51	5%
441	3,414	470	14%	1,198	35%	803	24%	271	8%
446/447	1,129	229	20%	395	35%	153	14%	62	5%
452	3,517	357	10%	1,410	40%	919	26%	273	8%
448/453/454	3,232	295	9%	1,333	41%	709	22%	208	6%
Glendale Subtotal	19,956	2,305	12%	7,973	40%	4,596	23%	1,304	7%
Phoenix									
660	2,906	164	6%	1,067	37%	1,053	36%	357	12%
665	2,614	316	12%	931	36%	812	31%	300	11%
661/743	1,763	198	11%	535	30%	310	18%	103	6%
739	1,153	59	5%	372	32%	422	37%	208	18%
744	2,008	228	11%	742	37%	539	27%	242	12%
666/747	184	32	17%	84	46%	34	18%	1	1%
671/752	2,831	421	15%	1,134	40%	701	25%	222	8%
750/753/826	811	59	7%	297	37%	247	30%	86	11%
748	1,056	100	9%	393	37%	288	27%	115	11%
Phoenix Subtotal	15,326	1,577	10%	5,555	36%	4,406	29%	1,634	11%
Study Area Total	74,606	7,101	10%	27,305	37%	21,458	29%	6,898	9%
City of Peoria	28,548	1,137	4%	8,350	29%	11,833	41%	3,947	14%
City of Glendale	68,145	3,752	6%	20,370	30%	24,932	37%	10,005	15%
City of Phoenix	449,423	33,068	7%	146,761	33%	148,428	33%	51,726	12%
Maricopa County	1,017,342	57,020	6%	336,483	33%	355,578	35%	126,966	12%

Source: MAG 1995 Special Census Summary Table 18 September 1997



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**Exhibit 4.27
 Auto Ownership**

Legend

	Study Boundary
Percent of Households without an Automobile	
	0 - 4.99%
	5 - 9.99%
	10 - 14.99%
	15 - 20%

Sources: MAG 1985 Special Census, Summary Tables (September 1997)
 Arizona Central NAD 27 Feet

g:\projects_grand\project\deliver_0480.apr

4.7 SOCIO-ECONOMIC CONCERNS

Windshield survey, mapping and socioeconomic statistical breakdown by TAZ are a few of the methods that have been utilized to investigate socio-economic concerns and potential displacement of families and/or businesses within the corridor. Exhibit 4.28 presents a summary matrix of Title VI socioeconomic concerns.

The ultimate selection of a preferred option, either Option 4 or Option 5, may require the relocation of families and/or businesses in order to construct the proposed Grand Avenue improvements.

4.7.1 Residential Concerns

Exhibit 4.28 summarizes the need for careful analysis of Options 4 and 5 potential to impact residential neighborhoods. Analysis of the areas within the City of Glendale will be concentrated in the areas between 67th Avenue to 51st Avenue and Bethany Home Road (TAZ 445, 439/440, 441, 446/447) to Northern Avenue. Significant minority, poverty, female head of household, mobility disability, no high school diploma and/or no automobile populations reside in several of these areas.

In the City of Peoria, between 83rd Avenue to Loop 101 and Peoria Avenue to Olive Avenue, as well as between Northern Avenue to Olive Avenue and 83rd Avenue to 75th Avenue, will be studied (TAZ 358/360, 364). Higher than average populations of minority, elderly, no high school diploma and no automobile characterize socio-economic concerns in these areas.

Within the City of Phoenix, there are several land areas where socio-economic factors are a concern. The land areas fall generally between Camelback Road to I-10, 43rd Avenue and 27th Avenue (TAZ 665,661/743,739,744,666,747,748). Several of the previously mentioned socio-economic areas of concern are manifested within these land areas.

4.7.2 Business Concerns

Business relocation will be concentrated in the potential impact areas adjacent to and surrounding the proposed arterial overpass locations in Option 4 and overpass locations adjacent to Grand Avenue in Option 5.

The potential for business relocation and/or access revision along the Grand Avenue Corridor will be given particular attention. Relocation and/or access revisions may be necessary with overpass construction. Particular concern is warranted regarding buildings of historical significance. In the City of Glendale, for example, the law offices at the intersection of Glendale Avenue and 59th Avenue occupy a historical bank building.

There is an impact potential for businesses within the City of Peoria near the intersections of Cactus and 91st Avenue, Peoria Avenue and 83rd Avenue, Olive Avenue and 75th Avenue and Northern Avenue and 67th Avenue. Within the City of Glendale, the land area on the north side of Grand Avenue between Olive Avenue and Northern Avenue may be impacted by overpass construction. Those businesses adjacent to the intersection of Maryland Avenue and Grand

Avenue, as well as Bethany Home Road and 51st Avenue may be impacted. Overpass construction within the City of Phoenix has the potential to impact Camelback and 43rd Avenue and 27th Avenue and Thomas Road. Each of these intersections merits particular attention.

Exhibit 4.28
Socio-Economic Concerns

TAZ	TAZ with 30% + Populations Minority	TAZ with 15% + Populations 60 Years and Older	TAZ with 20% + Populations Poverty Income	TAZ with 15% + Populations Female Head of Household	TAZ with 10% + Populations Mobility Disability	TAZ with 30% + Persons with No High School Diploma	TAZ with 10% + Households with No Automobile	Total of Socio-economic Factors of Concern
Peoria								
347								0
358/360	36%	16%					11%	3
365	31%							1
348	35%	17%						2
352	33%							1
362/363								0
364	65%	20%				79%		3
Glendale								
366/436/438		16%					11%	2
445	57%	21%	30%		10%	35%	12%	6
439/440	51%	16%	32%	15%		39%	14%	6
433				17%		37%	14%	3
441	60%		34%	19%		55%	20%	5
446/447	79%	16%	44%	19%	15%			5
452	40%		21%	20%				3
448/453/454	39%	17%		15%				3
Phoenix								
660	40%			15%				2
665	54%		23%	16%			12%	4
661/743	57%			15%			11%	3
739	56%			16%		37%		3
744	70%		22%	15%		35%	11%	5
666/747	44%	18%	36%		10%	42%	17%	6
671/752	58%						15%	2
750/753/826	36%	23%						2
748	80%		39%	17%		55%		4

Note: Percentages are rounded up.

Chapter 5.0

ENVIRONMENTAL CONSIDERATIONS SUMMARY

5.0 SUMMARY

An Environmental Overview was prepared for the Grand Avenue MIS and is provided under separate cover. This chapter summarizes the existing environmental conditions found within the Grand Avenue study area and identifies any potential environmental concerns for any roadway improvements proposed for the study area. The study area includes an area one-half mile on either side of Grand Avenue. More detail on environmental conditions including a list of reference documents can be found in the *Grand Avenue Major Investment Study Environmental Overview*.

Environmental conditions are discussed for the physical and natural environment and cultural resources. The information provided within this chapter is based on existing data sources from various municipal, county, State, and Federal agencies, and a windshield survey of the study area. Below is a brief summarization of environmental conditions presented in this chapter.

5.1 PHYSICAL AND NATURAL ENVIRONMENTAL CONSIDERATIONS SUMMARY

Urban and suburban environments in the Phoenix metropolitan area support a variety of native wildlife species adapted to urban conditions. These wildlife utilize minimal habitat provided by vegetation in home and commercial landscaping, parks, agricultural fields, and roadway plantings. The Arizona Game and Fish Department indicates that two Wildlife of Special Concern in Arizona species, black-bellied whistling duck (*Dendrocygnus autumnalis*) and roundtail chub (*Gila robusta*), have been documented as occurring within 2 miles of the study area. Both species could occur along surrounding waterways. Any potential impacts to wildlife associated with the built aquatic habitats (Grand Canal) within the study area should be evaluated prior to project implementation.

The Grand Canal is not designed to carry storm flows; however, this canal conveys stormwater and may be jurisdictional. Further investigation will be necessary to determine the Section 404 status of this facility. All 100-year floodplain areas, except those associated with the Grand Canal, are bound to the northern side of Grand Avenue.

To preserve the visual environment, future corridor improvements should implement measures to ensure that impacts to the existing visual resources are minimized or improved upon. Potential air and noise impacts are concerns that will need to be evaluated on a project-specific scale. No unique farmland exists within the corridor, though most lands within the study corridor are classified as prime farmland.

The Grand Avenue study corridor retains a total of 118 hazardous materials sites. These hazardous materials sites are composed of listings from more than one environmental record or database. Because of the substantial number of listed hazardous material sites within the corridor, an Initial

Site Assessment (ISA) should be conducted. The ISA would confirm or deny the presence of hazardous materials at specific locations.

5.2 CULTURAL RESOURCES CONSIDERATIONS SUMMARY

A total of 96 sites have been previously documented within the study area. The majority of these sites are historic habitations or other historic structures. Prehistoric canal segments are also common, followed by prehistoric habitation sites in frequency. The area of highest cultural resource density is located along the southeastern portion of the corridor, with other areas of high density centered along the intersections of Grand and Glendale Avenues, and Grand and 83rd Avenues. Four structures and one district within the corridor (the Beet Sugar Factory, the Peoria Central School, the First National Bank of Glendale, Glendale Woman's Club Clubhouse, and the Glendale Townsite / Catlin Court Historic District) are listed on the National Register of Historical Places (NRHP). Cultural resource sensitivity may be present elsewhere within the study area in areas not yet intensively surveyed. Consultation with State Historic Preservation Office (SHPO) will be required to identify the appropriate mitigation measures for cultural resources.

5.3 SECTION 4(f) / 6(f) PROPERTIES CONSIDERATIONS SUMMARY

Section 4(f) of the Department of Transportation Act resources within the study area include 17 public parks, two open campus public schools, and the four NRHP listed properties previously mentioned. There are no wildlife or waterfowl refuges within the study area. Evaluation of direct and proximity impacts to Section 4(f) sites and an evaluation of Section 6(f) of the Land and Water Conservation Act properties by the National Park Service would be required as part of the NEPA process.

Chapter 6.0

ROADWAY OPTIONS

6.0 SUMMARY

The Grand Avenue MIS Steering Committee identified the following two options to be further developed and evaluated in the MIS:

Option 4 – Alternating Grade Separations

Option 5 – Limited Expressway

Concepts for the options were developed with considerations for incorporation of transit, bicycle, and pedestrian elements, phased implementation, and ultimate development of a limited access expressway along Grand Avenue. The ultimate expressway is not necessarily a freeway like Loop 101 or I-10. An expressway can have traffic signals and can have some other intersecting streets.

To ensure that the two options are comparable, each option was defined as eight separate projects along the Grand Avenue Corridor. Both options provide grade separations at each of the seven six-legged intersections between I-17 and 75th / Olive intersection plus they both include ramps to and from Loop 101 north connecting to the 91st / Cactus intersection. A “grade separation” takes one of the three intersecting streets over or under the other two. For example, Indian School Road is “grade separated” from Grand Avenue, 35th Avenue and the railroad.

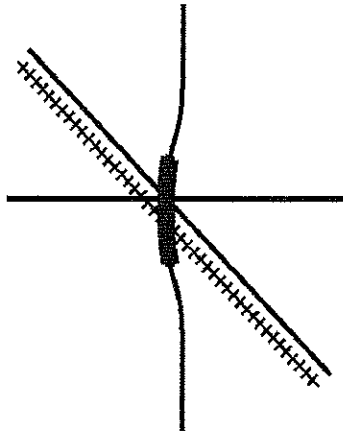
Option 4 is called the “Alternating Grade Separations” because it places emphasis on providing grade separations for the east-west and north-south arterial streets at the railroad tracks and Grand Avenue. Five new railroad grade separations with the railroad are proposed with Option 4.

Option 5 is called the “Limited Expressway” because it places emphasis on expediting travel along Grand Avenue by having Grand Avenue grade separate at the north-south and east-west arterial streets. With this concept, the number of traffic signals for traffic traveling along Grand would be reduced significantly; however, only one new grade separation with the railroad would be provided at 55th / Maryland.

This chapter presents the two roadway options evaluated as part of the Grand Avenue MIS and provides geometric layouts of all eight project locations for both options. Below is a summary of the two roadway options. With both options, transit and multi-modal improvements can be included. Transit alternatives are discussed in Chapter 7.

Option 4 – Alternating Grade Separations – Expedites Travel Across Railroad

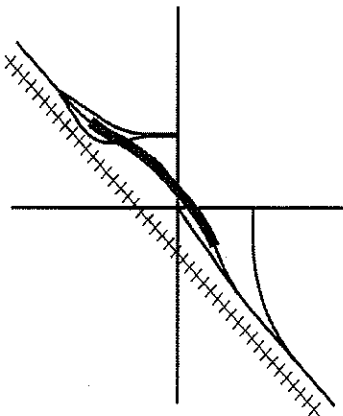
At the six-legged intersections, one street (either the north-south or east-west or Grand Avenue) would be put on an overpass (grade separation) to remove that street from the intersection. Five new grade separations over the railroad would be provided with this option. The roadway cross section would be very similar to arterial streets such as Camelback Road or 51st Avenue. Grade separations to be provided include:



- Grand Avenue over Thomas Road and 27th Avenue
- Camelback Road over Grand Avenue, BNSF and 43rd Avenue
- 51st Avenue over BNSF, Grand Avenue and Bethany Home Road
- Maryland Avenue over Grand Avenue and BNSF
- Grand Avenue under Glendale Avenue and 59th Avenue
- 67th Avenue over BNSF, Grand Avenue and Northern Avenue
- Olive Avenue over Grand Avenue, BNSF and 75th Avenue
- Connection to Loop 101 at 91st Avenue

Option 5 – Limited Expressway – Expedites Travel Along Grand Avenue

Grand Avenue would be put on an overpass to remove it from the six-legged intersections. There would be traffic signals on Grand Avenue at some minor streets. Ramp connections between Grand Avenue and the arterial streets will be included where needed to provide access. Overpasses to be provided include:



- Grand Avenue over Thomas Road and 27th Avenue
- Grand Avenue over Camelback Road and 43rd Avenue
- Grand Avenue over Bethany Home Road and 51st Avenue
- Maryland Avenue over Grand Avenue and BNSF
- Grand Avenue under Glendale Avenue and 59th Avenue
- Grand Avenue over Northern Avenue and 67th Avenue
- Grand Avenue over Olive Avenue and 75th Avenue
- Connection to Loop 101 at 91st Avenue

6.1 DEVELOPMENT OF OPTIONS

The Steering Committee directed that two of the three options developed in the Grand Avenue Corridor Study be refined and further evaluated in the Grand Avenue MIS. The two options are **Option 4 – Alternating Grade Separations**, and **Option 5 – Limited Expressway**. A third option, Option 6 – Full Expressway, was not considered in the Grand Avenue MIS due to constraints in available construction funds in the next decade, lack of public support, and the difficulty in developing an acceptable direct connection between I-17 and Grand Avenue.

The primary focus of the refinement of the options has been at the six-legged intersections. The public indicated that traffic delays at these intersections were the main concern in the corridor. Six-legged intersections are found from 19th Avenue to 75th Avenue. The 83rd / Peoria intersection has been modified to be two separate intersections with Grand Avenue. West of those two intersections, the intersections on Grand Avenue are all more standard four-leg or three-leg intersections. Accordingly, the options do not include improvements west of Loop 101.

In defining the two options, the Steering Committee directed that improvement east of I-17 and west of Loop 101 would not be included as part of the Grand Avenue MIS. The portion of Grand Avenue from McDowell Road to 7th Avenue has recently been improved with new curbs, gutters, sidewalks and landscaping. ADOT has turned this street over to the City of Phoenix. This street is adjacent to an historic neighborhood, and urban revitalization is under way. In addition, ADOT has officially rerouted US 60 to follow I-10 to I-17 at the Stack and then follow I-17 to Thomas Road.

Due to constraints in construction funds, the Steering Committee also directed that no improvements should be considered at the 35th / Indian School / Grand intersection. There already is a grade separation that takes Indian School over the BNSF, Grand Avenue, and 35th Avenue. The direct connection between I-17 and Grand Avenue was also removed from the scope of the Grand Avenue MIS by the Steering Committee due to the lack of feasibility and construction funds. However, future connections were considered in the design of the grade separation at the 27th / Thomas intersection.

A grade separation was proposed for Grand Avenue at Peoria and 83rd Avenues as part of the *Grand Avenue Corridor Study*. Improvements to the intersections at 83rd Avenue and Peoria Avenue with Grand Avenue were also not considered at this time due to the request of the City of Peoria. This feature was eliminated because of potential adverse impact to downtown Peoria and the fact that the intersections are not six-legged.

The primary feature in both options is the grade separations at the six-legged intersections. For the purposes of this report, these grade separations are referred to as overpasses which implies that one street goes over one or more other streets without connecting to those other streets. The concepts for the options developed in this report include some form of connection between the streets although that connection may be somewhat removed from the location of the overpass and not provide all turn movements. Both options also include a half-diamond connection to Loop 101 at 91st Avenue.

6.2 DESIGN CONSIDERATIONS AND STANDARDS

6.2.1 Design Criteria

Minimum geometric design elements used to develop the geometric design for the grade separations and other roadway improvements were obtained from the ADOT Roadway Engineering Group, *Roadway Design Guidelines*, May 1996 and *ADOT Construction Standards*, July 1994, including all updates to both, and the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*, 1990 (Green Book). Exhibit 6.1 lists the design standards used for both options. The overpasses on the cross streets in Option 4 are planned to meet multi-lane urban highway standards with a design speed of 50 mph. The overpasses on Grand Avenue in both Options 4 and 5 are planned to meet standards that correspond to a 60 mph design speed. The roadway as proposed would not be designed to ADOT urban freeway standards.

In Option 4, the overpass for Maryland Avenue is proposed as a two-lane collector street with a 40 mph design speed. In Option 5, it is proposed as a four-lane arterial street with a 50 mph design speed. Ramps are proposed to have a 40 mph design speed for Option 4 and 50 mph for Option 5. The design year chosen for the geometric designs is Year 2020 under both options.

A minimum vertical clearance of 16 1/2 feet will be provided over arterial streets. Fifteen feet of vertical clearance will be provided over ramps and frontage roads. Over the railroad tracks, a minimum vertical clearance distance of 24 feet will be provided to accommodate dual containers on flatbed cars (only 23 feet of clearance is required by law; however, the railroad prefers 24 feet). Horizontal clearance requirements to centerline of track are 25 feet.

6.2.2 Standard Cross-Sections

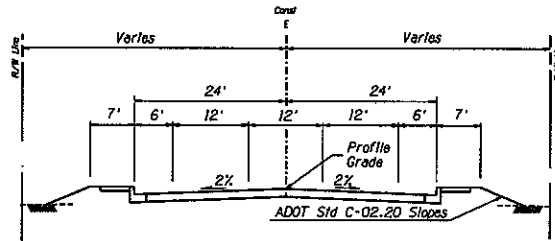
The proposed typical sections are shown in Exhibits 6.2, 6.3 and 6.4. Maryland Avenue is the only collector street being considered for an overpass. With Option 4, Section A would be used; with Option 5, Section B or C would be used.

The typical cross-section for overpasses on the arterial cross streets under Option 4 is a four-lane arterial street cross-section with a flush median and sidewalks (Section B or C). Lanes would be adjusted to the planned width of the street leading to the overpass. On those streets 64-68 feet wide that have been restriped for three lanes in one direction, the outside third lane is proposed to be dropped as a frontage road at the beginning of the grade separation. Overpasses on Grand Avenue on Option 4 have a six-lane cross-section with a raised median and no sidewalks (Section D). To accommodate bicycle lanes, the travel lanes would be narrowed to 11 feet to provide 6-foot bicycle lanes between the outside lane and the lip of the gutter. Frontage roads would have a one- or two-lane cross-section as needed.

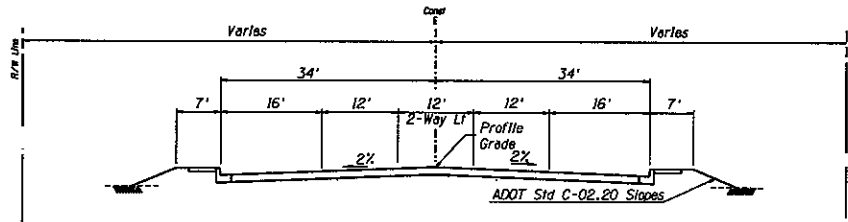
Under the Option 5 Concept, the Grand Avenue overpasses would have a typical cross-section of six lanes with a barrier median, inside and outside shoulders, and no sidewalks (Section E). Ramps would be one-lane ramps that would widen out at the intersection to provide exclusive turn lanes as needed.

**Exhibit 6.1
Design Standards**

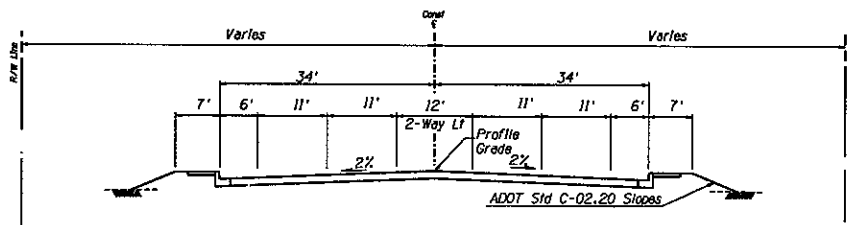
Design Element	Collector Street	Arterial Street	Limited Access Expressway	Arterial / Expressway Ramp
GENERAL DESIGN ELEMENTS				
Design Year	2020	2020	2020	2020
Design Capacity (veh/hr/ln)	350-450	550-700	700-850	700
Minimum Level of Service	D	D	D	D
Design Speed, V (mph)	40	50	60	40/50
Superelevation Rate, e (max)	0.04 ft/ft	0.04 ft/ft	0.06 ft/ft	0.06 ft/ft
Minimum Horizontal Radius (ft)	575	955	1350	510
Maximum Grade	7%	6%	4.5%	+5/-7%
Minimum Grade	0.4%	0.4%	0.4%	0.4%
Minimum Vertical Curve Length (ft)	200	200	600	200
Minimum Vertical Clearance (ft)	15	16.5	16.5	15
CROSS-SECTION ELEMENTS				
Lane Width (ft)	12	12 (two-way left turn flush median)	12	12
Median Width (ft)	0	16 (12 w/ flush median)	18 (w/ barrier)	-
Shoulder Width (left/right) (ft)	0/6	0/4	8/10	2/8
Sidewalk Width (ft)	5	5	-	-



A COLLECTOR STREET TYPICAL SECTION
2-Lane



B ARTERIAL TYPICAL SECTION
4-Lane with Flush Median



C ARTERIAL TYPICAL SECTION
4-Lane with Striped Shoulders

GRAND AVENUE MAJOR INVESTMENT STUDY

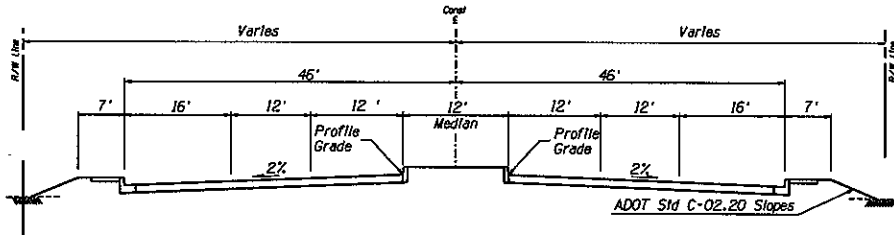


URS Greiner Woodward Clyde

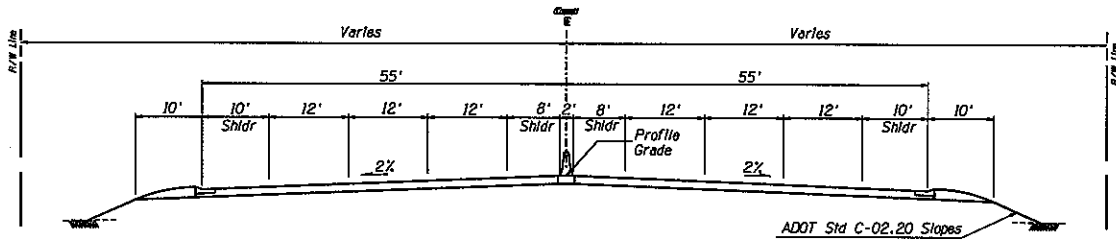
In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

**Exhibit 6.2
Typical Sections**

Sources: Arizona Department of Transportation
Roadway Engineering Group,
Roadway Design Guidelines, May 1996



D ARTERIAL TYPICAL SECTION
6-Lane with Raised Median



E LIMITED EXPRESSWAY
TYPICAL SECTION
6-Lane with Median Barrier

GRAND AVENUE MAJOR INVESTMENT STUDY

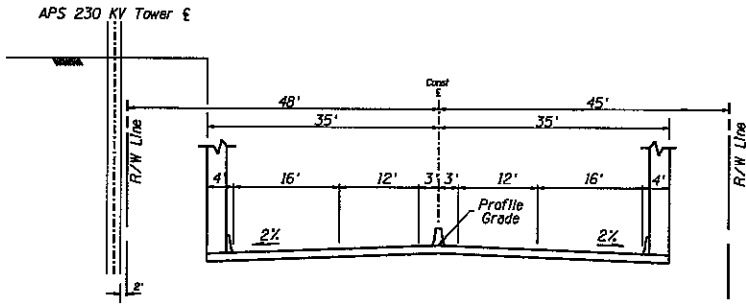


URS Greiner Woodward Clyde

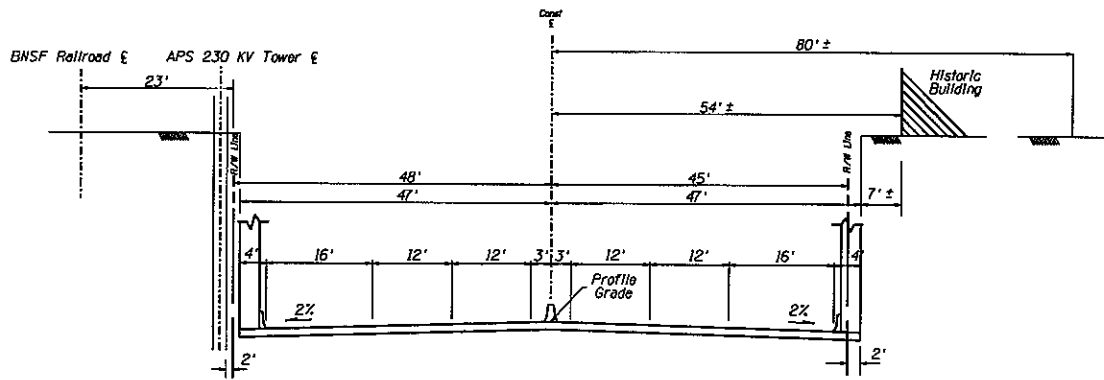
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Partners for Strategic Action, Inc.

Exhibit 6.3
Typical Sections

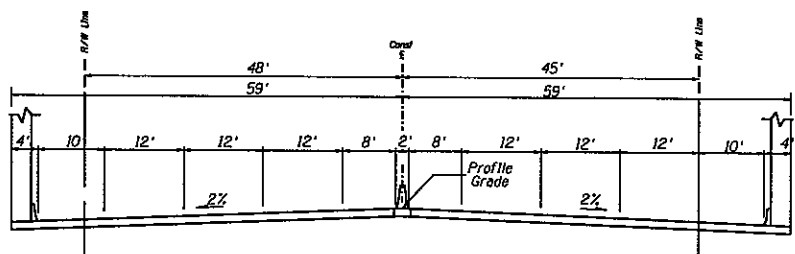
Source: Arizona Department of Transportation
Roadway Engineering Group,
Roadway Design Guidelines, May 1996



F ARTERIAL TYPICAL SECTION
 GRAND AVENUE UNDERPASS @ GLENDALE RD.
 4 LANE



G LIMITED EXPRESSWAY
 TYPICAL SECTION
 GRAND AVENUE UNDERPASS @ GLENDALE RD.
 6 LANE (MINIMUM)



H LIMITED EXPRESSWAY
 TYPICAL SECTION
 GRAND AVENUE UNDERPASS @ GLENDALE RD.
 6-LANE (DESIRABLE)

GRAND AVENUE MAJOR INVESTMENT STUDY



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Exhibit 6.4
Underpass Typical Sections
at Glendale Ave./ 59th Ave.

Source: Arizona Department of Transportation
 Roadway Engineering Group.
 Roadway Design Guidelines, May 1996

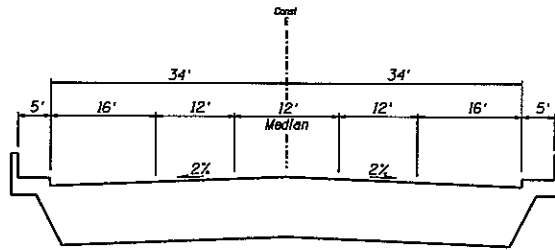
The proposed improvement under both options for the 59th/ Glendale intersection is an underpass that takes Grand Avenue under 59th Avenue and Glendale Avenue. It is proposed under Option 4 to keep the underpass within the existing Grand Avenue right-of-way. The maximum roadway that could fit within this space is a four-lane arterial street (Section F). With Option 5, a six-lane section is proposed for consistency with the existing roadway and forecast traffic volumes. However, the full shoulders would be reduced to fit the cross-section between the west right-of-way line and the historical building on the east side (Section G). Section H shows the desirable typical section for Option 5 used at other locations. This typical section would not be used at the 59th/ Glendale underpass.

Because of the diagonal alignment of the Grand Avenue overpasses, it appears most logical to build separate structures for northeast- and southwest-bound traffic. The separate structures would allow the span lengths to be shortened for the separate structures compared to a single structure. The typical sections for the structures are shown in Exhibit 6.5. Bridge Section K corresponds to roadway Section D; bridge Section J corresponds with roadway Section E; and bridge Section I corresponds with roadway Sections B and C and is a single structure. In Option 4, the Maryland Avenue bridge would be similar to Section I, except it would be 48 feet wide instead of 68 feet wide.

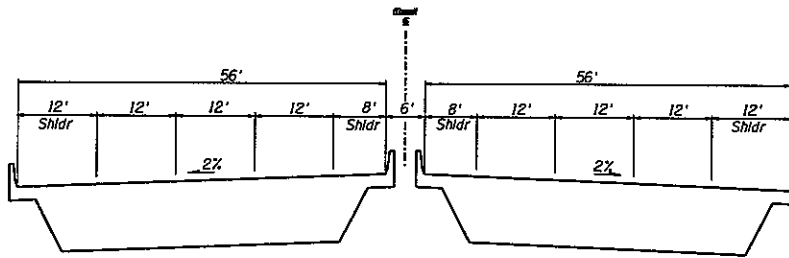
6.2.3 Overpass Alignment

There are several factors that strongly influence the placement and alignment of the overpasses that are common to both options. For the most part, the overpasses are aligned so that they do not coincide with the existing street; instead, the overpass is offset to one side. There are several factors that lead to this feature. Most importantly, the existing right-of-way for Grand Avenue is generally 90 to 100 feet wide in the section from 27th Avenue to 75th Avenue. Analysis has shown that it is not possible to build an overpass structure within this right-of-way and still maintain access to the property fronting on Grand Avenue. In many cases, if additional right-of-way is taken from the abutting property, the existing function on that property is destroyed so that the entire property may have to be taken. Therefore, the new overpass can be aligned to use as much of the parcel as needed without incurring additional right-of-way cost. In this case, it may not be necessary to provide access to Grand Avenue for the residual property. Similar analyses apply to the north-south and east-west arterial streets that are considered for overpasses in Option 4.

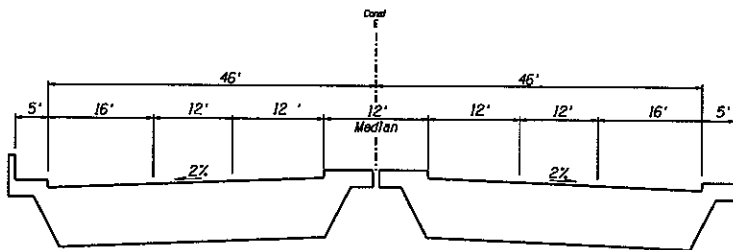
A second major factor is maintaining traffic flow during construction. By offsetting the overpass construction, traffic can continue to use the existing street during construction. The third major factor is the length of spans for the overpass bridges. If the overpass for Grand Avenue were aligned diagonally across the existing six-legged intersection, the span length would exceed 200 feet, which is generally considered as the upper limit of span length for conventional structure types. Where the arterial streets are to be put on overpasses over Grand Avenue and the BNSF, the offset alignment often enables the bridge to be better aligned to reduce span lengths and to find more suitable footing locations. For these reasons, an offset alignment is proposed for all overpass locations except the underpass at 59th/ Glendale intersection.



I BRIDGE TYPICAL SECTION
Arterial



J BRIDGE TYPICAL SECTION
Limited Expressway



K BRIDGE TYPICAL SECTION
Grand Ave. @ Thomas Rd. - Option 4

GRAND AVENUE MAJOR INVESTMENT STUDY



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Exhibit 6.5
Bridge Typical Sections

Source: Arizona Department of Transportation
Roadway Engineering Group.
Roadway Design Guidelines, May 1996

6.2.4 Drainage Considerations

Stormwater issues have always been complex in this corridor because of the absence of any drainageways or major stormwater conveyance system. Copies of the *Maryvale Area Drainage Master Study (ADMS) Flood Plain Mitigation Study* (November 1997) and the *Glendale-Peoria ADMS* were obtained for the MIS. The Flood Control District of Maricopa County (FCDMC) prepared both reports. These studies identified flood prone areas and evaluated feasible 10-year and 100-year mitigation options.

Flood prone areas have been defined by FEMA floodplain maps and also by the Maryvale ADMS. The flooding limits as delineated by FEMA were delineated using approximate methods and are generally more extensive than those identified by the ADMS. The identification of flood prone areas by the ADMS was delineated using detailed methods. Seven ponding areas were identified along Grand Avenue by the ADMS and are shown in Exhibit 6.6.

The Maryvale ADMS identified and evaluated alternatives to mitigate the flooding along Grand Avenue. The results of the ADMS identified mitigation options for each ponding area. Most mitigation options involved constructing a series of detention basins along Grand Avenue to reduce the flooding impacts. The study concluded that most mitigation options required land and business acquisition of expensive established properties and most drainage conveyance systems would be built in intense traffic and utility conflict areas. The estimated costs for mitigating the flooding made the projects not cost-effective. Due to the low benefit/cost ratio, the FCDMC has not developed the mitigation options further except for the Orangewood-Northern Detention Basin project.

A new detention basin is planned south of Northern Avenue between 65th and 63rd Avenues. This basin is called the Orangewood-Northern Detention Basin, and FCDMC has applied to ADOT for a permit to construct the outlet facilities across Grand Avenue.

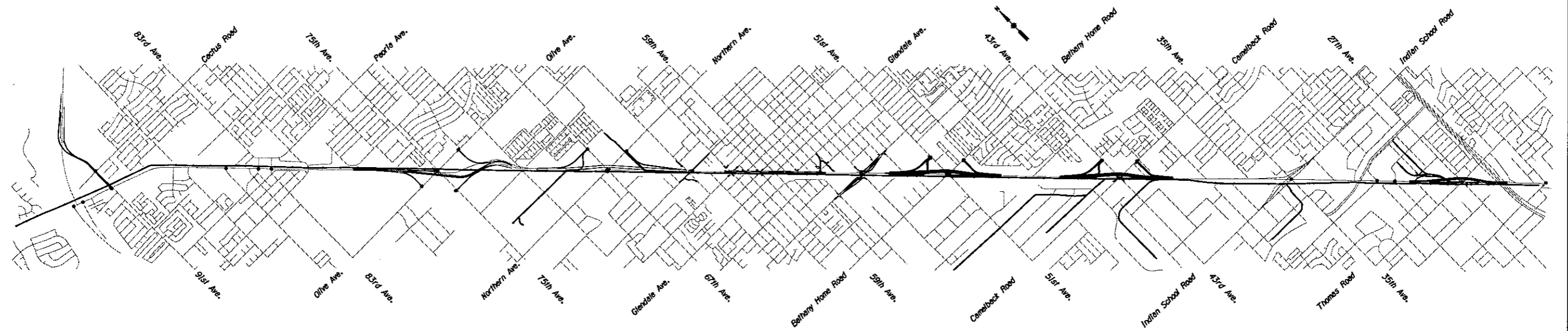
For the purposes of this MIS, it is assumed that roadway drainage would be collected at the overpasses and conveyed to retention basins to be constructed on excess right-of-way acquired for the overpass. Sheet flow cross drainage that is interrupted by the proposed embankments for the overpasses would be collected and routed to these same basins. No analyses have been conducted to test this assumption or to quantify the magnitude of the system elements.

There are special drainage considerations associated with the proposed underpass at Glendale and 59th Avenues. This issue will be addressed during the refinement stage of the MIS.

6.2.5 Utility Considerations

The major utility companies and Bluestake were contacted to identify who has major utilities in the Grand Avenue Corridor. Meetings were held with Arizona Public Service and Salt River Project Power and Water. The three cities also supplied information about their water, sewer and storm drain facilities. A letter and copies of concept drawings were sent to BNSF with a request for comments regarding potential impacts and need for coordination.

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GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.16

Option 5
Limited Expressway

● Traffic Signal



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The locations of major utilities were included in our base file CADD system. Impacts and potential relocations will be identified as part of the evaluation process.

Major utility providers in the corridor include the following:

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

Utilities with prior rights are those that exist prior to the roadway. Relocation of these utilities will be a project cost. Utilities without prior rights normally must relocate at their own expense.

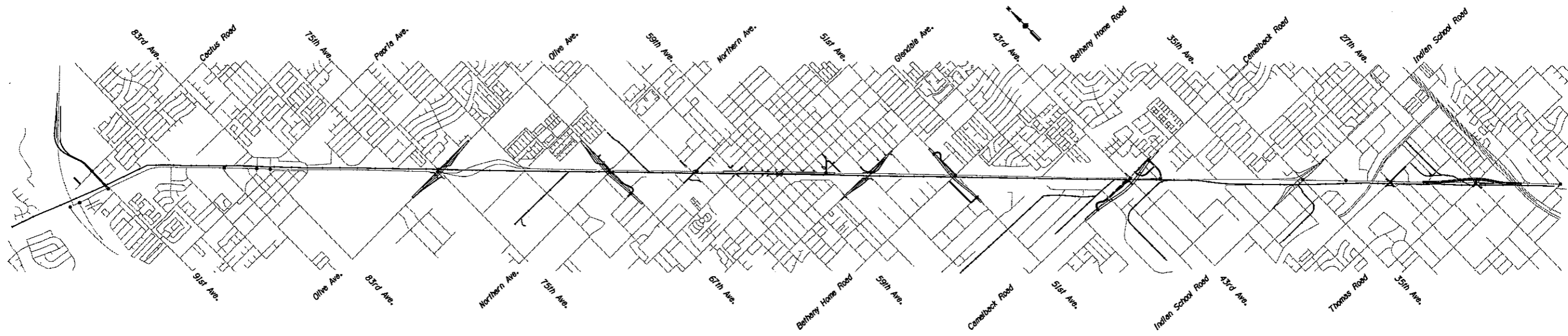
6.3 OPTION 4 — ALTERNATING GRADE SEPARATIONS


6.3.1 Overview

The goal of this option is to eliminate the major six-legged intersections along Grand Avenue and to expedite travel across the BNSF by providing additional grade separations over the railroad tracks. The concept is illustrated in summary fashion in Exhibit 6.7 and in more detail in Sections 6.3.2 through 6.3.9. Option 4 includes grade separations at the following locations:

- Grand Avenue over 27th Avenue and Thomas Road
- Camelback Road over BNSF railroad tracks, Grand Avenue, and 43rd Avenue
- 51st Avenue over BNSF railroad tracks, Grand Avenue, and Bethany Home Road
- Maryland Avenue over BNSF railroad tracks and Grand Avenue; 55th Avenue would be eliminated from crossing the BNSF railroad tracks and intersecting Grand Avenue
- Grand Avenue under Glendale Avenue and 59th Avenue
- 67th Avenue over BNSF railroad tracks, Grand Avenue, and Northern Avenue
- Olive Avenue over BNSF railroad tracks, Grand Avenue, and 75th Avenue.

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GRAND AVENUE MAJOR INVESTMENT STUDY	
Exhibit 6.7	
 URS Greiner Woodward Clyde <small>In Association With</small> <small>BRW</small> <small>Logan Simpson Design, Inc.</small> <small>Partners for Strategic Action, Inc.</small>	<p>Option 4</p> <p>Alternating Grade Separations</p> <p>● Traffic Signal</p>

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In addition to the grade separations, Option 4 includes a half-diamond interchange connection from 91st Avenue to Loop 101. The half-diamond configuration will provide a northbound on-ramp and a southbound off-ramp for Loop 101. These movements are the missing movements from the existing Loop 101 and Grand Avenue interchange.

The original intent of this option was to provide grade separations in the north-south, east-west, and Grand Avenue direction in an alternating but uniform series. This system would provide equal benefits to each direction of travel. However, in examining each location and discussing the alternatives with the affected city, it became apparent that localized land uses often became the determining factor as to which direction the overpass would be most feasible and logical. The concept at each location is described below and the reasons for selecting the direction of the overpass.

The grade separations in this option are each independent of the others. The grade separations are not along a single roadway so that a single major roadway is not created. Instead, the option would provide a series of grade separations similar in character to the existing Indian School Road overpass. Each overpass can be constructed independently of the others as funds become available and as need dictates.

The Option 4 concept reduces the number of traffic signals on Grand Avenue within the study area from 18 to 16 (five signals are removed and three are added). Five new minor signals are added to the arterial cross streets to provide access between the overpass and street network. Five new grade separations over the railroad would be created by Option 4. Local property access would be provided via frontage roads. Access to and from the arterial streets with the overpass would also occur via the frontage roads; however, not all turn movements would be permitted.

6.3.2 27th Avenue / Thomas Road

This intersection was the subject of a specific study entitled *Grand Avenue–27th Avenue Thomas Road Grade Separation Feasibility Study* concluded in 1985 for the ADOT Planning Division in cooperation with the City of Phoenix. The recommendation in that study was to have Grand Avenue grade separated over 27th Avenue and Thomas Road. This recommendation still appears valid and was used in this concept for Option 4 with significant modifications.

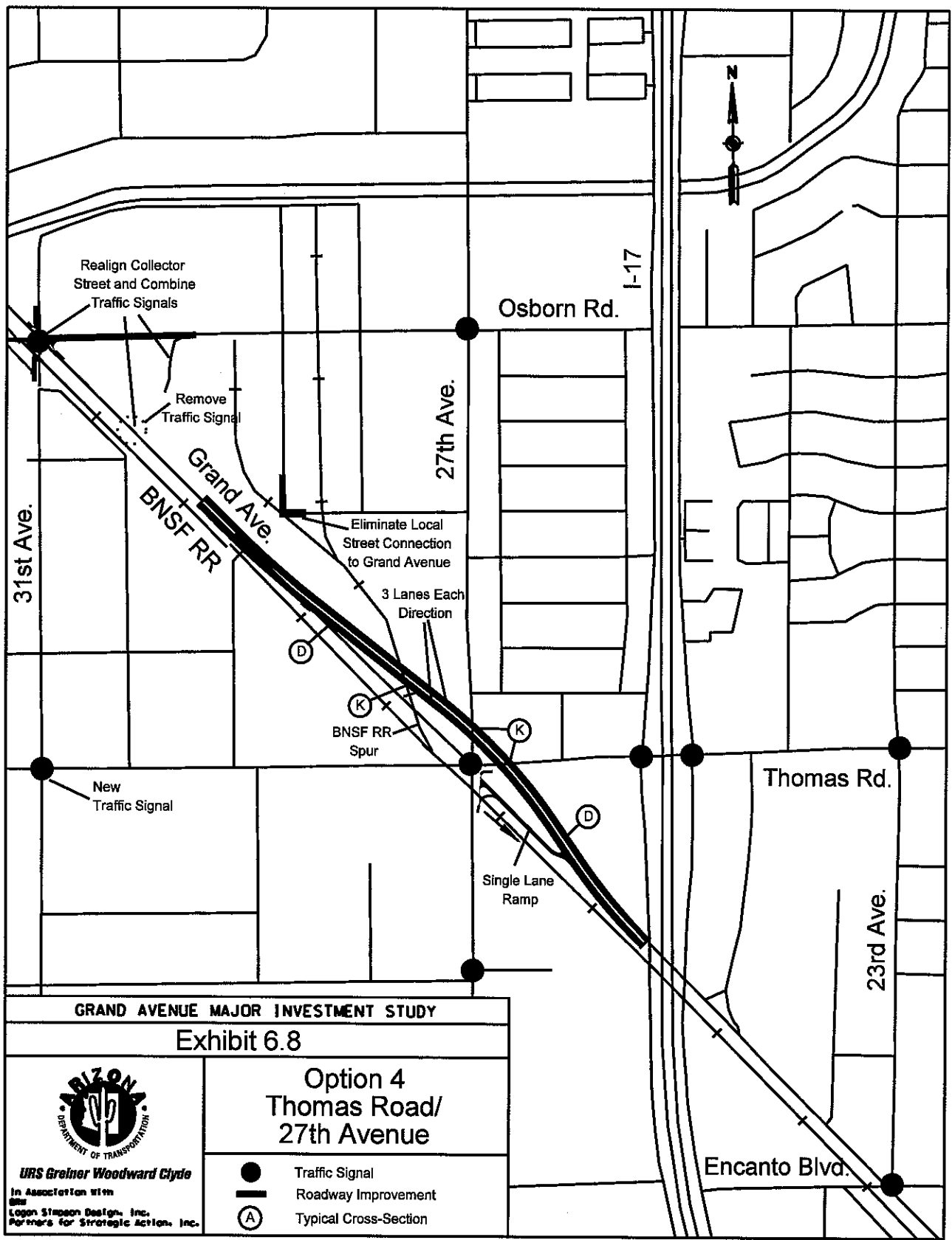
Overpasses along Thomas Road or 27th Avenue although possible are less desirable compared to an overpass along Grand Avenue. An overpass to take Thomas Road over Grand Avenue and 27th Avenue would return to grade very close to the I-17/ Thomas interchange. Eastbound trucks would have to stop on a downgrade at the east-side intersection of the interchange. Westbound trucks would typically have to start up the upgrade from a dead stop. Both situations are not desirable. 27th Avenue is a street that contains significantly lower traffic volumes than Grand Avenue and Thomas Road, parallels I-17 less than 1/2 mile away, and provides access only to and from the west at I-10. Because of these conditions, 27th Avenue is not viewed as vital in improving access to central Phoenix or across the railroad tracks. An overpass along Grand Avenue would improve the linkage that Grand Avenue provides for the West Valley to I-10 via 19th Avenue and to Downtown Phoenix.

The earlier concept in *the Grand Avenue–27th Avenue Thomas Road Grade Separation Feasibility Study* aligned the overpass along existing Grand Avenue and required considerable encroachment on the BNSF, particularly during construction. The major concern was to avoid encroachment on the Pioneer Ford dealership. The dealership has since been relocated to another site and the land has been acquired by ADOT. For the general reasons cited previously, the Option 4 concept aligns the Grand Avenue overpass to the east of Grand Avenue away from the BNSF. The former Pioneer Ford site could be used as a drainage basin. A spur of the railroad crosses Grand Avenue just north of Thomas Road. The overpass would have to go over the spur as well as go over 27th Avenue and Thomas Road.

The concept for the overpass is shown in Exhibit 6.8. The typical section is Section D in Exhibit 6.3. Both 27th Avenue and Thomas Road would remain as they currently exist. With Grand Avenue removed from the intersection, a four-legged 90-degree intersection would remain. Left-turn movements on Thomas Road at 27th Avenue could be restored.

Access to and from Grand Avenue would occur at the 23rd/ Encanto/ Grand intersection and at the Osborn/ 31st/ Grand intersection. In addition, an on-ramp providing access to the southeast-bound Grand Avenue would start at the intersection and follow existing Grand Avenue and join southeast-bound Grand Avenue at the east-end of the overpass.

There are two existing traffic signals on Grand Avenue west of the proposed overpass: one at Osborn Road east and one at 31st Avenue and Osborn Road west. It is suggested that Osborn Road east be realigned to meet Osborn Road west and thus eliminate the signal closest to the end of the overpass. This element is not essential to the overpass concept but is included because it could improve traffic operations.






GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.8

Option 4
Thomas Road/
27th Avenue


URS Greiner Woodward Clyde
 In Association with

Logan Simpson Design, Inc.
 Partners for Strategic Action, Inc.

-  Traffic Signal
-  Roadway Improvement
-  Typical Cross-Section

Access from Grand Avenue (northwest leg) to I-17 (south leg) would be provided via Osborn Road, 27th Avenue, and Thomas Road. Access from Grand Avenue (southeast leg) to I-17 (north leg) would be as it is today which is via 23rd Avenue and Thomas Road.

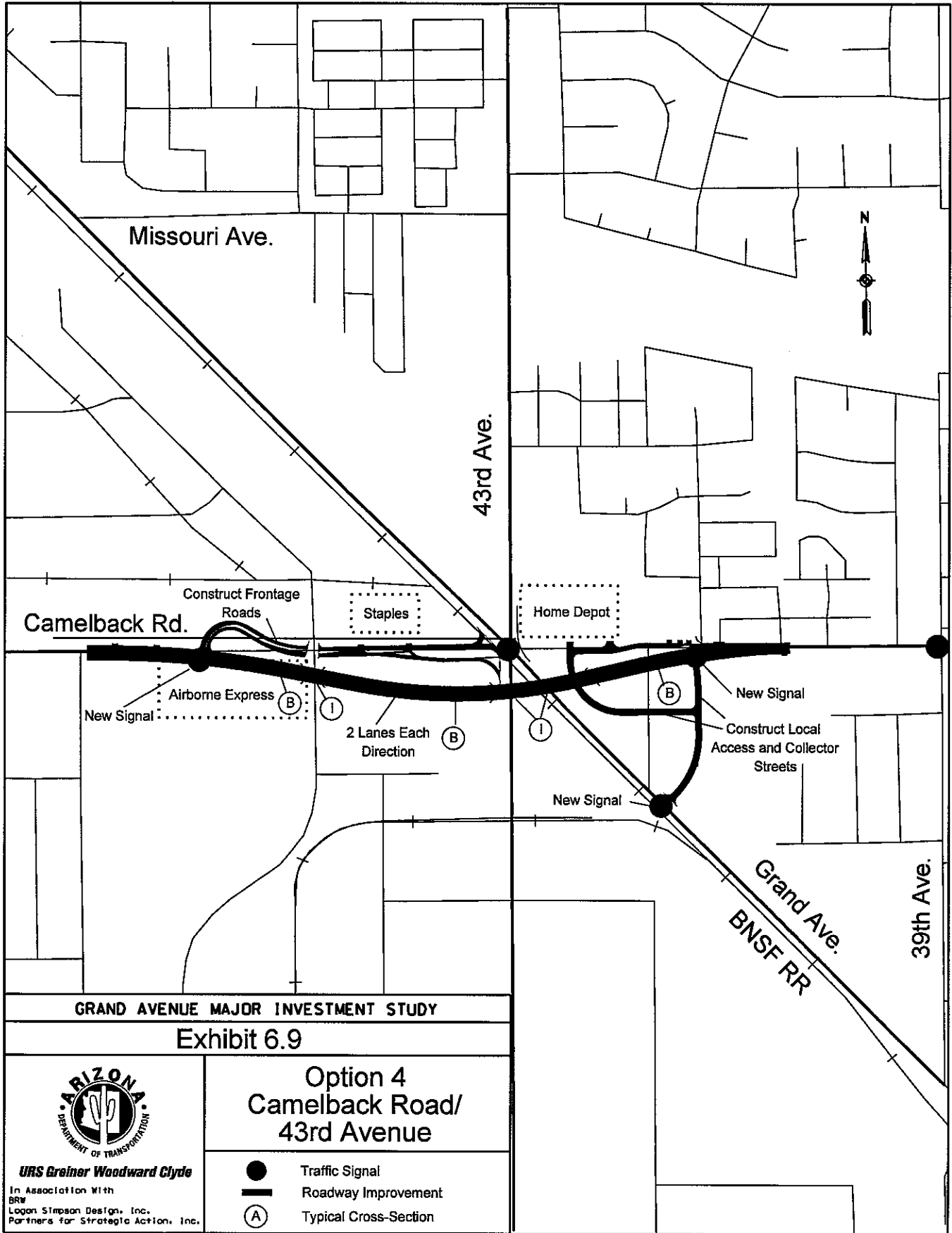
6.3.3 43rd Avenue / Camelback Road

It is possible to provide an overpass along either 43rd Avenue or Camelback Road and both have been laid out geometrically. An overpass taking Camelback Road over the BNSF railroad tracks, 43rd Avenue, and Grand Avenue appears to be the most desirable for the following reasons. A spur from the railroad track crosses 43rd Avenue south of Camelback Road. The spur track would have to be crossed by the overpass causing a significant increase in construction costs and impacting a larger number of land parcels. Camelback Road is a more prominent street in the regional system than is 43rd Avenue. Although 43rd Avenue carries more traffic than Camelback Road, much of the difference in traffic could shift to 51st Avenue if an overpass is built on 51st Avenue (51st Avenue is the preferred roadway for an overpass at 51st/ Bethany Home).

The Camelback Road overpass shifts to the south of the existing Camelback Road centerline (see Exhibit 6.9). This alignment would be on undeveloped property east and west of 43rd Avenue. The alignment also would require removing a newly constructed Airborne Express facility and disrupt new development plans on the southwest corner of 43rd/ Camelback intersection (Home Depot is relocating to this location).

Local access would be provided with a series of frontage and collector streets. Access to properties west of 43rd Avenue (including Staples retail store) would be along a two-way frontage road north of the overpass. A frontage road would connect to Camelback Road at the west end of the overpass. Access to the large parcel of undeveloped land south of Camelback Road would require an additional structure allowing a collector road to pass under the overpass and connect to the frontage road. On the east side of 43rd Avenue, access to properties (including residential parcels and Home Depot) would be provided via a two-way frontage road north of the overpass and collector streets south of the overpass. A new collector street would connect Camelback Road with Grand Avenue east of 43rd Avenue. New traffic signals would be located on either end of the collector street at both Camelback Road and Grand Avenue.

Both 43rd Avenue and Grand Avenue would remain unchanged. With Camelback Road removed from the intersection, a four-legged 45-degree skewed intersection would remain. Access to Camelback Road from either Grand Avenue or Bethany Home Road would be via the frontage road west of 43rd Avenue or the collector street connecting Camelback and Grand Avenue. Access from Camelback Road to Grand Avenue would be via the collector street. The only direct access to 43rd Avenue from Camelback Road would be via the frontage road, which would allow a right turn onto southbound 43rd Avenue.



6.3.4 51st Avenue / Bethany Home Road

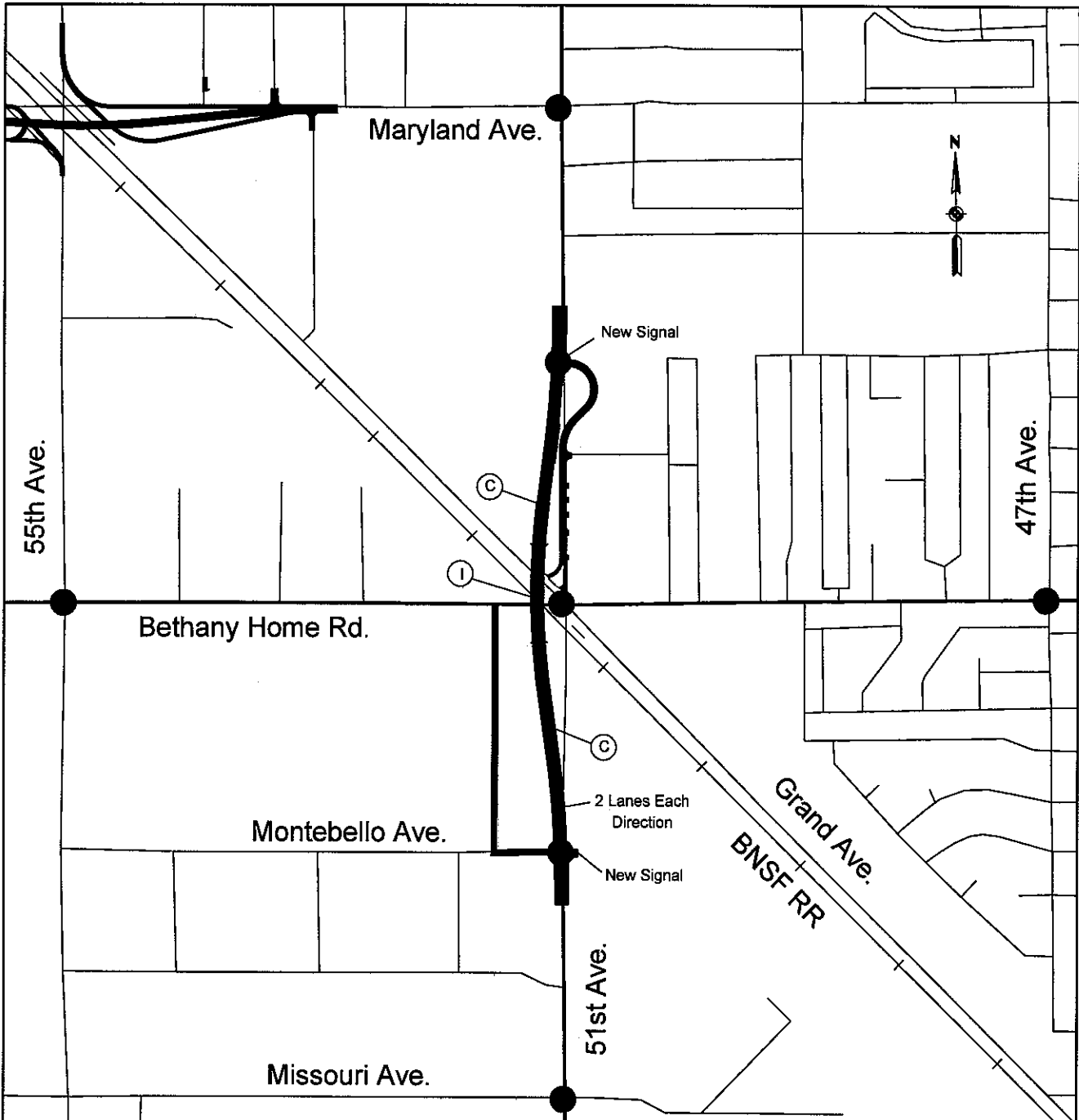
This intersection is wholly within the City of Glendale. It is possible to provide an overpass along either 51st Avenue or Bethany Home Road and both have been laid out geometrically. An overpass taking 51st Avenue over the BNSF railroad tracks, Bethany Home Road, and Grand Avenue appears to be the most logical choice for the following reasons. Traffic flows in Glendale are more predominately north-south than east-west. 51st Avenue carries 3,000-4,000 more vehicles per day than Bethany Home Road. In addition, 51st Avenue is a much more regionally significant route than Bethany Home Road as it stretches from the Gila River Indian Reservation in the south to the farthest northern developments in the metropolitan area and serves the heart of the City of Glendale.

In addition, a hospital, Maryvale Medical Center, is located on the northwest corner of Campbell Avenue and 51st Avenue (approximately 1 1/2 miles south of Grand Avenue). An overpass along 51st Avenue would better remove the railroad tracks and trains as a possible barrier between the hospital and the heart of Glendale for emergency vehicles by providing the most direct route.

The overpass alignment is shown just west of the 51st Avenue centerline (see Exhibit 6.10). An alignment further west may be needed to maintain traffic flow on 51st Avenue during construction. A few industrial buildings would be taken for right-of-way for the overpass. Local access to the remaining property north of Bethany Home Road would be via a two-way frontage road along the east side of 51st Avenue and at a new signal at the intersection of the frontage road and 51st Avenue. Access to property south of Bethany Home would be via a two-way frontage road along the west side of 51st Avenue and at a signal at the intersection of the frontage road and 51st Avenue.

Both Bethany Home Road and Grand Avenue would remain unchanged. With 51st Avenue removed from the intersection, a four-legged 45-degree skewed intersection would remain. Access to 51st Avenue from either Grand Avenue or Bethany Home Road would be via the frontage roads. Access from 51st Avenue to Grand Avenue or Bethany Home Road would also be via the frontage roads; however, only right turns from the northbound 51st Avenue frontage road and the right turn from southbound 51st Avenue frontage road to Grand Avenue would be allowed.

New traffic signals would be installed on either end of the 51st Avenue overpass at the intersections with the frontage roads.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.10

**Option 4
Bethany Home Road/
51st Avenue**



URS Greiner Woodward Clyde
In Association With
SRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- (A) Typical Cross-Section

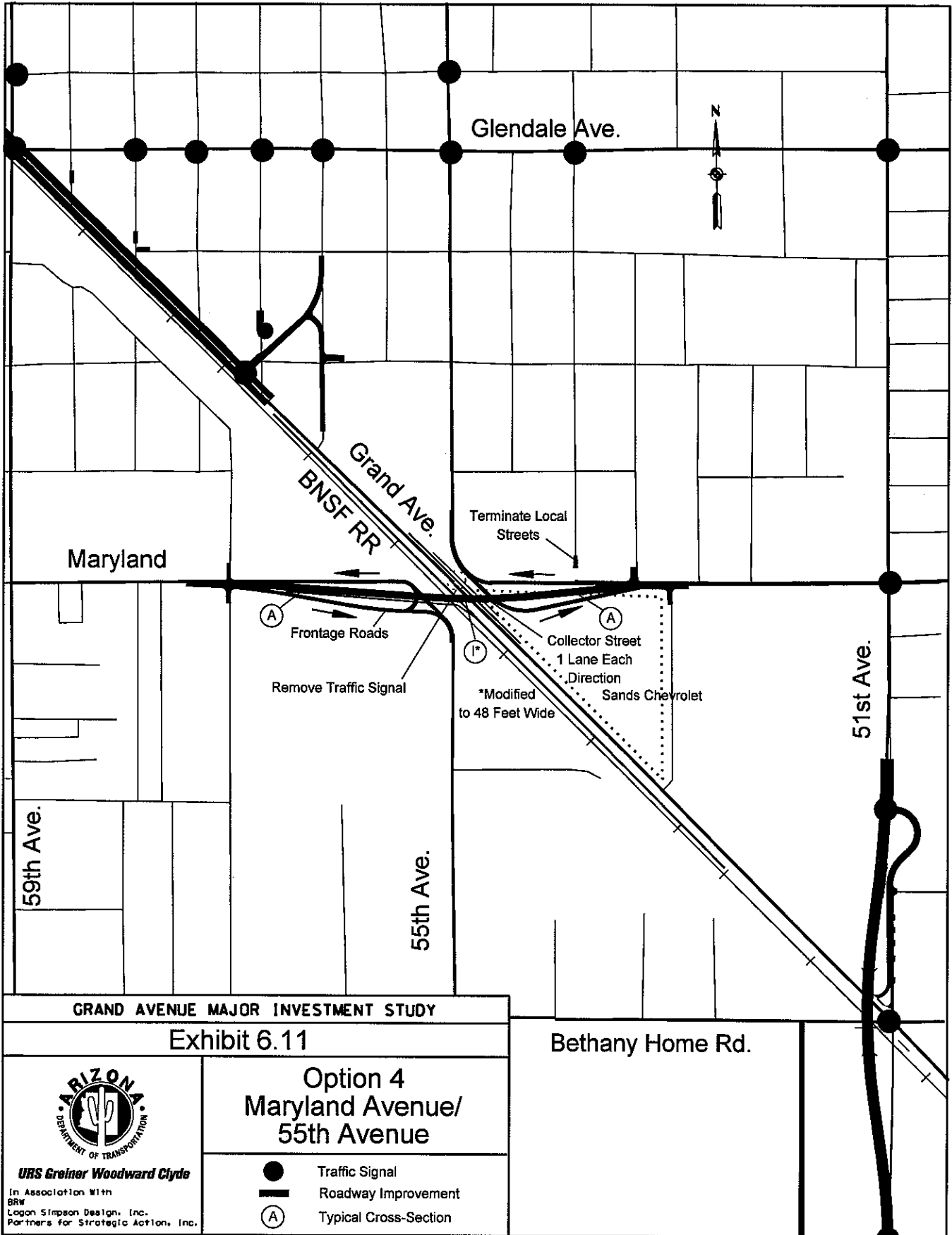
6.3.5 55th Avenue / Maryland Avenue

Maryland Avenue is a collector street located on a mid-section line. This is the only non-arterial street intersection considered for an overpass. Railroad activity is very high across 55th Avenue and Maryland Avenue because of the proximity of the railroad yard. If these at-grade crossings could be eliminated, the frequency of trains crossing Bethany Home Road, 51st Avenue, Camelback Road and 43rd Avenue might be reduced.

The concept includes an overpass for Maryland Avenue that would go over the BNSF railroad tracks and Grand Avenue (see Exhibit 6.11). The overpass would be aligned to the south of existing Maryland Avenue. This alignment would utilize mostly vacant property west of 55th Avenue but would have a major impact on the Sands Chevrolet dealership.

The at-grade crossing of 55th Avenue and the railroad would also be eliminated by not allowing 55th Avenue to intersect Grand Avenue. Access to Grand Avenue would not be provided from 55th Avenue or Maryland Avenue, and the existing traffic signal at the intersection would be removed.

Local access to the properties along Maryland Avenue would be via one-way frontage roads at the foot of the embankment for the overpass. These frontage roads are proposed to connect Maryland and 55th Avenue but neither street would intersect Grand Avenue. 55th Avenue would curve into the frontage roads both south and north of Maryland Avenue.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.11

Option 4
Maryland Avenue/
55th Avenue



URS Greiner Woodward Clyde

In Association With
BBW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- Ⓐ Typical Cross-Section

6.3.6 59th Avenue / Glendale Avenue

This intersection is adjacent to the Glendale City Hall parking structure and is a major access point to Downtown Glendale. A grade separation along Glendale Avenue would have major visual and economic impacts to downtown Glendale and thus was not considered. The overpass would impact and eliminate many businesses along Glendale Avenue. An overpass along 59th Avenue, is possible but was not desired because of its close proximity to City Hall, visual impacts to downtown Glendale and impacts to land uses downtown. To reduce visual impacts, an underpass is proposed for Grand Avenue to go under 59th Avenue and Glendale. The removal of Grand Avenue from this intersection would increase the ability of 59th Avenue and Glendale Avenue to serve as access routes to Downtown Glendale.

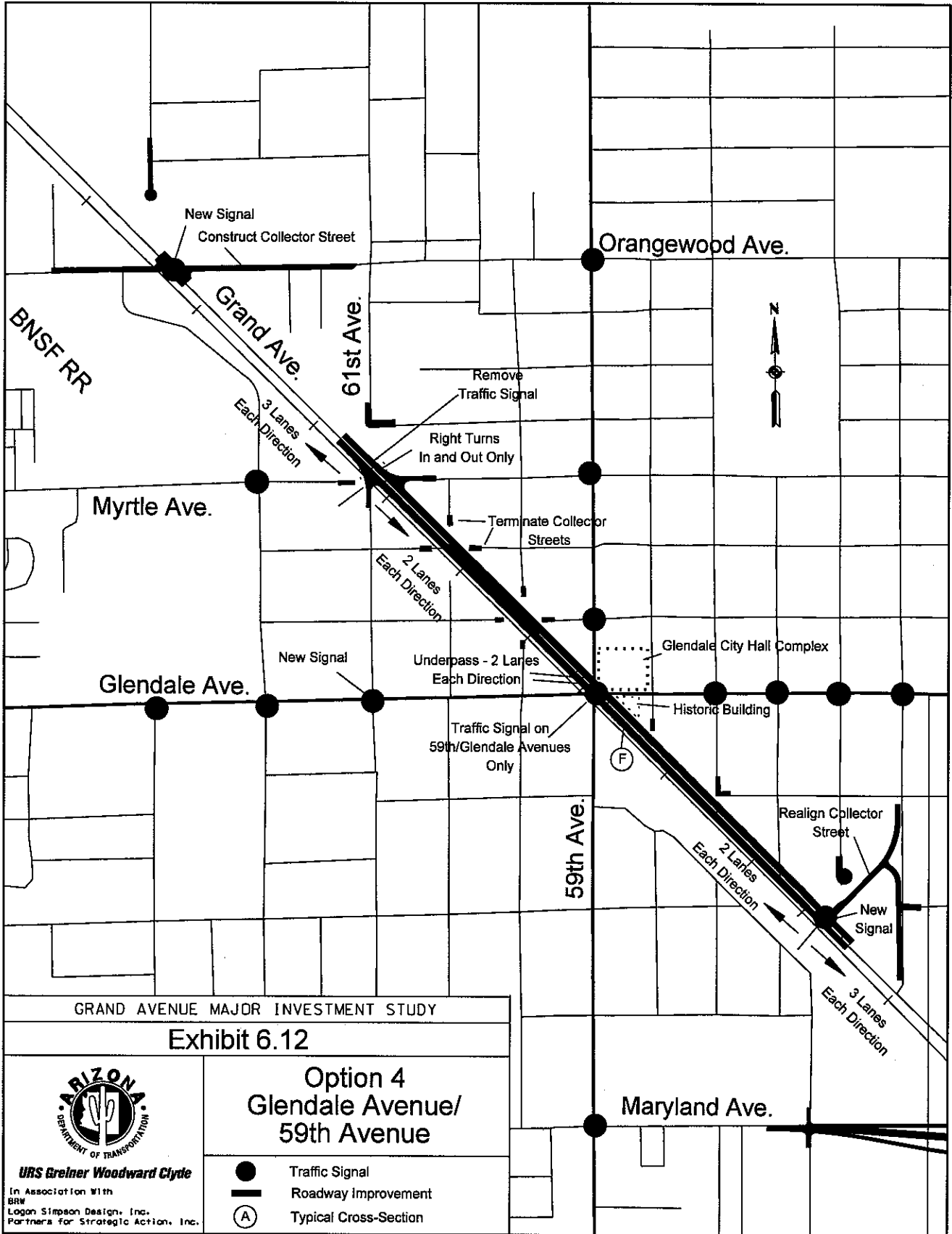
It is proposed to keep the underpass within the existing Grand Avenue right-of-way. The maximum roadway that could fit within this space in an underpass is a four-lane arterial street (refer to Exhibit 6.12). Grand Avenue would have to be closed to traffic for approximately 18 months while the construction is accomplished. The complete 59th/ Glendale intersection would also have to be closed to traffic for a few months to construct bridges.

The underpass would create significant drainage issues. It is assumed that some of the adjacent streets may have to be reconstructed to prevent sheet flow storm water from entering the underpass. A major storm water pump station would be required along with a system to transport the pumped water to retention basins that would be constructed in some of the excess right-of-way that would be obtained as part of the necessary right-of-way acquisition.

Utilities in the existing roadways would have to be relocated, not just lowered or encased, as they would be for an overpass. It is assumed that the major transmission pole at the south corner of 59th Avenue and Grand Avenue can remain in place; however, additional analyses is needed.

Access to property on the either side of Grand Avenue through the underpass area would be eliminated. Access to these properties would be provided from the north-south and east-west local streets.

Access to Downtown Glendale from Grand Avenue southeast would be via 57th Avenue or one of the other adjacent local streets. From Grand Avenue northwest, the access is proposed to be via Orangewood Avenue and via 61st Avenue and Myrtle Avenue. Right-turn movements in and out of the 61st/ Myrtle intersection would be allowed; however, left-turn movements would be prohibited. The existing signal at Myrtle Avenue and Grand Avenue would be removed. All other local streets between Orangewood Avenue and 57th Avenue would be eliminated from intersecting Grand Avenue. Orangewood Avenue would be upgraded to a collector street and a new traffic signal would be installed at the Orangewood/ Grand intersection.



6.3.7 67th Avenue / Northern Avenue

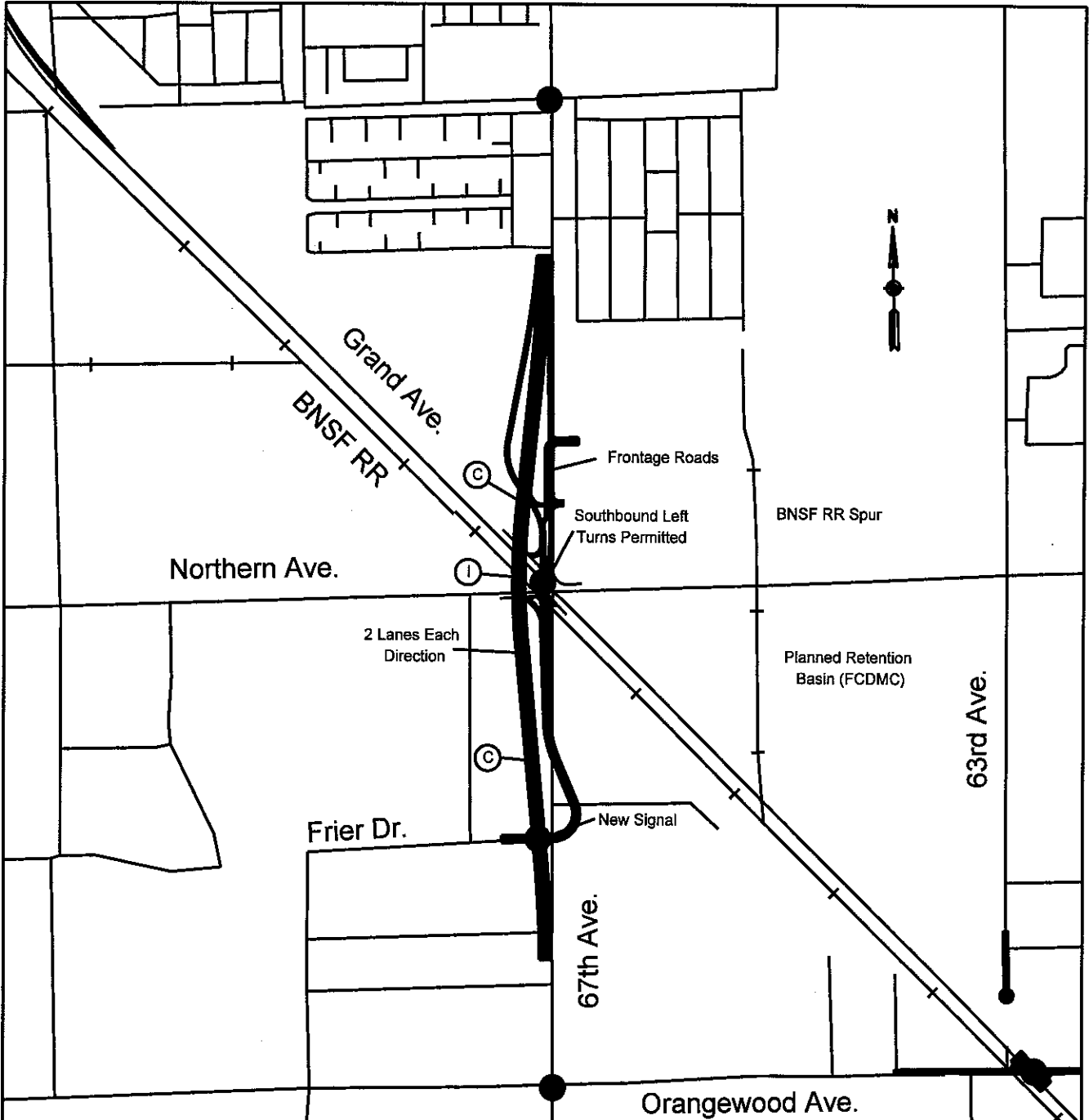
This intersection is within the City of Glendale. It is possible to provide an overpass along either 67th Avenue or Northern Avenue and both have been laid out geometrically. 67th Avenue was chosen for the proposed overpass primarily because there is a spur track that crosses Northern Avenue east of Grand Avenue. This track would conflict with an overpass on Northern Avenue. In addition, 67th Avenue carries 9,000 more vehicles per day than Northern Avenue. An east-west overpass was chosen at the next intersection to the northwest (at 75th/ Olive), thus, a north-south overpass would alternate the direction of the grade separations.

Development at this intersection is intense in the southwest and northeast quadrants. Through discussions with City of Glendale staff, it appears preferable to impact the southwest rather than the northeast quadrants. Accordingly, the proposed 67th Avenue overpass alignment is shifted to the west (see Exhibit 6.13). Several industrial and commercial buildings would have to be acquired.

Local property access, south of Northern Avenue, would be provided via a two-way frontage road east of 67th Avenue. The frontage road would intersect 67th Avenue at the south end of the overpass at a new signal. North of Northern Avenue, access would be provided via a one-way frontage road west of 67th Avenue and a two-way frontage road east of 67th Avenue.

There currently is a heavy southbound left-turn movement on 67th Avenue. To accommodate this movement, the southbound frontage road (north of Northern Avenue) is proposed to cross under the overpass and connect to the remaining Northern/ Grand intersection. This connection would create a five-legged intersection, similar to the existing 35th/ Grand intersection with Indian School Road.

An alternative to creating a five-legged intersection is to connect southbound 67th Avenue to Grand Avenue west of 67th Avenue. This connection would require a new traffic signal and require additional right-of-way.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.13

**Option 4
Northern Avenue/
67th Avenue**



URS Greiner Woodward Clyde
In Association with
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- (A) Typical Cross-Section

6.3.8 75th Avenue / Olive Avenue

This intersection lies within the City of Peoria. An overpass for either Olive Avenue or 75th Avenue is possible and both have been considered. An overpass for Olive Avenue is proposed because it can be built on largely agricultural land and Olive Avenue carries more traffic than 75th Avenue and provides a more direct connection to Loop 101 two miles to the west and to I-17 5 miles to the east.

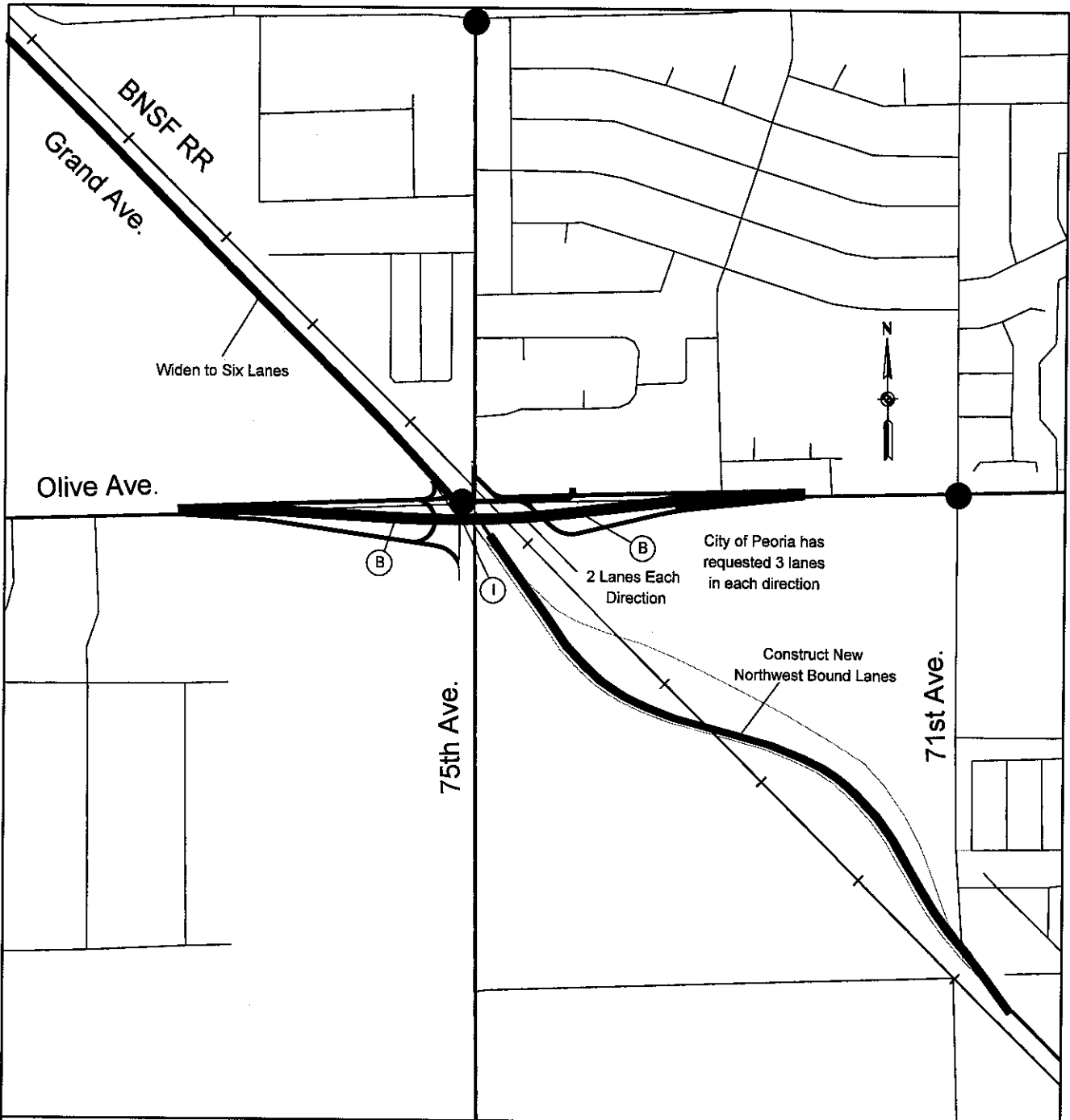
The Olive Avenue overpass would be realigned to the south of existing Olive Avenue and cross over 75th Avenue, Grand Avenue, and the BNSF (see Exhibit 6.14). A residential structure located in the southeast corner of 75th Avenue and Olive Avenue would be impacted. This structure is potentially eligible for listing in the National Register for Historic Places.

Access to properties along Olive Avenue would be via one-way frontage roads. The roads would cross under the Olive Avenue overpass.

The remaining Grand Avenue / 75th Avenue intersection would be skewed at 45 degrees but would function as a four-legged intersection. Traffic from Olive Avenue approaching the intersection would be limited to right turns only.

Some improvements to Grand will still be needed. The northwest-bound roadway is proposed to be reconstructed to parallel the southeast-bound roadway and cross over the BNSF. This improvement would eliminate the existing "Peoria underpass" that does not meet horizontal curvature or vertical clearance requirements.

North of Olive Avenue, Grand Avenue currently has four traffic lanes. It is proposed to widen Grand Avenue to six lanes continuous between Olive Avenue and Peoria Avenue.



GRAND AVENUE MAJOR INVESTMENT STUDY

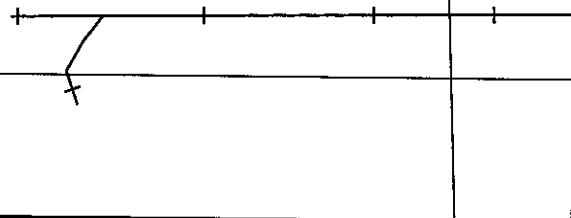
Exhibit 6.14



URS Greiner Woodward Clyde
 In Association With
 BRW
 Logan Simpson Design, Inc.
 Partners for Strategic Action, Inc.

**Option 4
 Olive Avenue/
 75th Avenue**

- Traffic Signal
- Roadway Improvement
- ⓐ Typical Cross-Section



6.3.9 Loop 101

To provide access from Grand Avenue to and from Loop 101 to the north, a concept for a half-diamond interchange has been developed that would connect to the intersection of 91st Avenue and Cactus Road (see Exhibit 6.15). The southbound ramp from Loop 101 would fly over the freeway while the northbound ramp would remain essentially at grade. It appears that there would be adequate weaving distance on Loop 101 between these new ramps and the existing ramps on the south half of the Thunderbird Road interchange with the addition of auxiliary lanes between the ramps.

The intersection of Cactus Road and 91st Avenue will remain unchanged. The intersection would most likely need to be signalized to handle increased traffic volumes associated with the ramps. No access would be allowed to the ramps north of Cactus Road. A local access road would be constructed east of 91st Avenue and north of Cactus Road to provide access to parcels between 91st Avenue and Loop 101.

South of Cactus Road, 91st Avenue would remain on its existing alignment that has an at-grade crossing of the BNSF and a signalized intersection with Grand Avenue. The roadway has recently been widened to four lanes and a center two-way left turn lane between Grand Avenue and Cactus Road.

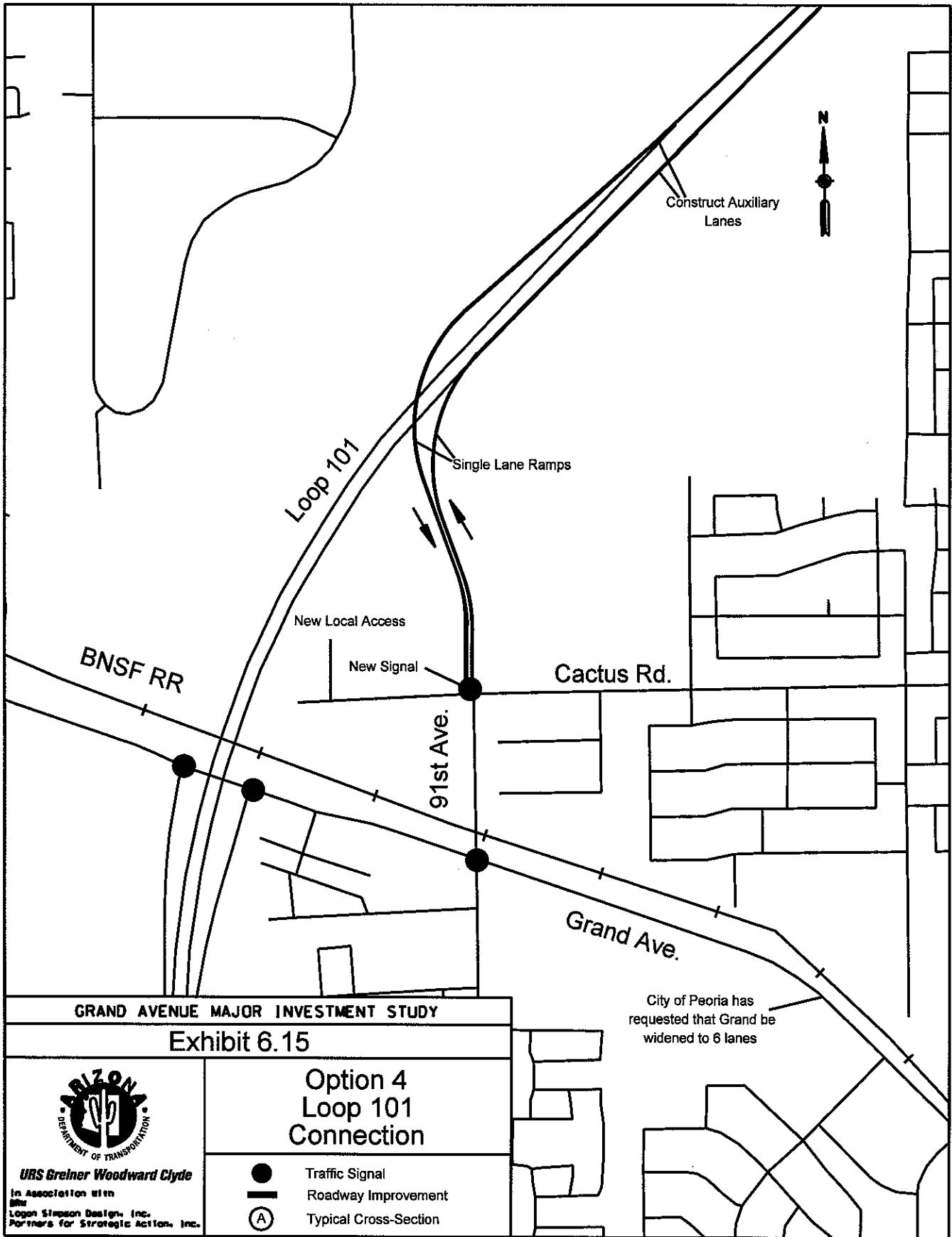
West of 85th Avenue, Grand Avenue currently has four traffic lanes. The City of Peoria has requested that Grand Avenue be widened to six lanes continuous between Loop 101 and 85th Avenue.

6.4 OPTION 5 — LIMITED EXPRESSWAY

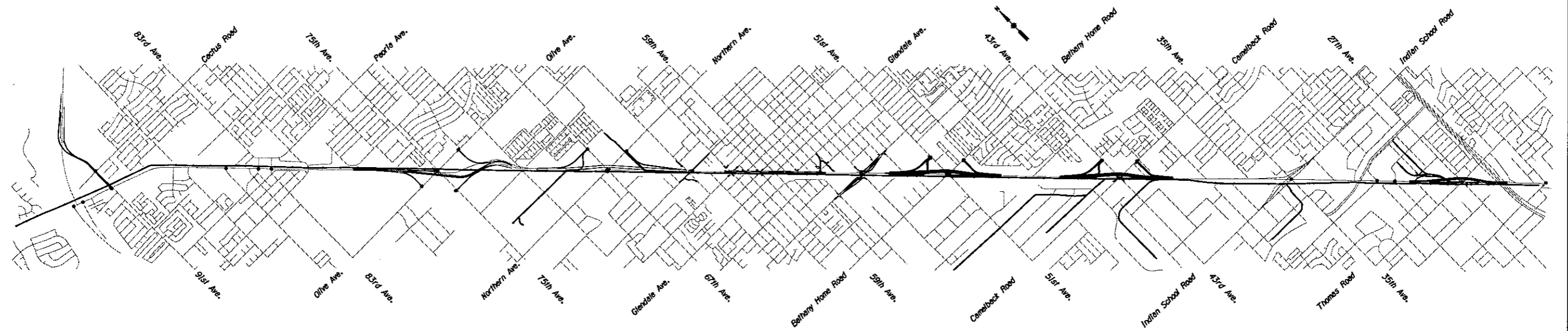
6.4.1 Overview

Option 5 is envisioned as a limited expressway concept along Grand Avenue between Loop 101 and I-17 with the priority being to provide increased capacity and reduced travel times on Grand Avenue. The concept is illustrated in summary form in Exhibit 6.16. The concept for Option 5 includes overpasses (or an underpass) for Grand Avenue at each of the major six-legged intersections. The overpasses (or underpass) are assumed to provide six lanes of traffic and full shoulders. At the end of the overpasses, the roadway would transition back to existing Grand Avenue, which has six lanes of traffic. Overpasses would occur at the following locations.

- Grand Avenue over 27th Avenue and Thomas Road.
- Grand Avenue over 43rd Avenue and Camelback Road.
- Grand Avenue over 51st Avenue and Bethany Home Road.
- Maryland Avenue over BNSF railroad tracks and Grand Avenue; 55th Avenue would be eliminated from crossing the BNSF railroad tracks and intersecting Grand Avenue.
- Grand Avenue under Glendale Avenue and 59th Avenue.
- Grand Avenue over 67th Avenue and Northern Avenue.
- Grand Avenue over 75th Avenue and Olive Avenue.



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GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.16

Option 5
Limited Expressway

● Traffic Signal



URS Greiner Woodward Clyde
In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

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In addition to the grade separations, Option 5 includes a half-diamond interchange connection from 91st Avenue to Loop 101, the same as proposed and described above for Option 4.

The overpasses for Grand Avenue are essentially independent of each other so that each one can be constructed separately. However, each time an overpass is constructed, there will be some interference with traffic on Grand Avenue. The connection of the new overpasses to existing Grand Avenue would involve transitions in roadway cross-section, horizontal alignment, vertical alignment, pavement type, and design speed. These connections will have to be designed carefully to provide smooth and safe transitions.

A brief description of the improvements recommended at each intersection is provided below. A more detailed concept drawing is provided for each location. The typical roadway sections were provided earlier in Exhibits 6.2 through 6.5.

The number of traffic signals on Grand Avenue within the study area would be reduced from 18 to 11 (nine signals would be removed and two would be added). However, nine new signals are added to the arterial cross streets. The resulting limited expressway would have stretches of up to 3 miles with no traffic signals. There would not be any six-legged intersections, and none of the traffic signals would be at arterial street intersections; they would all be at collector street intersections. Local property access would occur via the existing arterial cross streets. Access to and from Grand Avenue would occur via on- and off-ramps.

6.4.2 27th Avenue / Thomas Road

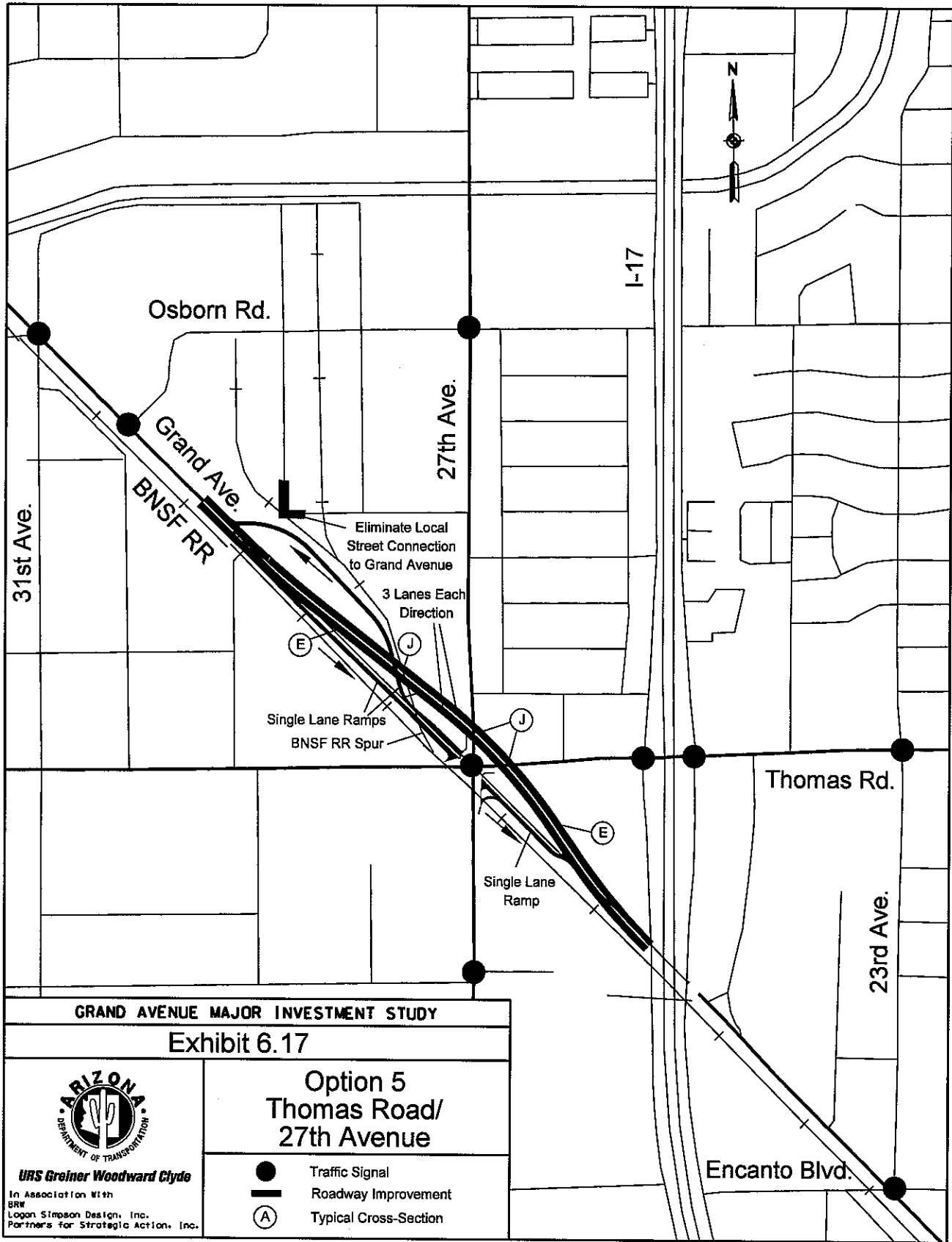
The proposed overpass concept is similar to the one described for Option 4 with Grand Avenue passing over 27th Avenue and Thomas Road but with additional ramps (southeast-bound off-ramp and northwest-bound on-ramp). Refer to Exhibit 6.17. For the general reasons cited previously, the Option 5 concept aligns the Grand Avenue overpass to the east of Grand Avenue away from the BNSF. Just as in Option 4, a portion of the former Pioneer Ford site (now owned by ADOT) would be used as a drainage basin. A spur of the railroad crosses Grand Avenue just north of Thomas Road. The overpass would have to go over the spur as well as go over 27th Avenue and Thomas Road.

Access to Grand Avenue would occur via two on-ramps from the 27th/ Thomas intersection. The on-ramp providing access to northwest-bound Grand Avenue would start at the intersection, follow the spur under the overpass and join northwest-bound Grand Avenue at the west-end of the overpass. The on-ramp providing access to the southeast-bound Grand Avenue would start at the intersection, follow existing Grand Avenue and join southeast-bound Grand Avenue at the east-end of the overpass.

A southeast-bound off-ramp is proposed with Option 5. This ramp would follow existing Grand Avenue to the 27th/ Thomas intersection. This ramp would create a fifth leg to the intersection that would accommodate southeast-bound left- and right-turning traffic (no through movements). This ramp was included to enhance the linkage between Grand Avenue and I-17 via Thomas Road.

Both 27th Avenue and Thomas Road would remain as they currently exist. With Grand Avenue removed from the intersection, a five-legged intersection similar to the one at Grand Avenue and 35th Avenue would remain. Left-turn movements on Thomas Road at 27th Avenue could be restored.

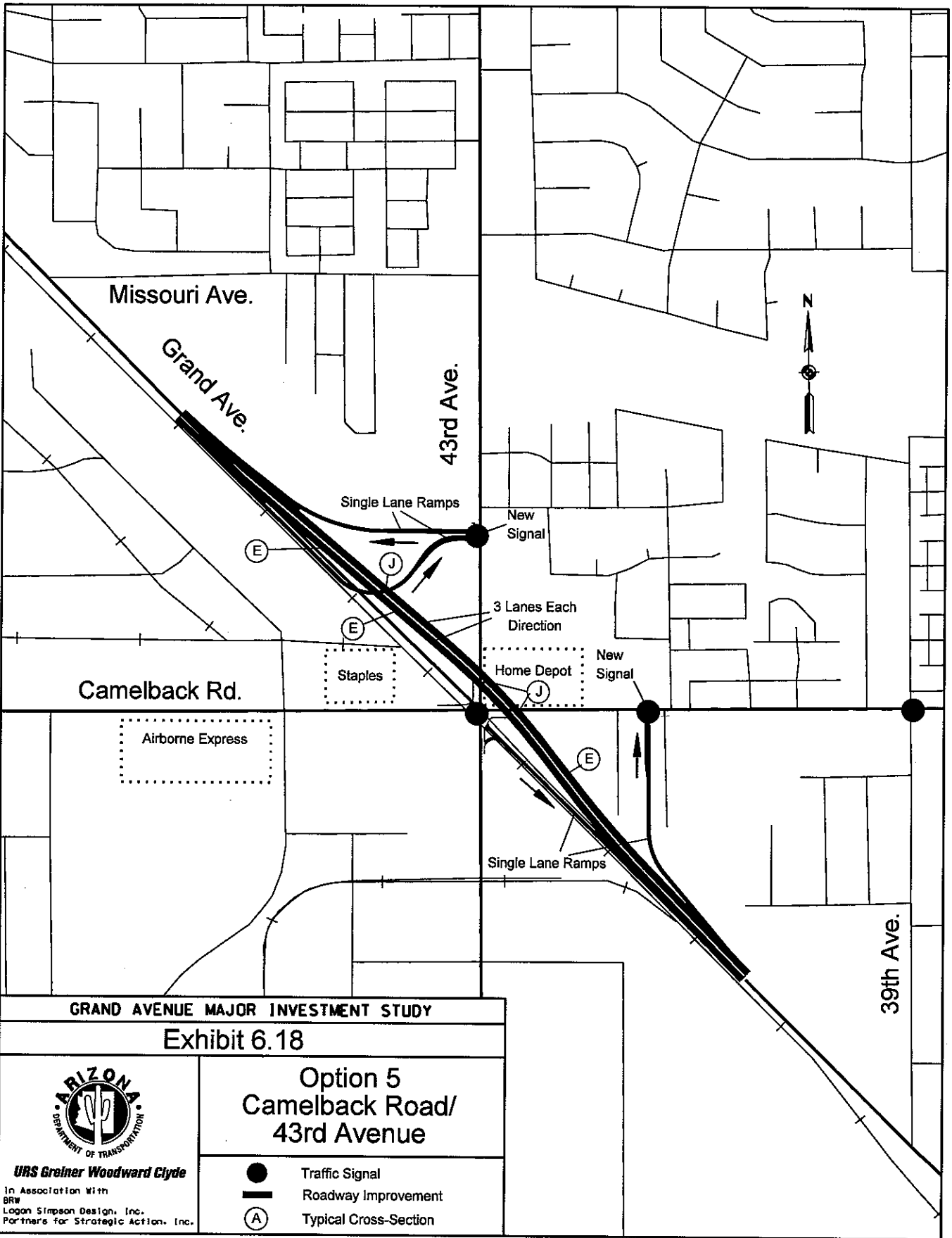
With Option 5, Osborn Road is proposed to remain as it is today and not be realigned as in Option 4. The two signals (Osborn east and 31st/Osborn west) would remain. If Grand Avenue were further upgraded in the future, these intersections would be eliminated.



6.4.3 43rd Avenue / Camelback Road

The proposed overpass at this location is prototypical of several other locations. The overpass would be offset away from the railroad so that it can be built with limited interference with traffic on Grand Avenue (see Exhibit 6.18). Access to and from Grand Avenue would be provided via on- and off-ramps. Ramps to and from the northwest on Grand Avenue connect to 43rd Avenue north of Camelback Road at a new traffic signal. An additional structure is needed to allow the southeast-bound off-ramp to pass under the overpass. A ramp from the southeast on Grand Avenue connects to Camelback Road east of 43rd Avenue at a new traffic signal. A southeast-bound on-ramp starting at the 43rd/ Camelback intersection utilizes existing Grand Avenue right-of-way and connects with southeast-bound Grand Avenue. These ramps were included to minimize potential traffic increases on 39th Avenue which passes through a residential neighborhood and adjacent to a high school.

Both 43rd Avenue and Camelback Road would remain as they currently exist. With Grand Avenue removed from the intersection, a four-legged 90-degree intersection would remain. Left-turn movements on Camelback Road at 43rd Avenue could be restored.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.18

**Option 5
Camelback Road/
43rd Avenue**



URS Greiner Woodward Clyde

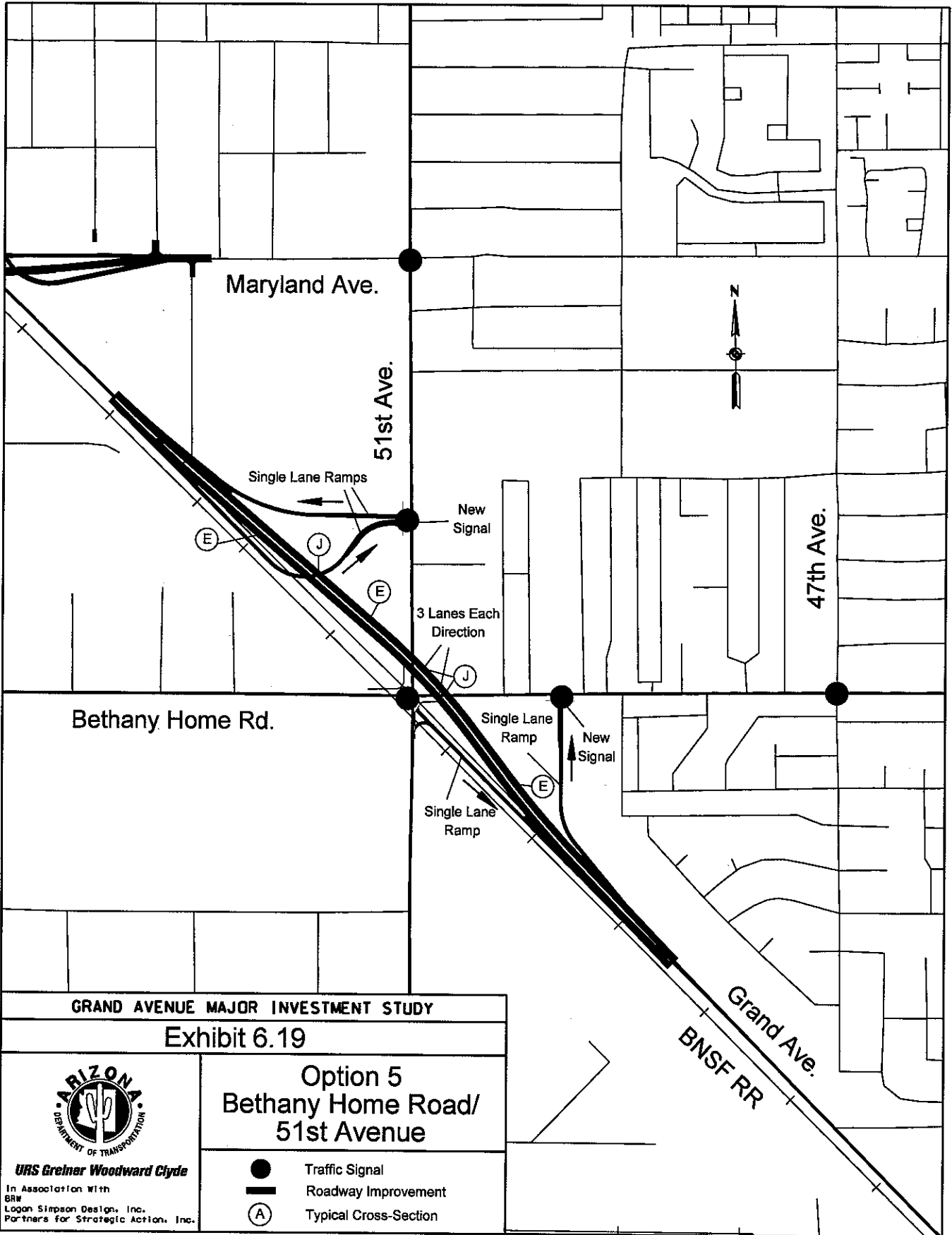
In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- Ⓐ Typical Cross-Section

6.4.4 51st Avenue / Bethany Home Road

The Grand Avenue overpass is very similar to the one proposed at 43rd / Camelback intersection. The overpass would be offset away from the railroad so that it can be built with limited interference with traffic on Grand Avenue (see Exhibit 6.19). Access to and from Grand Avenue would be provided via on- and off-ramps. Ramps to and from the northwest on Grand Avenue connect to 51st Avenue north of Bethany Home Road at a new traffic signal. An additional structure is needed to allow the southeast-bound off ramp to pass under the overpass. A ramp from the southeast on Grand Avenue connects to Bethany Home Road east of 51st Avenue at a new traffic signal. A southeast-bound on-ramp starts at the 51st / Bethany Home intersection and connects with southeast-bound Grand Avenue.

Both 51st Avenue and Bethany Home Road would remain as they currently exist. With Grand Avenue removed from the intersection, a four-legged 90-degree intersection would remain.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.19

Option 5
Bethany Home Road/
51st Avenue



URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- Ⓐ Typical Cross-Section

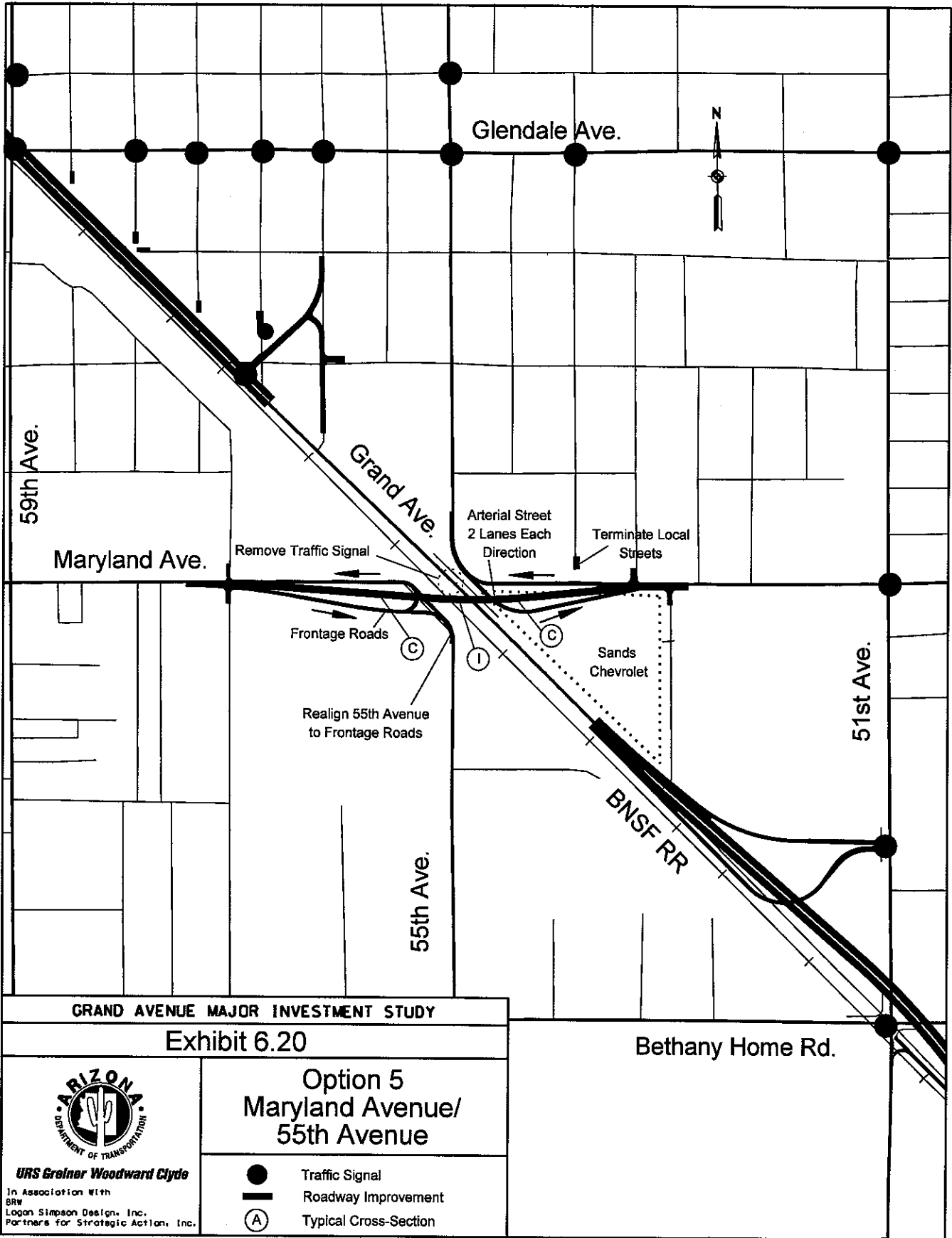
6.4.5 55th Avenue / Maryland Avenue

The east-west overpass for Maryland Avenue is similar to the one described in Option 4. Refer to Exhibit 6.20. The primary difference is that with Option 5, the Maryland Avenue overpass is proposed to have a four-lane arterial cross-section versus a two-lane cross-section. Since Maryland Avenue would be the only new grade separation with the railroad, traffic volumes are expected to be greater than with Option 4 and, therefore, greater emphasis is warranted.

Maryland Avenue is the only non-arterial street intersection considered for an overpass. Railroad activity is very high across 55th Avenue and Maryland Avenue because of the proximity of the railroad yard. If these at-grade crossings could be eliminated, the frequency of trains crossing Bethany Home Road, 51st Avenue, Camelback Road and 43rd Avenue may be reduced.

The concept includes an overpass for Maryland Avenue that would go over the BNSF and Grand Avenue. The overpass is proposed to be aligned to the south of existing Maryland Avenue. This alignment would utilize mostly vacant property west of 55th Avenue and would have a major impact on the Sands Chevrolet dealership.

The at-grade crossing of 55th Avenue and the railroad would also be eliminated by not allowing 55th Avenue to intersect Grand Avenue. Access to Grand Avenue would not be provided from 55th Avenue or Maryland Avenue, and the existing traffic signal at the intersection would be removed. Local access to the properties along Maryland Avenue would be via one-way frontage roads along the foot of the embankment for the overpass. These frontage roads are proposed to connect Maryland Avenue and 55th Avenue, but neither street would intersect Grand Avenue. 55th Avenue would curve into the frontage roads both south and north of Maryland Avenue.



6.4.6 59th Avenue / Glendale Avenue

The basic concept here is similar to the one described for Option 4 (refer to Exhibit 6.21). This intersection is adjacent to the Glendale City Hall parking structure and is a major access point to Downtown Glendale. To reduce visual impacts, an underpass is proposed for Grand Avenue to go under 59th Avenue and Glendale. The removal of Grand Avenue from this intersection would increase the ability of 59th Avenue and Glendale to serve as access routes to Downtown Glendale.

To maintain lane continuity on the limited expressway, the underpass is proposed to accommodate six lanes of traffic. The proposed cross-section cannot be built in the existing Grand Avenue right-of-way. Refer to Exhibit 6.4. The full-width shoulders in the desirable cross-section would be eliminated to avoid railroad property and direct impact to the historical building. The large transmission angle pole at the corner of Grand Avenue and 59th Avenue would have to be relocated.

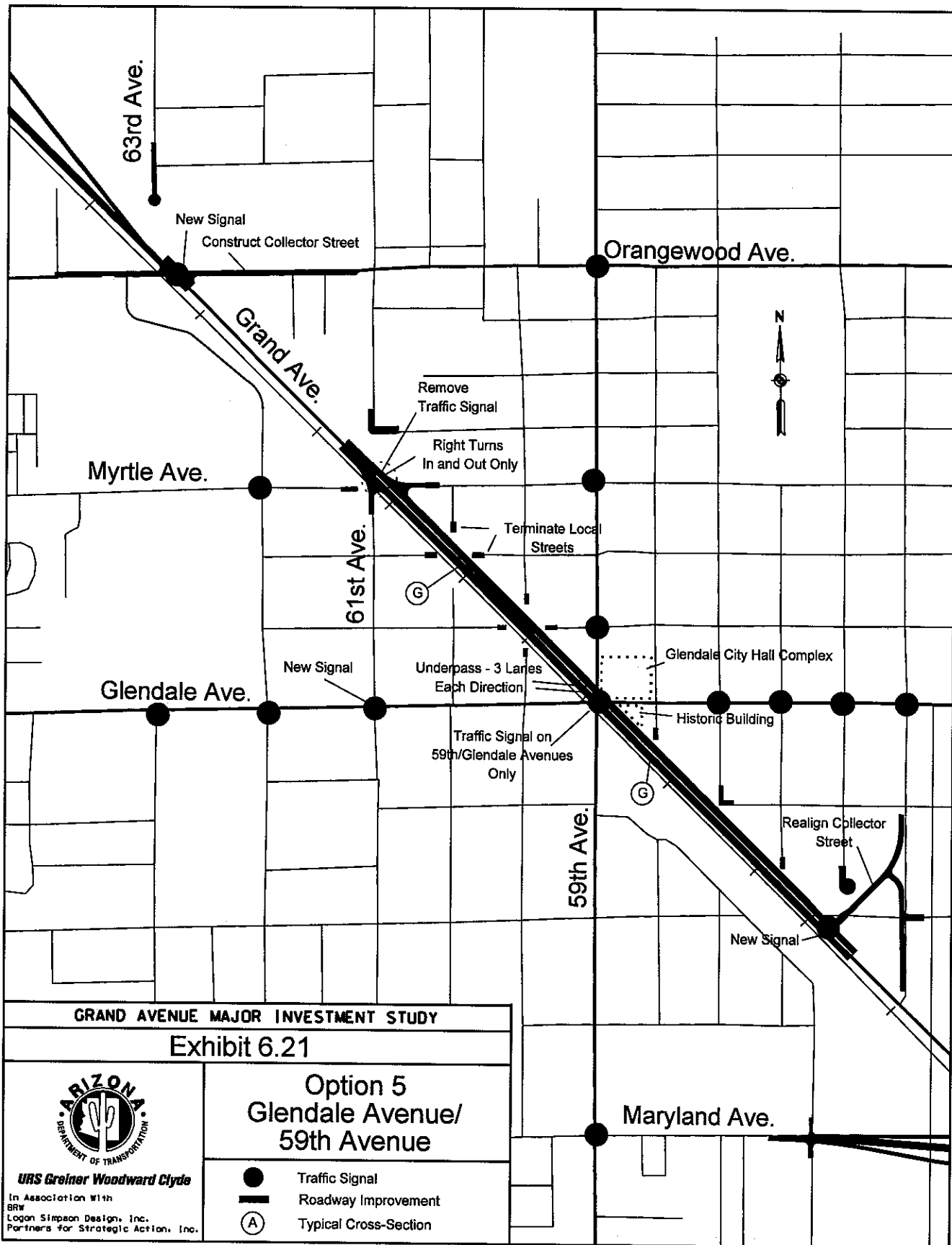
The underpass construction would come within 7 feet of the historical building on the east side of Grand Avenue south of Glendale Avenue. Special construction techniques will be required to build the underpass walls, which would serve as abutments. Top-down construction of cut walls will be required. Potential techniques include soldier pile, lagging walls, secant drill shaft walls, and anchor / tie-back walls.

The underpass would create significant drainage issues. It is assumed that some of the adjacent streets may have to be reconstructed to prevent sheet flow stormwater from entering the underpass. A major stormwater pump station would be required along with a system to transport the pumped water to retention basins that would be constructed in some of the excess right-of-way that would be obtained as part of the necessary right-of-way acquisition.

Utilities in the existing roadways would have to be relocated, not just lowered or encased, as they would be for an overpass.

Access to property on either side of Grand Avenue would be eliminated through the underpass section. Some property that abuts Grand Avenue would be acquired for right-of-way.

Access to Downtown Glendale from Grand Avenue southeast would be via 57th Avenue or one of the other adjacent local streets. From Grand Avenue northwest, access is proposed to be via Orangewood Avenue and via 61st Avenue and Myrtle Avenue. Right-turn movements in and out of 61st Avenue and Myrtle Avenue would be allowed; however, left-turn movements would be prohibited. The existing signal at Myrtle Avenue and Grand Avenue would be removed. All other local streets between Orangewood Avenue and 57th Avenue would be eliminated from the intersection with Grand Avenue. Orangewood Avenue west would be extended to intersect Grand Avenue and join with Orangewood Avenue east. A new traffic signal would be installed at the Orangewood/ Grand intersection. Orangewood would be reconstructed as a collector street between Grand Avenue and 57th Avenue.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.21



Option 5
Glendale Avenue/
59th Avenue

URS Greiner Woodward Clyde

In Association With
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Partners for Strategic Action, Inc.

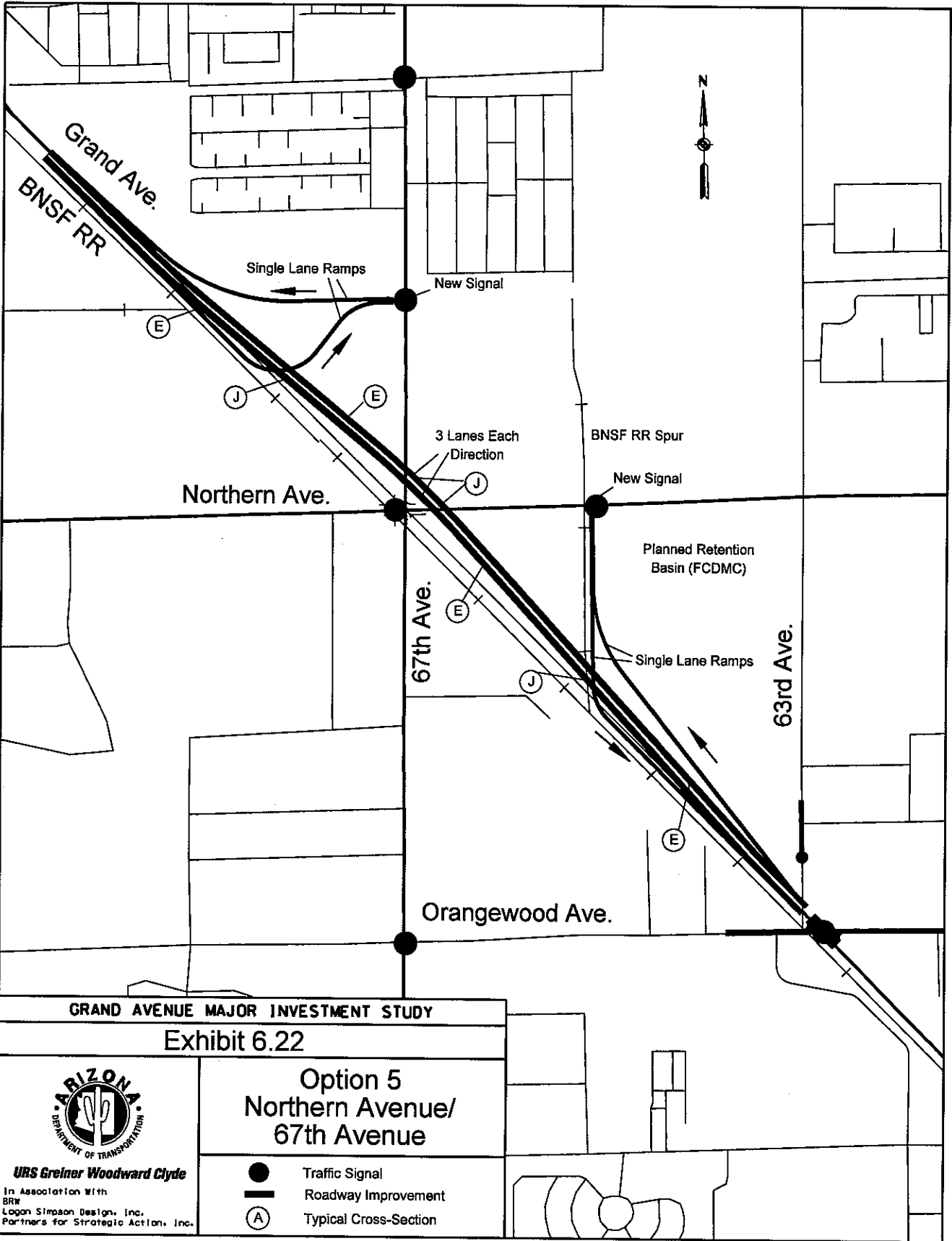
- Traffic Signal
- ▬ Roadway Improvement
- ⊙ Typical Cross-Section

6.4.7 67th Avenue / Northern

The concept for this overpass is similar to the one described for 51st/ Bethany Home intersection (refer to Exhibit 6.22). The major difference is the southeast-bound on-ramp. The on-ramp is placed east of the spur so it does not cross the tracks. Grand Avenue would go over the on-ramp and the spur.

Access to and from Grand Avenue would be provided via on- and off-ramps. Ramps to and from the northwest on Grand Avenue connect to 67th Avenue north of Northern Avenue at a new traffic signal. Ramps to and from the southeast on Grand Avenue connect to Northern Avenue east of 67th Avenue at a new signal. Additional structures are needed to allow the southeast-bound on- and off- ramps to pass under the overpass.

Both 67th Avenue and Northern Avenue would remain as they currently exist. With Grand Avenue removed from the intersection, a four-legged 90-degree intersection would remain.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.22

Option 5
Northern Avenue/
67th Avenue



URS Greiner Woodward Clyde

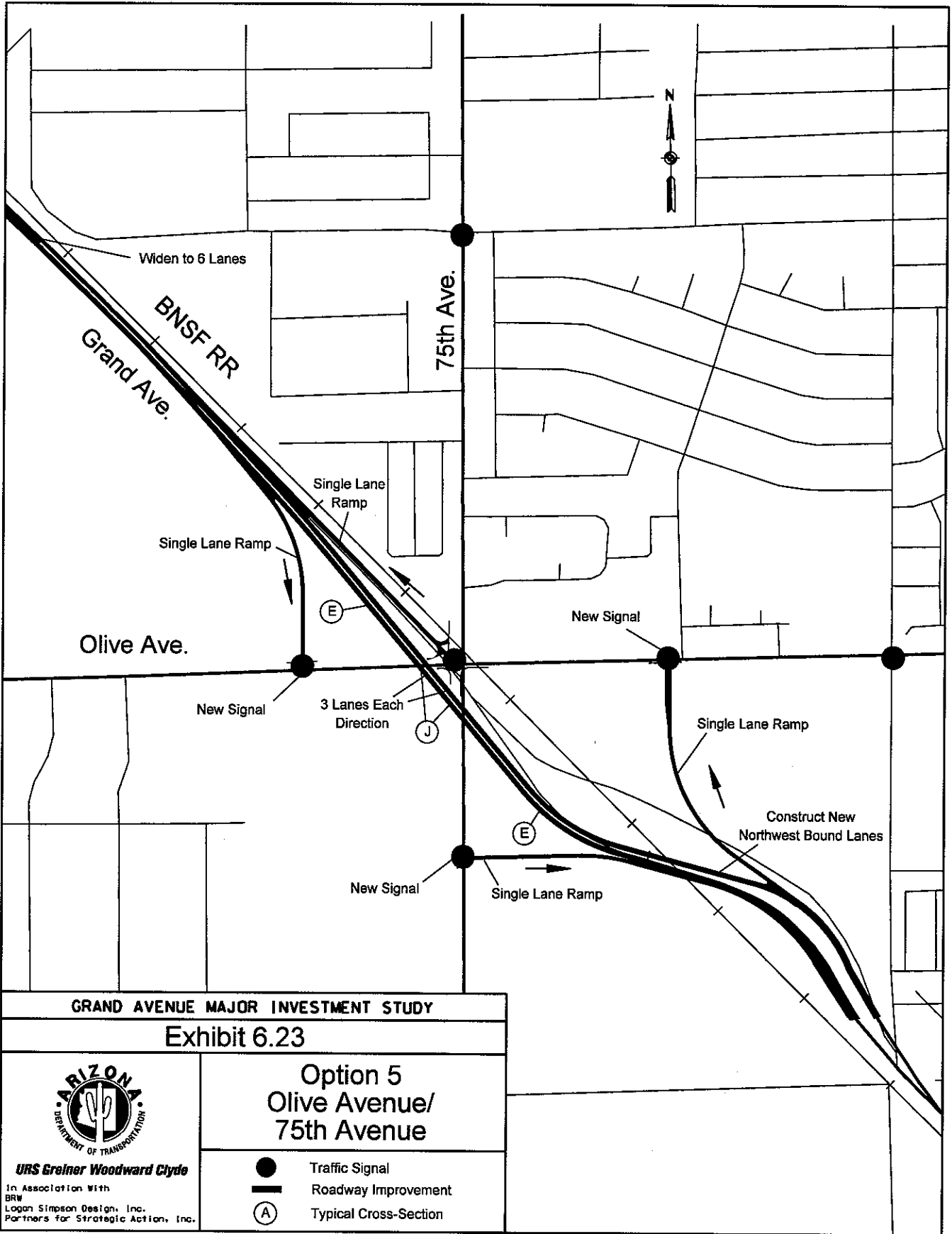
In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

6.4.8 75th Avenue / Olive

Northwest-bound Grand Avenue would be reconstructed to parallel the existing southeast-bound roadway, which has an overpass over the BNSF (see Exhibit 6.23). The existing underpass would be eliminated. At the intersection of 75th/ Olive, the alignment of Grand Avenue would be shifted to the west and Grand Avenue would pass over the two arterial streets.

Access to and from Grand Avenue would be provided via on- and off-ramps. A southeast-bound on-ramp would be provided from 75th Avenue to Grand Avenue. The ramp would require a structure over the railroad tracks and a new signal on 75th Avenue. A northwest-bound off-ramp from Grand Avenue would intersect with Olive Avenue, east of 75th Avenue at a new signal. The on-ramp providing access to northwest-bound Grand Avenue would start at the intersection and join northwest-bound Grand Avenue at the west-end of the overpass. The southeast-bound off-ramp from Grand Avenue would intersect 75th Avenue, south of Olive Avenue at a new signal.

Both 75th Avenue and Olive Avenue would remain as they currently exist. With Grand Avenue removed from the intersection, a four-legged 90-degree intersection would remain.



6.4.9 Loop 101

The connection to Loop 101 would be the same as that described for Option 4 (see Exhibit 6.24). To provide access from Grand Avenue to and from Loop 101 to the north, a half-diamond interchange would connect to the intersection of 91st Avenue and Cactus Road. The southbound ramp from Loop 101 would fly over the freeway while the northbound ramp would remain essentially at grade. It appears that there would be adequate weaving distance on Loop 101 between these new ramps and the existing ramps on the south half of the Thunderbird Road interchange with the addition of auxiliary lanes between the ramps.

The intersection of Cactus Road and 91st Avenue will remain unchanged. The intersection would most likely need to be signalized to handle increased traffic volumes associated with the ramps. No access would be allowed to the ramps north of Cactus Road. A local access road would be constructed east of 91st Avenue and north of Cactus Road to provide access to parcels between 91st Avenue and Loop 101.

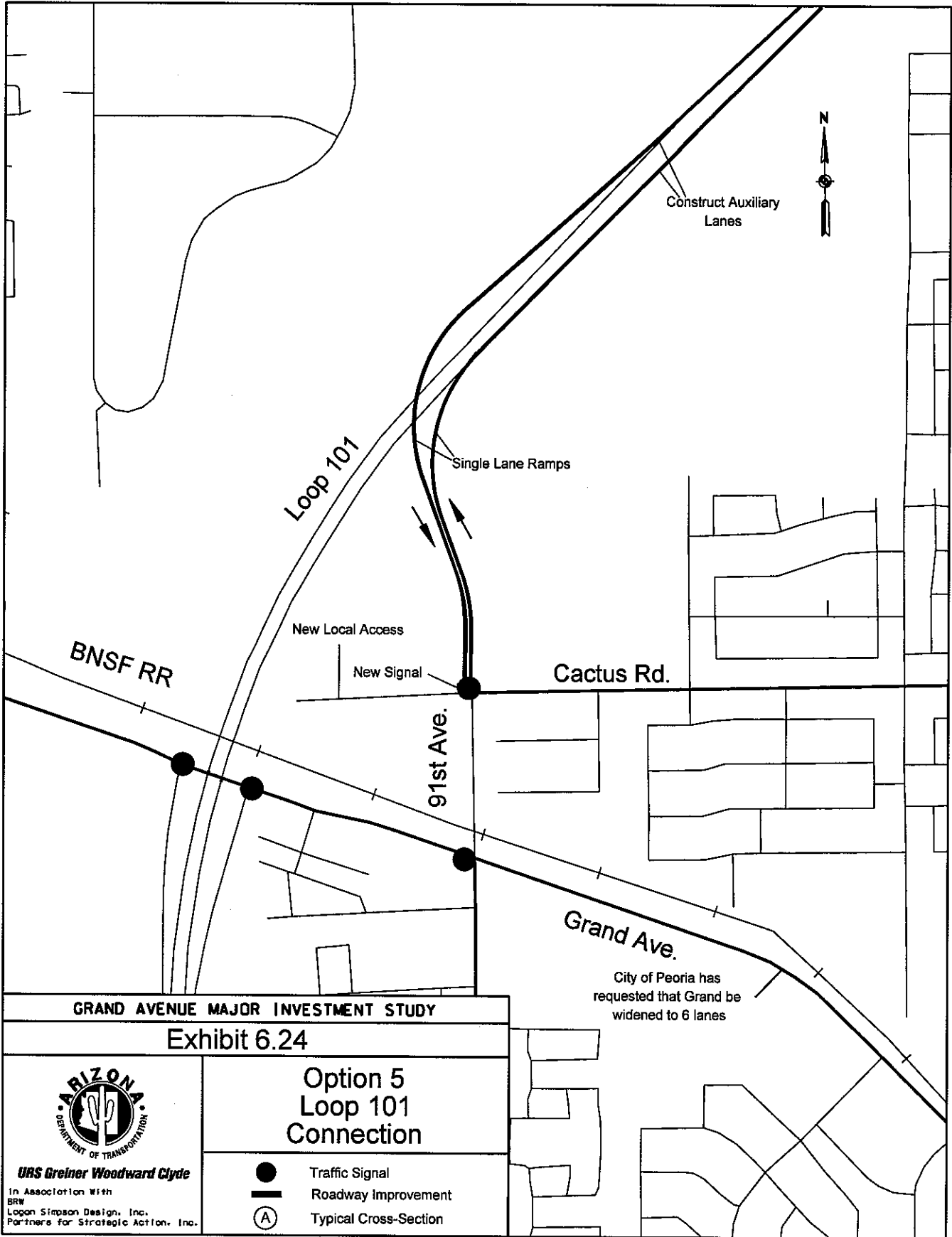
South of Cactus Road, 91st Avenue would remain on its existing alignment that has an at-grade crossing of the BNSF and a signalized intersection with Grand Avenue. The roadway has recently been widened to four lanes and a center two-way left turn lane between Grand Avenue and Cactus Road.

West of 85th Avenue, Grand Avenue currently has four traffic lanes. The City of Peoria has requested that Grand Avenue be widened to six lanes continuous between Loop 101 and 85th Avenue.

6.5 Future Expressway

Many participants in the MIS have indicated a desire to eventually construct an expressway in the Grand Avenue Corridor. An expressway is **not** necessarily a freeway like Loop 101 or I-10. An expressway can have traffic signals and can have some other intersecting streets.

A higher level expressway could be obtained on Grand Avenue under both Options 4 and 5 by eliminating more signals, intersecting streets and private property access, and by adding more grade separations. Additional funds, right of-way acquisition and construction would be required. Purchasing properties along Grand Avenue could eliminate more property access. Intersecting streets and minor traffic signals at the intersection of these streets with Grand Avenue could be eliminated by constructing grade separations over Grand Avenue along the street, rerouting streets so they do not intersect Grand Avenue or disconnecting the street by constructing a cul-de-sac. Eliminating major signals and major intersecting streets would require construction of grade separations along Grand Avenue.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 6.24

**Option 5
Loop 101
Connection**



URS Greiner Woodward Clyde
 In Association With
 BRW
 Logan Simpson Design, Inc.
 Partners for Strategic Action, Inc.

- Traffic Signal
- Roadway Improvement
- (A) Typical Cross-Section

City of Peoria has requested that Grand be widened to 6 lanes

Option 5 could be more easily converted than Option 4 by connecting the eight projects and providing grade separations along Grand Avenue at 35th / Indian School and 83rd / Peoria intersections. Currently, the City of Peoria is opposed to that type of construction through the downtown Peoria area. If the Indian School Road overpass is to remain, the Grand Expressway would have to be aligned to cross over Indian School Road east of the existing overpass and also cross over 35th Avenue before rejoining with the existing Grand Avenue alignment.

To reach the full expressway status under Option 4, grade separations along Grand Avenue would need to be constructed at each of the locations of an arterial street overpass. The overpasses would have to be aligned to the east as described above for 35th Avenue / Indian School Road.

Chapter 7.0

MULTI-MODAL ELEMENTS

7.0 SUMMARY

This chapter addresses existing multi-modal elements of the Grand Avenue Corridor, including local bus service, bicycles and pedestrians. The chapter also considers two transit modes that may be added to the corridor in the future: express bus service and light rail transit (LRT). The emphasis is on a comparison of the impacts of Options 4 and 5 on each mode. Below is a brief summary of the multi-modal elements presented in this chapter.

Local Bus Service

With respect to existing local bus service, the major issue is the impact of each roadway improvement option on transfers between routes. Under both options, new grade separations would impede some transfers and facilitate others, with the details depending on the direction of the grade separation. The chapter considers existing routes as well as potential future routes on 51st, 75th, Northern and Olive Avenues. Each option, but especially Option 5, would have major impacts on Yellow Line (Grand Avenue) operations and ridership. Overall, Option 4 would require removal or relocation of at least 10 bus stops near four intersections. Option 5 would require removal or relocation of 13 bus stops near six intersections.

Express Bus Service

This chapter analyzes two potential express bus routes for both Option 4 and Option 5. One proposed route would travel from Arrowhead Mall to the Phoenix Central Business District (CBD) via SR 101, Grand Avenue, Camelback Road and Central Avenue. The second would run from the 59th Avenue / Bell area to the Phoenix CBD via 59th Avenue, Grand Avenue, 19th Avenue and Washington / Jefferson Streets. Both would operate in mixed traffic on the Grand Avenue portion of the route, and both would require new park-and-ride facilities in the corridor. Express buses may need to be detoured off their main route to serve these lots and possible transit centers in Downtown Glendale and Peoria.

HOV Lanes

The concept of high-occupancy vehicles (HOV) lanes was considered for Grand Avenue, but rejected for a number of reasons. HOV lanes in this corridor would offer minimal travel time savings and would not be warranted by the anticipated number of express buses. Because of right-of-way constraints, creation of HOV lanes would require taking of general traffic lanes. Implementation of HOV lanes on arterial streets also poses a number of operational and safety concerns, especially involving vehicles making turns on and off of Grand Avenue.

Bicycles and Pedestrians

Both roadway options would also impact existing and planned bicycle and pedestrian facilities. Numerous existing and planned bikeways cross the corridor; each option would facilitate some bicycle movements and impede others. In addition, the 1999 *MAG Regional Bicycle Plan* designates Grand Avenue as part of the future regional bikeway system, although the type of facility is not specified. Under both Options 4 and 5, bicycles can continue using the roadway as they do today. A separate bike path in the corridor, most likely on the railroad side, may also be feasible but would require additional right-of-way acquisition and possibly relocation of portions of the roadway. Placement of a bike path within a major roadway corridor also raises several operational and safety concerns.

Light Rail Transit

The last topic discussed in this chapter is the future extension of an LRT line from its planned terminus in downtown Glendale to downtown Peoria via the Grand Avenue Corridor. Under both Options 4 and 5, several alignment alternatives are available, although all would involve additional costs and tradeoffs. Under Option 4, an LRT alignment could be either on-street or adjacent to the roadway. Several possible off-street alignments requiring grade separations are described and compared for Option 5. Most alternatives require new right-of-way, and Valley Metro would have to obtain much of the necessary right-of-way for LRT at a later date.

Other LRT alternatives may be feasible, especially if Arrowhead Mall rather than downtown Peoria is deemed the key Northwest Valley destination. Even if the decision is made to extend LRT to downtown Peoria, routes other than Grand Avenue may be considered. For example, a route that leaves the corridor at Northern and enters Peoria via 83rd Avenue may provide better access to the traditional downtown area southwest of Grand. Future planning of an LRT line in the corridor would require a separate Major Investment Study to establish the preferred alternative.

7.1 LOCAL BUS SERVICE IMPACTS

Most grade separations proposed under Options 4 and 5 would have an impact on local bus stops and on transfers between routes. Because the Yellow Line carries fewer riders than most intersecting routes, Option 5, which retains the at-grade grid intersections, would generally inconvenience fewer bus riders than Option 4. The transit impacts at each intersection are described below and summarized in Exhibit 7.1.

27th Avenue / Thomas: With either Option 4 or 5, the Grand Avenue overpass would require removal of the three bus stops (one near side and two far side) serving the southeast-bound and northwest-bound Yellow Line. Transfers between the Yellow Line and the other two routes would entail longer walk distances. Because the Green Line (Thomas) is much more heavily traveled than Route 27, most of the affected transfers would be: westbound Green to northwest-bound Yellow, northwest-bound Yellow to westbound Green, eastbound Green to southeast-bound Yellow, and eastbound Yellow to eastbound Green. Each of these movements would require passengers to walk one-fourth mile or more to or from the nearest Yellow Line stop. On

the other hand, the Grand Avenue grade separation would facilitate transfers between the Green Line and Route 27 by eliminating the six-legged intersection.

43rd Avenue / Camelback: Option 4 would affect all transfers to and from Route 50, requiring removal of the existing far side bus stops serving Camelback riders. Longer walk distances and potential ramp crossings would be required for everyone making one of the 16 possible transfers to or from this major east-west route.

If the Yellow Line were retained under Option 5, this option would have the same impacts as those described for the 27th/ Thomas intersection. Because the Yellow Line carries far fewer passengers than Route 50 and has lower peak period frequencies, this alternative works better than Option 4 for local transit riders, especially those transferring between Routes 50 and 43.

51st Avenue / Bethany Home: Since there is currently no bus service on 51st Avenue, Option 4 would not currently affect transit riders at this intersection; however, this will change in the future when planned Route 51 is implemented. If the Yellow Line were retained under Option 5, this alternative would have impacts on bus stops and transferring passengers (between the Yellow Line, Route 60 and a future 51st Avenue route) similar to those described for 27th/ Thomas.

59th Avenue / Glendale: With either Option 4 or 5, the Grand Avenue underpass would require removal of the two far side bus stops serving the southeast-bound and northwest-bound Yellow Line, and longer walks for all transfers to and from this route. Since this intersection has more Yellow Line boardings and alightings than any location in the corridor, a substantial number of riders may be affected. On the other hand, Routes 24 and 59 have a higher ridership per mile than the Yellow Line, and the underpass would facilitate transfers between them. With elimination of the six-legged intersection, it may make sense to reroute Route 24, which currently detours via Glenn Drive and 59th Avenue, so that it stays on Glendale Avenue.

67th Avenue / Northern: Separation of 67th Avenue under Option 4 and separation of Grand under Option 5 would have similar impacts on transfers between the two existing bus routes: Route 67 and the Yellow Line. In either case, bus stops on 67th Avenue or Grand would have to be removed from the intersection area, and walk distances for transfers would increase. Route 80 (Northern), which currently ends at 59th Avenue, may be extended across Grand Avenue in the future; this would create another set of transfers affected by either Option 4 or Option 5.

75th Avenue / Olive: Since the Yellow Line is the only bus route serving this intersection, transfers are not currently an issue, although they would be if Route 90 is extended and a new 75th Avenue route is initiated. If the Yellow Line is retained with Option 5, the realignment and grade separation of Grand Avenue will affect bus stop placement. Under Option 4, with Olive Avenue crossing above grade, the existing bus stops on Grand Avenue could be retained.

Overall, Option 4 would require removal or relocation of at least 10 bus stops near four intersections. Option 5 would require removal or relocation of 13 bus stops near six intersections. This difference is due to the lack of existing bus routes on two of the grade-separated roadways (51st Avenue and Olive Avenue) in Option 4.

Exhibit 7.1
Existing Local Bus Transfers Impeded by Options 4 and 5

Location	Impeded Transfers*	
	Option 4	Option 5
27 th / Thomas	27-Y; G-Y	Same as Option 4
43 rd / Camelback	43-50; 50-Y	43-Y; 50-Y
51 st / Bethany Home	None	60-Y
59 th / Glendale Avenue	24-Y**; 59-Y**	Same as Option 4
67 th / Northern Avenue	67-Y	Same as Option 4

G= Green Line, Y = Yellow Line.

*Represents change from existing condition.

**Assumes Yellow Line remains on Grand through intersection.

Sources: *Grand Avenue Corridor Study* (MAG, May 1998); and BRW, Inc., February 1999.

Exhibit 7.2 summarizes additional transfers that would be impeded upon future westward extension of Routes 80 and 90 beyond Grand Avenue, and initiation of new Routes 51 (51st Avenue) and 75 (75th Avenue). It is anticipated that this expansion of the existing bus system will occur during the next 20 years as development intensifies and funding becomes available.

By simplifying intersections, Option 4 facilitates transfers between the following pairs of (existing and potential future) bus routes: G-27, Y-43, Y-60, 24-59, Y-80, and Y-75. Option 5 does the same for the following transfers: G-27, 43-50, 51-60, 24-59, 67-80, and 75-90.

Exhibit 7.2
Future Local Bus Transfers Impeded by Options 4 and 5

Location	Impeded Transfers*	
	Option 4	Option 5
51 st / Bethany Home	51*-60; 51*-Y	51*-Y
67 th / Northern	67-80*	80*-Y
75 th / Olive	75*-90*; 90*-Y	75*-Y; 90*-Y

Y = Yellow Line.

*Potential future bus route or future extension of existing route.

Source: BRW, Inc., May 1999.

It is clear that Option 5, and to a lesser extent Option 4, would have major impacts on Yellow Line operations and ridership. The inability to transfer safely and efficiently to connecting routes (except Route 35), coupled with the lack of transit access to the land uses near intersections, makes the continuation of Grand Avenue local bus service under Option 5 problematic. There may be an opportunity to replace the Yellow Line with an all-day express route connecting Arrowhead Mall with the central business districts of Peoria, Glendale and Phoenix. (Off-peak trips could be turned back at downtown Glendale upon opening of the Phoenix-Glendale LRT line.) With Grand Avenue functioning as a limited expressway under Option 5, this could be the

ideal corridor for testing all-day express bus service in the Phoenix area. Such service operates in many other cities such as Dallas, San Diego and Seattle. Local bus riders would use the grid system of routes to reach their destinations.

If the Yellow Line is retained under Option 5, it could be detoured off the mainline at each intersection to serve the major cross streets. This would, however, reduce the route's cost-effectiveness and attractiveness to riders by increasing travel times and operating costs. Even under Option 4, the Yellow Line may be rerouted through downtown Glendale to serve a future transit center with connections to other local routes, express buses and ultimately LRT.

7.2 EXPRESS BUS SERVICE

The following peak period express bus routes are proposed for consideration under both Options 4 and 5:

1. A route from Arrowhead Mall to the Phoenix Central Business District (CBD) via SR 101L, Grand Avenue, Camelback Road and Central Avenue.
2. A route from the 59th Avenue / Bell Road area to the Phoenix CBD via 59th Avenue (with a possible short detour to a park-and-ride at the Glendale LRT terminus), Grand Avenue, 19th Avenue and Jefferson / Washington Streets.

Each of these routes would operate in mixed traffic on headways of approximately 15 minutes. In keeping with the current direction of regional express bus policy, express buses would stop (outside the CBD) only at a small number of locations with substantial park-and-ride capacity. Because of its potential to attract work trips and its possible future status as a bus / LRT transit hub, downtown Glendale is a possible exception.

It is anticipated that one or two park-and-ride facilities would be developed along the Grand Avenue portion of the route. One of the routes would serve a park-and-ride lot in downtown Peoria. Since Grand Avenue would not be grade separated in this area, no special provisions for express bus access to or from the mainline would be required.

An additional park-and-ride facility in the corridor could be located either northwest or southeast of downtown Glendale. A northwest location (e.g., near 67th and Northern Avenues) should be designed to serve as a future Glendale LRT terminus. Under Option 4, buses could enter and leave Grand Avenue at the at-grade Grand / Northern intersection. Under Option 5, buses would use the entry and exit ramps to access 67th Avenue (to and from the northwest) and Northern Avenue (to and from the southeast).

Express buses would not stop between the 43rd / Camelback area and the Phoenix CBD. Whether or not a park-and-ride is provided at 43rd / Camelback, express buses on the Arrowhead-North Central route would have to turn left from Grand to Camelback in the morning and right from Camelback to Grand in the afternoon. The 43rd / Camelback / Grand intersection can accommodate these movements under both options, although Option 4 will require inbound buses to detour around the Camelback overpass along with other left turning vehicles.

Express buses operating in mixed traffic, with no on-street stops, are not confined to a specific travel lane. Bus operators can readily change lanes to bypass hazards or vehicle queues. If local bus service remains on Grand Avenue, it may be desirable for express buses to avoid the right lane.

7.3 EXPRESS / LOCAL BUS INTERACTION

Most express bus riders in Phoenix and similar cities reach their bus by automobile. The percentage of express riders who transfer from local buses is quite small. It is nevertheless important to accommodate these riders by planning for express / local passenger interchange. In addition, an all-day express service may attract a different population that is more likely to access the service by local bus.

Transfers between express and local bus routes are most likely to occur in downtown Peoria and downtown Glendale. These locations are candidates for future transit centers where local buses may ultimately feed LRT as well as express buses. Since these transit centers will be located several blocks from Grand Avenue, express buses will need to be detoured off the mainline.

7.4 CONSIDERATION OF EXPRESS BUS HOV LANE CONCEPT

The National Cooperative Highway Research Program (NCHRP) report, *Bus Use of Highways —Planning and Design Guidelines*, recommends a minimum of 30 buses during the peak hour to justify replacing a general traffic lane with a bus-only lane. With the express bus service proposed above, plus continuation of local service at existing levels, Grand Avenue would carry 10 buses in the peak direction during the peak hour. It is clear that exclusive bus lanes are not warranted in this corridor.

The NCHRP report does not address warrants for a lane shared by buses and other high-occupancy vehicles. HOV lanes are most common and most useful on freeways. Few arterial diamond lanes have been open to carpools; exceptions include the 3-mile North Washington Street HOV lane in Alexandria, Virginia, and a 1.5-mile segment of SR 99 in Seattle, Washington. Replacing general traffic lanes with HOV lanes on Grand Avenue would raise the following problems and concerns:

- Buses and carpools do not mix as well on arterial streets as on freeways, especially if local buses are included in the traffic mix. Carpoolers may be discouraged from using the lanes by local buses making frequent stops.
- The travel time benefits to carpoolers may be negligible, especially if the curb lanes are reserved for HOVs, owing to the continued availability of these lanes to vehicles making right turns (to and from the mainline) at driveways and intersections. Particularly under Option 5, ramp merge / diverge movements at grade separations may also reduce the travel time advantage of curbside HOV lanes. Median HOV lanes present their own operational problems due to left-turning vehicles weaving across the lanes.

- Police enforcement of HOV restrictions would be complicated by the need to allow general traffic to use the lanes for right turns. This issue currently affects Central and 1st Avenues between Roosevelt and Van Buren, the only arterial streets in the Phoenix area that have restricted diamond lanes.
- Under Option 4, HOVs may be blocked by right-turning vehicles at major intersections, especially ones with substantial pedestrian activity. If right-turn lanes are provided, safety concerns may result from vehicles weaving across the HOV lane to reach the turn lane.
- Local buses in a curbside HOV lane will hinder non-stop express bus operations. Drivers may not expect to see express buses pull out of the HOV lane to pass local buses.
- If HOV lanes are underutilized compared to the general traffic lanes, they are not only perceived as wasteful and inefficient, but also create safety issues. Drivers turning right onto Grand Avenue from streets and driveways may perceive the curb lane as mostly empty and fail to watch closely enough for approaching vehicles. This concern is especially pertinent to express buses, which require longer distances for emergency stops when traveling at high speeds.
- Another safety issue arises from drivers making right turns onto the mainline, who may turn directly into the inside lanes instead of merging to the left from the curb HOV lane. On the other hand, these same merging maneuvers will impede HOV operations and complicate enforcement.
- With so few buses using the HOV lanes, any kind of bus-oriented signal priority treatments (active or passive) would not be justifiable. Under Option 4 especially, express buses would experience the same delays as non-HOVs at signalized intersections.

In conclusion, Grand Avenue does not appear to be a suitable corridor for HOV lanes under either Option 4 (improved arterial) or Option 5 (limited expressway). Apart from the many other operational and safety issues, the minimal travel time advantages offered by HOV facilities in this corridor will make them insufficiently attractive to constitute a cost-effective alternative to general traffic lanes. This is particularly true in light of right-of-way constraints that preclude widening Grand Avenue beyond the current four to six lanes.

7.5 BICYCLE AND PEDESTRIAN IMPACTS

Exhibits 7.3 and 7.4 show the expected impacts of Options 4 and 5 on existing and planned non-motorized routes in the Grand Avenue Corridor. The two options differ in their impacts on the proposed 51st Avenue, 67th Avenue, and Grand Avenue bikeways. Both options have similar impacts on the other listed facilities.

Exhibit 7.3
Potential Impacts of Option 4 on Non-Motorized Facilities

Facility	Impact
51 st Avenue bike route (planned)	No at-grade intersection or connection with Grand or Bethany Home. Overpass, which would accommodate bike lanes, removes signal.
Maryland Avenue bike lanes	No at-grade intersection or connection with Grand or 55 th Avenue Overpass, which would accommodate bike lanes, removes signal.
55 th Avenue bike lanes (planned)	No direct access to Grand or crossing of Grand.
Glendale / 59 th Avenue bike route / lanes (planned)	No at-grade intersection or connection with Grand, but easier access across corridor.
61 st Avenue undesignated facility	Removal of 61 st / Myrtle signal eliminates access across Grand.
63 rd Avenue bike lanes (planned)	New signalized access across Grand and railroad (via Orangewood).
Orangewood Avenue bike lanes (planned)	New signalized access across Grand and railroad.
67 th Avenue bikeway (planned)	No at-grade intersection or connection with Grand or Northern. Overpass, which would accommodate bike lanes, removes signal.
Grand Avenue bikeway	No at-grade intersection or connection with the following cross streets: 27 th Avenue, Thomas Road, Camelback Road, 51 st Avenue, Maryland Avenue, 59 th Avenue, Glendale Avenue, 67 th Avenue and Olive Avenue. Grade separations at 27 th , Maryland, and 59 th remove signals.

Sources: *Grand Avenue Corridor Study* (MAG, May 1998); URS Greiner and BRW, Inc., February 1999.

Exhibit 7.4
Potential Impacts of Option 5 on Non-Motorized Facilities

Facility	Impact
51 st Avenue bike route (planned)	No at-grade intersection or connection with Grand, but Grand overpass simplifies intersection.
Maryland Avenue bike lanes	No at-grade intersection or connection with Grand or 55 th Avenue Overpass, which would accommodate bike lanes, removes signal.
55 th Avenue bike lanes (planned)	No direct access to Grand or crossing of Grand.
Glendale / 59 th Avenue bike route / lanes (planned)	No at-grade intersection or connection with Grand, but easier access across corridor.
61 st Avenue undesignated facility	Removal of 61 st / Myrtle signal eliminates access across Grand.
63 rd Avenue bike lanes (planned)	New signalized access across Grand and railroad (via Orangewood).
Orangewood Avenue bike lanes (planned)	New signalized access across Grand and railroad.
67 th Avenue bikeway (planned)	No at-grade intersection or connection with Grand, but Grand overpass simplifies intersection.
Grand Avenue bikeway	No at-grade intersection or connection with the following cross streets: 27 th Avenue, Thomas Road, 43 rd Avenue, Camelback Road, 51 st Avenue, Bethany Home Road, Maryland Avenue, 59 th Avenue, Glendale Avenue, 67 th Avenue, Northern Avenue, 75 th Avenue and Olive Avenue. Grade separations remove signals at 27 th , 43 rd , 51 st , Maryland, 59 th , 67 th , and 75 th .

Sources: *Grand Avenue Corridor Study* (MAG, May 1998); URS Greiner and BRW, Inc., February 1999.

7.6 PROPOSED GRAND AVENUE BIKEWAY

The 1999 MAG Regional Bicycle Plan designates all of Grand Avenue, from Van Buren Street to SR 74, as part of the future regional bikeway system. The type of facility is not specified. The following facility types could be considered for Grand Avenue within the study corridor:

Wide Curb Lanes – Wide Curb Lanes are the simplest and least obtrusive type of bicycle-related street improvement. On roads without bike lanes, a right lane wider than 12 feet can better accommodate bicycles and motor vehicles in the same lane, and thus is beneficial to all users. With a wide curb lane, motorists often do not need to change lanes to pass a cyclist. Also, more maneuvering room is available when drivers are exiting from driveways or in areas with limited sight distance. A width of 15 feet of usable pavement is generally desired. Greater widths can encourage the undesirable operation of two motor vehicles in the same lane and should include edge stripes to separate bicycles from motor vehicles. Wide curb lanes must be provided on both sides of the street to accommodate the two directions of travel.

Edge Line Buffer Zones – Edge Line Buffer Zones use a white stripe on the outside of the curb lanes, which provides a space wide enough for bicycles to safely use without specific markings for bicyclists.

Bike Lanes – Bike Lanes are the most visible type of on-street facility. Like wide curb lanes and edge stripe zones, they must be provided on both sides of the road. Bike lane striping and signing can increase cyclists' confidence that motorists will not stray into their path of travel. They also enhance the visibility of cycling as an alternate mode of transportation. Raised pavement markings and barriers present a hazard to bicyclists and should not be used to delineate bike lanes; the use of paint or thermoplastic markings for delineation is preferred. Since Grand Avenue does not and will not have on-street parking, conflicts between cyclists and parked vehicles are not an issue.

The minimum desirable bike lane width is 4 feet. Certain edge conditions require additional width, however. Bike lanes tend to complicate both bicycle and motor vehicle turning movements, especially right turns, at intersections. Option 5 has fewer intersection crossings than Option 4 but does include ramp merges / diverges, which could be problematic for cyclists.

Bike Paths – Bike Paths are facilities on exclusive rights-of-way with minimal cross flow by motor vehicles. They should be viewed as extensions of the highway system for the exclusive or preferential use of bicycles, in much the same way that freeways serve motor vehicles. According to the *Arizona Bicycle Facilities Planning & Design Guidelines*, bike paths should not be considered a substitute for the street, because many cyclists will find them less convenient than the street, especially for commute and other non-recreational trips. Problems with bike paths located immediately adjacent to roadways include the following:

- Unless paired, they require one direction of bicycle traffic to ride against auto traffic, contrary to normal rules of the road.
- When the bike path ends, cyclists going against traffic will tend to continue traveling on the wrong side of the street. Likewise, bicyclists approaching a bike path often travel on the wrong side of the street in getting to the path. Wrong way travel is a major cause of bicycle / auto accidents and should be discouraged.
- At intersections, motorists entering or crossing the road may not notice bicyclists coming from their right, as they are not expecting contra-flow vehicles. Even cyclists from the left may go unnoticed, especially when sight distances are poor.
- When constructed in narrow roadway right-of-way, the shoulder is often sacrificed, thereby reducing safety for motorists and cyclists using the roadway.
- Many bicyclists will use the highway instead of the bike path because they have found the highway to be safer, more convenient or better maintained. Bicyclists using the highway are sometimes harassed by motorists who feel that all bicyclists should be on the path.

- Bicyclists using the path generally are required to stop or yield at all cross streets and driveways, while cyclists using the highway usually have priority over cross traffic.
- Stopped cross street motor vehicles or vehicles exiting side streets or driveways may block the path crossing.
- Because of the proximity of motor vehicles to opposing bicycle traffic, barriers are often necessary to keep motor vehicles out of bike paths and bicyclists out of traffic lanes. These barriers can be a hazard to cyclists and motorists, complicate maintenance of the facility and cause other problems.
- As a new type of facility within the right-of-way, bike paths create new liability that highway agencies may be reluctant to accept.
- Particularly where the adjacent roadway lacks sidewalks, shared use of the path by bicycles and pedestrians will cause additional safety and liability concerns.

The paved width and the operating width required for a bike path are primary design considerations. Under most conditions, the desirable minimum width for a two-directional bike path is 10 feet. In some instances, 8 feet may be adequate where (a) bicycle traffic is expected to be low, even during peak days / hours, (b) pedestrian use of the facility is not expected to be more than occasional, (c) there will be good horizontal and vertical alignment, providing safe and frequent passing opportunities, and (d) the path will not be subject to maintenance vehicle loading that would cause pavement edge damage.

Under both Options 4 and 5, the need to cross ramps with merging and diverging auto traffic adds to the difficulty of including a bike path in the corridor, unless the path is located on the railroad side of the roadway. Delays caused by yielding to vehicular traffic would tend to defeat the function of the path as a “freeway for bicycles.”

Because of the high traffic volumes, high vehicular speeds and percentage of large vehicles (trucks, buses and recreational vehicles), either a 30-foot separation or a barrier should be provided between the outside edge of the curb lane and the inside edge of the bike path. Insufficient space is available to build two one-way bike paths or a single two-way bike path with a safe clear zone within the existing right-of-way. With additional right-of-way, however, a bike path could be constructed between the roadway and the railroad tracks. In some areas, this might be achieved by obtaining an easement from the railroad. In other locations, where less separation exists between Grand Avenue and the tracks, the roadway could be shifted northeast to accommodate a bike path on the southwest side.

A bike path on the railroad side of Grand Avenue would be advantageous in several respects:

- Minimal conflicts between bicycles and motorized traffic, except at signalized intersections.
- Opportunities to integrate landscaping and other amenities, improving the aesthetics of the corridor.
- Availability of an alternative to bicycle operation in mixed street traffic (a particular concern with Option 5).
- A direct route connecting the Grand Canal multi-use paths to downtown Glendale, and ultimately to the planned multi-use path along the New River.

Development of a bike path between Grand Avenue and the tracks would, however, occur under several constraints:

- There is insufficient right-of-way for a bike path through the 59th/ Glendale intersection. Bicycles could leave the Grand Avenue alignment at 57th Avenue (which will be signalized under Options 4 and 5) and travel through downtown Glendale on side streets designated as bike routes. Ample bike parking, along with water fountains and rest rooms, would be available in the Murphy Park area. One possible route would include 57th Avenue, Lamar Road and 58th Avenue to Orangewood Avenue, where bike lanes are planned by the City of Glendale. Cyclists could then use these bike lanes to rejoin the corridor at Orangewood, where Options 4 and 5 would add a signalized intersection.
- Under either roadway option, the path would cross the 65th Avenue railroad spur at grade.
- If extended southeast from the Grand Canal to Thomas Road, the path would also have to cross the railroad spur west of 27th Avenue at grade.

7.7 LRT ALIGNMENT OPTIONS, DOWNTOWN GLENDALE TO DOWNTOWN PEORIA

As discussed in Chapter 3, an MIS has recommended future construction of an LRT line from Chris-Town Mall to downtown Glendale via 19th and Glendale Avenues. While the MIS does not specify potential termini or routings in downtown Glendale, it suggests that the LRT line may need to be extended north or northwest to end at a park-and-ride facility. (Alternatively, parking could be provided at a non-terminal station, such as 51st Avenue.) The line might also be extended northwest to downtown Peoria at some future date.

The following paragraphs delineate alternatives for extending a future LRT line from downtown Glendale to a park-and-ride lot, and ultimately to downtown Peoria. Evaluation and selection of a preferred alternative will require detailed planning and engineering studies. In this analysis, it is assumed that the nearest and most convenient location for a park-and-ride is the triangular parcel bounded by the BNSF 65th Avenue Spur, Grand Avenue and Northern Avenue (and located just northwest of the planned detention basin bounded by the Spur and 63rd, Grand and Northern

Avenues). This site is close enough to downtown Glendale to minimize additional operating costs, enables LRT to serve an additional station near an arterial street, and is on the more convenient side of the BNSF tracks from the viewpoint of both LRT operations and most of the potential ridership base. Although the parcel is currently developed, it would in any case be substantially disturbed by roadway construction under Option 5.

LRT can operate either within the street or off-street in an exclusive right-of-way. In order to allow safe and efficient high-speed train operations, vehicle turns across the tracks would be permitted only at protected (i.e., signalized) locations. As in the *Grand Avenue Corridor Study*, it is assumed that the two tracks would be adjacent rather than separated, in order to simplify traffic operations and minimize right-of-way needs. Therefore, an on-street LRT alignment in the Grand Avenue Corridor would be located in a reserved median separating the two vehicular traffic directions. The greatest advantage of a median alignment is that it maintains unrestricted right-turn access to and from intersecting streets and driveways.

Exhibit 7.5 lists typical horizontal and vertical dimensions of two-track LRT alignments. The minimum right-of-way ranges from 22 to 30 feet except at stations, where additional width is required for the boarding platforms. Minimum vertical clearance is 14 feet, although higher clearances are desirable in most areas.

Exhibit 7.5 does not address minimum clearance for a LRT grade separation over the railroad. According to the BNSF, the Arizona Corporation Commission requires vertical clearance of at least 27 feet for such crossings.

Exhibit 7.5 **Typical Dimensions of LRT Lines**

Characteristic	Linear Extent (Feet)	
	On-Street (Median)	In Exclusive R/W (Off-Street)
Vehicle Width	9.5	9.5
Lane Envelope Clearance	11.0	12.5
Emergency Walkway Width	None	2.5
Border Barriers or Fencing (each)	None	1.0
Overall Minimum Right-of-Way	22.0	30.0
Station—Side Platform Width (each)	6.0	12.0
Platform Length	400	400
Minimum Vertical Clearance	14.0	14.0
Minimum Horizontal Curve Radius	200	200

Source: Institute of Transportation Engineers, *Transportation Planning Handbook*, 1992.

7.7.1 LRT Alignment Alternatives Under Option 4

Under Option 4, Grand Avenue remains at grade between the downtown Glendale underpass and downtown Peoria. Exhibit 7.6 shows the generalized LRT alignment under Option 4. The following alternatives are available for a Grand Avenue LRT alignment:

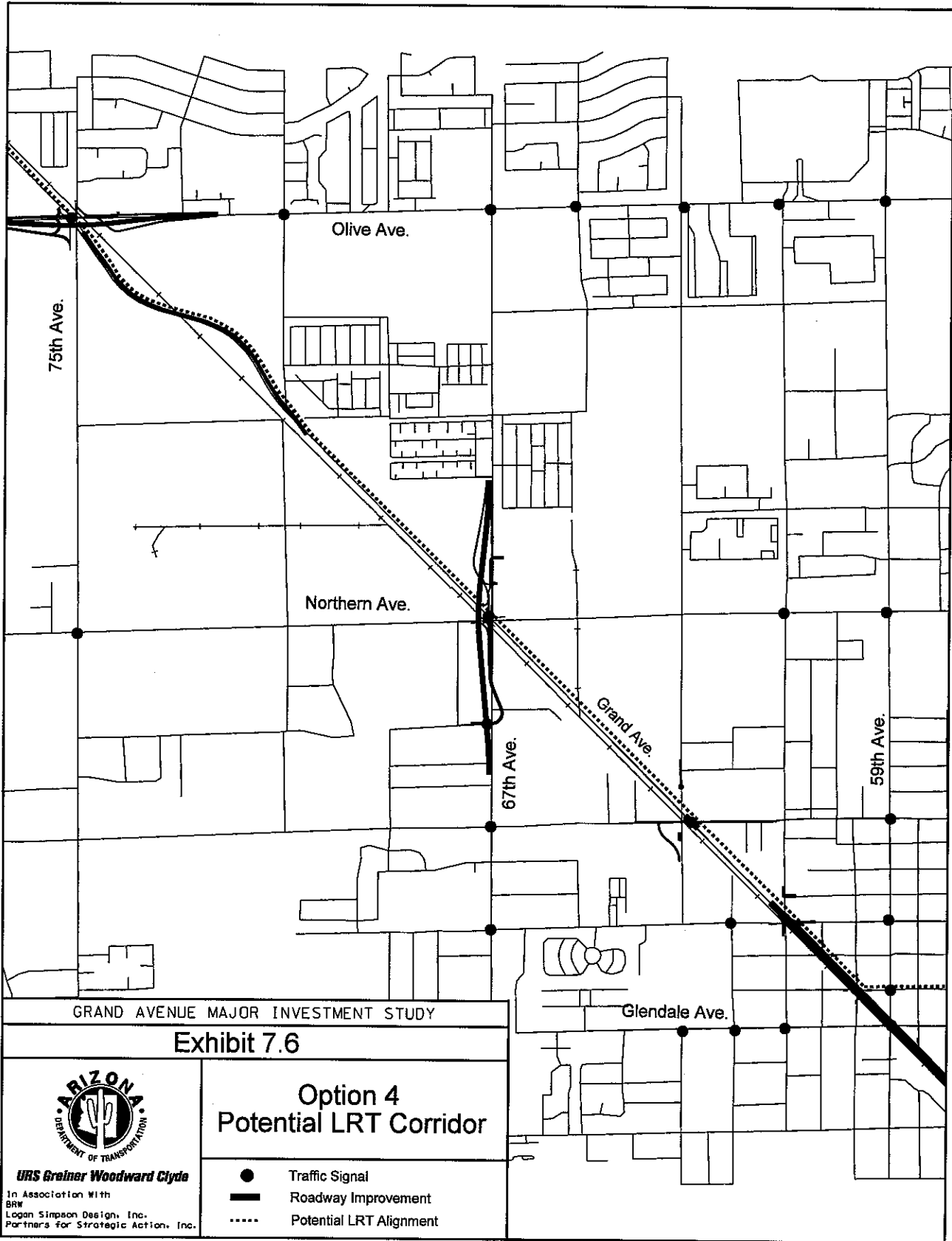
- A. On-street median alignment with no additional right-of-way taken (except at intersections)**
- B. On-street median alignment with additional right-of-way taken**
- C. Off-street alignment (requires taking of additional right-of-way)**

Alternative A requires the removal of two existing traffic lanes, reducing most of this portion of Grand Avenue from six lanes to four (see Exhibit 7.7). Some right-of-way would still have to be acquired at stations (e.g., at Northern and Olive Avenues). Moreover, all left turns across the tracks would be prohibited except at signalized intersections with a protected turn phase tied to the LRT signal system. Right-of-way acquisition would also be required to accommodate these turn lanes.

Alternative B is similar to A (see Exhibit 7.7), except that additional right-of-way would be taken to preserve the vehicular capacity of the roadway.

Alternative C also maintains existing roadway capacity but places the LRT tracks in a reserved right-of-way to one side of Grand Avenue. Between downtown Glendale and the existing 71st Avenue crossover, this alternative requires either (i) acquisition of right-of-way for an LRT alignment on the northeast side of the roadway (see Exhibit 7.8), or (ii) placement of the LRT tracks on the southwest (railroad) side, with the roadway shifted northeast into newly acquired right-of-way (see Exhibit 7.8). Between 71st Avenue and downtown Peoria, the LRT tracks would use an easement between Grand Avenue and the BNSF tracks, as stated in the *Grand Avenue Corridor Study*. Under any of the alternatives, Valley Metro would be responsible for acquiring needed right-of-way at a future date, after ADOT implements Option 4.

Exhibit 7.9 summarizes the major advantages and disadvantages of LRT alignment Alternatives A, B and C for Option 4. An on-street median alignment (Alternatives A and B) has several serious disadvantages; its greatest advantage over an off-street alignment is the retention of unrestricted right turns on both sides of the roadway. If the off-street alternative (C) is chosen, a northeast alignment has several advantages over an alignment on the southwest (railroad) side, including better passenger access, no LRT crossing of Grand Avenue in central Glendale, and minimal inconvenience to traffic during construction. However, future planning of an LRT line in the corridor would require a separate Major Investment Study to establish the preferred alternative.



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 7.6

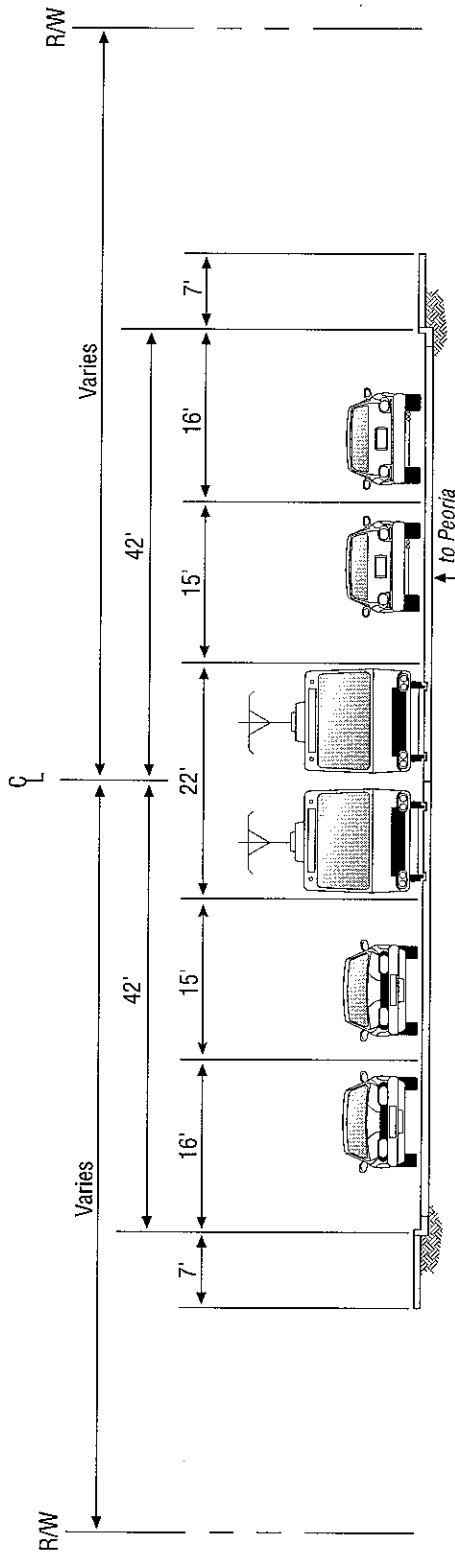


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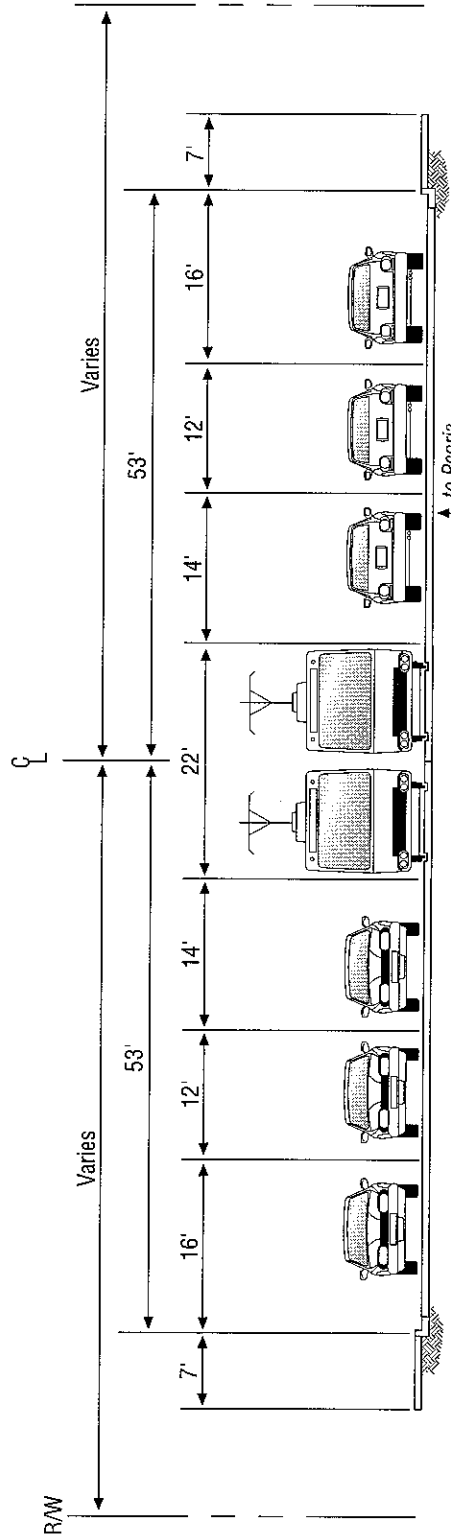
**Option 4
Potential LRT Corridor**

- Traffic Signal
- Roadway Improvement
- Potential LRT Alignment



Alternative A

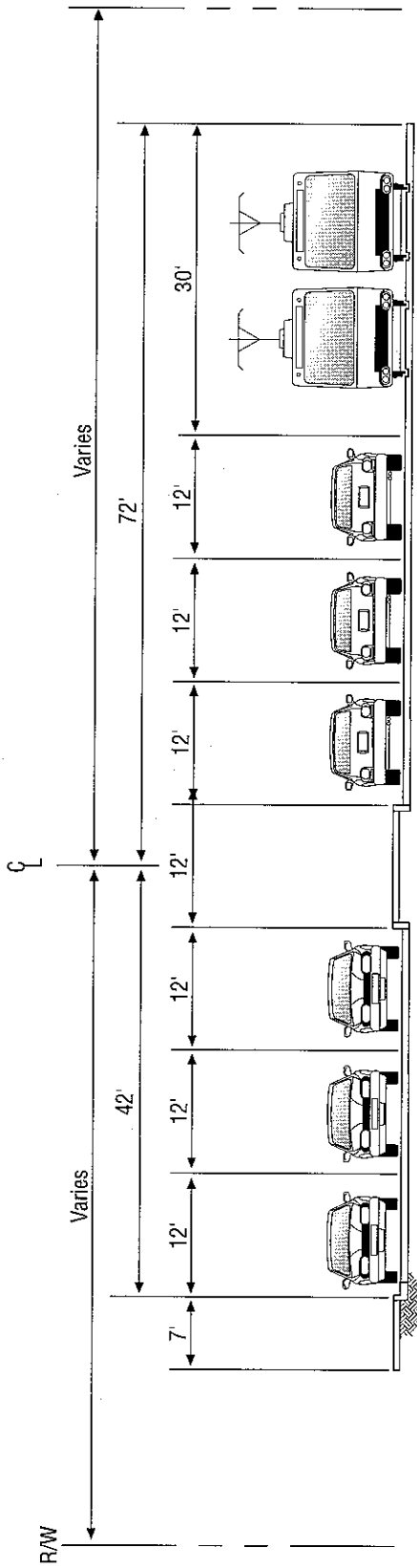
On-street median alignment – no additional right-of-way



Alternative B

On-street median alignment with additional right-of-way

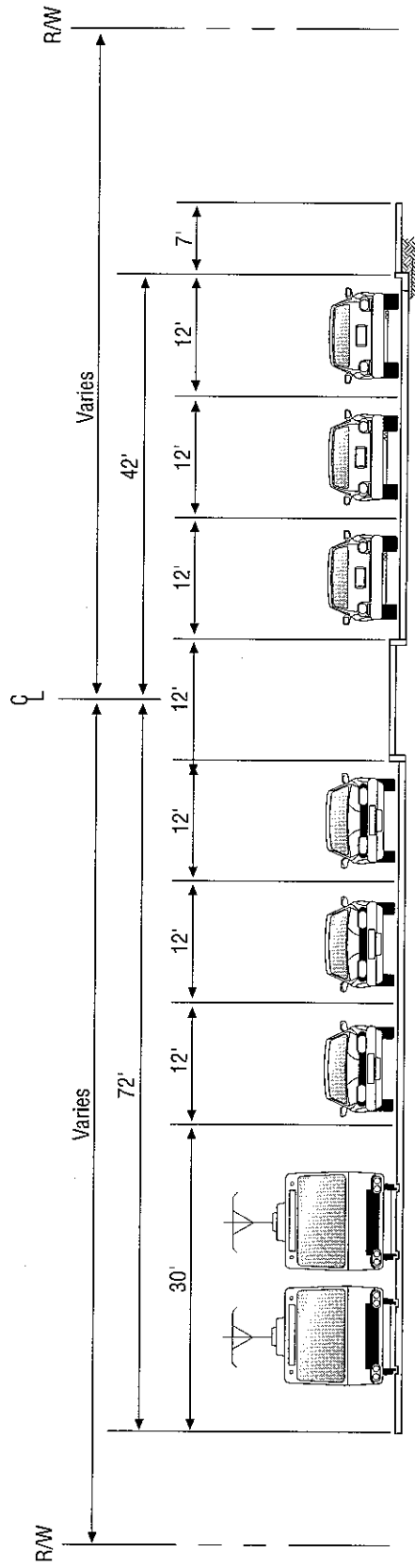
GRAND AVENUE MAJOR INVESTMENT STUDY	
Exhibit 7.7	
<p>Option 4 Alternative Cross-Sections with LRT</p>	
<p>URS Greiner Woodward Clyde in Association with: Logan Simpson Design, Inc. Partners for Strategic Action, Inc.</p>	



↑ to Peoria

Alternative C (i)

LRT off-street on northeast side



↑ to Peoria

Alternative C (ii)

LRT off-street on southwest side

GRAND AVENUE MAJOR INVESTMENT STUDY	
Exhibit 7.8	
<p>Option 4 Alternative Cross-Sections with LRT</p>	
<p>URS Greiner Woodward Clyde in Association with: BHW Simpson Design, Inc. Partners for Strategic Action, Inc.</p>	

Exhibit 7.9
LRT Alignment Alternatives Evaluation (Option 4)

Alternative	Advantages	Disadvantages
<p style="text-align: center;">A</p> <p>LRT in median— widen R/W at intersections</p>	<ul style="list-style-type: none"> • Minimal R/W requirements • Unrestricted right turn access to and from Grand 	<ul style="list-style-type: none"> • Reduced vehicular capacity on Grand • Requires stations in roadway median • No left turns at unprotected locations • Not well placed for proposed park-and-ride location • Tracks must cross northwest-bound lanes in downtown Glendale to reach median • Problematic crossing of BNSF 65th Avenue spur (no grade separation)
<p style="text-align: center;">B</p> <p>LRT in median— widen R/W throughout</p>	<ul style="list-style-type: none"> • No reduction in vehicular capacity • Unrestricted right turn access 	<ul style="list-style-type: none"> • Requires new R/W along entire segment • Requires stations in roadway median • No left turns at unprotected locations • Not well placed for proposed park-and-ride location • Tracks must cross northwest-bound lanes in downtown Glendale to reach median • Problematic crossing of 65th Avenue spur (no grade separation)
<p style="text-align: center;">C (i)</p> <p>LRT off-street on northeast side— new R/W</p>	<ul style="list-style-type: none"> • No reduction in vehicular capacity • Allows U-turns at unsignalized median breaks • Keeps LRT stations off street • Most convenient to park-and-ride • Tracks do not cross Grand • Unrestricted access to/from Grand on southwest side of roadway (northwest of Olive) • Allows separate structure to carry LRT tracks over 65th Avenue spur 	<ul style="list-style-type: none"> • Requires new R/W along entire segment • Cuts off access to properties / side streets on northeast side of Grand • Inconvenient access for riders on southwest side of Grand • Requires LRT crossing of railroad mainline via new structure (or existing underpass if feasible)
<p style="text-align: center;">C (ii)</p> <p>LRT off-street on southwest side— Grand Avenue moved to northeast</p>	<ul style="list-style-type: none"> • No reduction in vehicular capacity • Does not affect access on northeast side of roadway (southeast of 71st Avenue) • Provides “free crossing” of Grand at 71st • Allows separate structure to carry LRT tracks over 65th Avenue spur • Keeps LRT stations off street • Allows U-turns at unsignalized median breaks 	<ul style="list-style-type: none"> • Requires new R/W along entire segment • Requires tracks to cross Grand Avenue in downtown Glendale • Inconvenient access for riders on northeast side of Grand • Poor passenger access to park-and-ride • Location adjacent to railroad restricts station sizing and placement • Roadway alignment shift maximizes traffic disruption and raises costs during construction

Source: BRW, Inc., May 1999.

7.7.2 LRT Alignment Alternatives Under Option 5

From the standpoint of LRT planning, one advantage of Option 5 is its acquisition of new right-of-way for grade separations. Some of the additional right-of-way could accommodate LRT. Even under Option 5, however, no new right-of-way will be acquired along two segments (one southeast of Orangewood Avenue, and the other between Northern and Olive) of the existing at-grade roadway. Valley Metro would have to obtain much of the necessary right-of-way for LRT at a later date.

Option 5 imposes the following constraints on an LRT alignment in the Grand Avenue Corridor:

- Grand Avenue uses overpasses to fly over the 67th / Northern and 75th / Olive intersections, and it would be difficult to add LRT tracks to these structures later if space is not built in at the outset. An off-street alignment is more compatible with the function of Grand as an expressway type facility.
- Ramps providing access to and from Grand Avenue would be located on both sides of the 67th / Northern intersection. LRT trains cannot cross either these ramps or the 65th Avenue spur safely at grade.
- Because of the proximity of these ramps, LRT cannot cross the 67th / Northern intersection at grade. The LRT tracks would use either a grade separated structure or a route that bypasses the intersection. In the former case, an elevated station could be built next to the proposed park-and-ride lot. In the latter case, LRT could cross Northern at grade near the BNSF spur, rejoining the Grand Avenue right-of-way to the northwest of the Northern Avenue ramps. Alternatively, the tracks could follow Northern Avenue under the Grand Avenue overpass, rejoining Grand on the southwest side between the roadway and the railroad.
- As in Option 4, the LRT tracks (if on the northeast side of Grand) would elevate to achieve a grade separated crossing of the railroad near 71st Avenue. The tracks could then descend to grade, crossing the 75th / Olive intersection diagonally during a special signal phase. An at-grade station, either with or without parking depending on land availability, could be located northwest of the intersection.

These constraints have resulted in the three alignment alternatives described in Exhibit 7.10 and illustrated in Exhibit 7.11. Alternative A parallels Grand Avenue (on the northeast side) from downtown Glendale to downtown Peoria, while Alternatives B and C entail detours to enable the LRT tracks to remain at grade across Northern and 67th Avenues. Although Alternative A contains by far the longest grade separated segment, the other alternatives require one or more short grade separations, either to cross the BNSF mainline (Alternatives B and C) or to cross the 65th Avenue spur (Alternative C). In contrast, Alternative A follows the most direct route and would provide the fastest service, with its grade separated crossing of Northern and 67th Avenues. The choice between Alternative A and the other two alignments is partially a tradeoff between construction cost and right-of-way needs. Exhibit 7.12 provides a comparative evaluation of the three alternatives.

Exhibit 7.10
LRT Alignment Alternatives Description (Option 5)

Alternative	Description
A	<p>Downtown Glendale to Downtown Peoria via Grand Avenue</p> <ul style="list-style-type: none"> • Follows northeast side of Grand Avenue from Glenn Drive to 83rd Avenue • At grade from Glenn to Orangewood • Elevated over 65th Avenue spur and ramps; also over Northern and 67th Avenues • Elevated station southeast of 67th / Northern with direct park-and-ride access • Remains elevated northwest of Northern, over ramps and BNSF mainline • Descends to grade through 75th / Olive intersection • Remains at grade between roadway and railroad to Downtown Peoria
B	<p>Downtown Glendale to Downtown Peoria with northeast detour</p> <ul style="list-style-type: none"> • At grade except for railroad overpass near 71st / Butler • Follows northeast side of Grand from Glenn to Orangewood • Detours along east side of ramp and railroad spur from Grand / Orangewood to 65th / Northern • At grade station on south side of Northern Avenue east of spur (near park-and-ride) • Crosses Northern at signalized intersection during special LRT phase • Returns to Grand Avenue corridor via new R/W on 65th Avenue and Royal Palm alignments (signal required to cross 67th Avenue near Royal Palm) • Same as (A) from Grand Avenue railroad overpass to Downtown Peoria
C	<p>Downtown Glendale to Downtown Peoria with diversion to southwest side of Grand</p> <ul style="list-style-type: none"> • At grade except for crossing of railroad mainline and spur • Follows northeast side of Grand from Glenn to Orangewood • Crosses spur and ramp to Northern Avenue via underpass or overpass • Returns to grade and runs along west side of spur to Northern Avenue • At grade station on south side of Northern Avenue (near park and ride) • Follows north or south side of Northern Avenue under overpass at 67th Avenue intersection • Runs between Grand Avenue and BNSF tracks northwest of 67th / Northern • Crosses BNSF mainline near 71st Avenue • Same as (A) from 71st Avenue to Downtown Peoria



GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 7.11



URS Greiner Woodward Clyde

In Association With
Bill Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

Option 5
LRT Alignment Alternatives

● Traffic Signal — Roadway Improvement

LRT Alignments

- Alternative A (base)
- Alternative B (detour)
- Alternative C (detour)
- - - Grade Separated Sections

Exhibit 7.12
LRT Alignment Alternatives Evaluation (Option 5)

Alternative	Advantages	Disadvantages
A	<ul style="list-style-type: none"> • Requires minimal additional R/W • Fastest LRT service (most direct route, fewest intersection delays) • Direct access to park-and-ride • Avoids special LRT phases at intersections (except 75th / Olive) • Elevated portion facilitates access across LRT tracks 	<ul style="list-style-type: none"> • Costly to build due to long elevated portion between Orangewood and Olive • Additional elevated structure for LRT may be visually obtrusive
B	<ul style="list-style-type: none"> • Low construction cost per mile (two short grade separations) • May promote redevelopment along Northern Avenue 	<ul style="list-style-type: none"> • Most circuitous routing • Multiple at-grade crossings of major streets • Riders must cross 65th Avenue spur to reach park-and-ride • Remoteness of Northern Avenue station from 67th Avenue intersection • Extensive new R/W required
C	<ul style="list-style-type: none"> • Low construction cost per mile (two short grade separations) • Preserves street / driveway access on northeast side of Grand between Northern and Olive 	<ul style="list-style-type: none"> • Somewhat circuitous routing • Multiple grade crossings of major streets • Substantial R/W needs along Grand and Northern • R/W constraints on southwest (railroad) side of Grand northwest of Northern may make this portion problematic • Short grade separation over / under 65th Avenue spur may be geometrically difficult

Source: BRW, Inc., May 1999.

This cursory analysis is not intended to imply that no other alternatives are feasible. The Grand Avenue Corridor may not be the best choice for a continuation of LRT beyond downtown Glendale, especially if Arrowhead Mall rather than downtown Peoria is deemed the key Northwest Valley destination. Even if the decision is made to extend LRT to downtown Peoria, routes other than Grand Avenue may be considered. For example, a route that leaves the corridor at Northern and enters Peoria via 83rd Avenue may provide better access to the traditional downtown area southwest of Grand.

Chapter 8.0

EVALUATION OF OPTIONS

8.0 SUMMARY

Two roadway options with their associated multi-modal elements were defined in Chapters 6 and 7. This chapter presents the comparative evaluation of the two options. The evaluation draws heavily from data and information presented in Chapters 3 through 5.

The structure and framework for the evaluation as well as the results of the evaluation are presented in this chapter. The evaluation was divided into three categories of criteria — service, impacts, and implementation. For each category, specific criteria are defined and measures for each criterion are identified and utilized. The evaluation is presented for each measure and at the end of each section a summary of the evaluation for that category is presented.

The criteria used in the evaluation are not intended to be equal in importance; instead, they are intended to identify the differences between the two options. No attempt has been made to add up scores for the several criteria to arrive at a bottom line score. 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 and advantages and disadvantages of the two options are summarized in the following three exhibits. To assist the reader, for each criterion, the two options are rated using a box symbol. A full box means the option satisfied this criterion to a high degree. An empty box means the option did not satisfy the criterion.



Service Evaluation Summary

As shown in Exhibit 8.1, Option 5 meets the service criteria better than Option 4 with the primary exception of providing grade separations with the railroad. Option 4 provides four more grade separations with the railroad than Option 5. Both options eliminate the major six-legged intersections, however Option 4 leaves more complex intersections than Option 5. Option 5 improves regional mobility better than Option 4 by providing shorter travel times, more access control, and fewer traffic signals on Grand Avenue. Both options accommodate future traffic demand with equal levels of congestion and delay; however, Option 5 serves more traffic on Grand Avenue and provides more traffic with unimpeded movement through the intersections than Option 4. Option 5 promotes non-motorized travel better than Option 4. Option 5 also offers slightly more redevelopment opportunities. To improve aesthetics, Option 5 eliminates more unattractive land uses and provides more opportunities for landscaping than Option 4.

Exhibit 8.1 Service Evaluation Summary

Criteria	Option 4	Option 5	Measures	Option 4	Option 5
Eliminate Six-Legged Intersections	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Change in intersection complexity	1 – six-legged signalized 1 – five-legged signalized 3 – four-legged 45° signalized 2 – four legged 90° signalized 1 – four legged unsignalized 1 – intersection removed	2 – five-legged signalized 5 – four legged 90° signalized 1 – four legged unsignalized 1 – intersection removed
			Change in number of traffic signals	11 signals added 3 signals removed	13 signals added 2 signals removed
Reduce Railroad Crossings	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Number of new grade separated railroad crossings	5 grade separations	1 grade separation
Improve Regional Mobility and Promote Statewide Function	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Number of signals on Grand	16 signals	12 signals
			Travel time on Grand	20.5 minutes	16.2 minutes
			Access control on Grand	63 % access controlled 25 intersecting collector or local streets	74 % access controlled 24 intersecting collector or local streets
Promote Development and Redevelopment Opportunities	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Street frontage gains and losses	23,050 LF of net frontage lost	30,525 LF of net frontage lost
			Quantity of redevelopable property acquired	47.3 net acres of potentially developable property acquired	56.4 net acres of potentially developable property acquired
			Accessibility to developable or redevelopable land	Direct access to potential developable sites at five intersection segments would be eliminated	Direct access to potential developable sites at three intersection segments would be eliminated
Improve Aesthetics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Amount of unattractive land uses removed	Eliminates fewer unattractive land uses than Option 5	Eliminates more unattractive land uses than Option 4
			Amount of land available for landscaping	Provides fewer landscaping opportunities than Option 4	Provides more landscaping opportunities than Option 4
Promote Multi-modal Use	<input type="checkbox"/>	<input type="checkbox"/>	Promotion of local bus travel	Impedes 12 transfers Facilitates 5 transfers	Impedes 12 transfers Facilitates 5 transfers
			Promotion of express bus travel	More signals on Grand impeding travel than Option 5	Fewer signals on Grand impeding travel than Option 4
			Promotion of non-motorized travel	Option 4 serves bike routes better than Option 5 at 2 locations	Option 4 serves bike routes better than Option 5 at 2 locations
			Compatibility with proposed LRT alignment (Glendale to Peoria)	Less compatible with LRT than Option 5	More compatible with LRT than Option 4
Accommodate Future Traffic Demand	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Intersection level of congestion	23 intersections with light congestion 24 with medium congestion 26 with heavy congestion	27 intersections with light congestion 24 with medium congestion 24 with heavy congestion
			Intersection total delay	5,039 hours during p.m. peak hour	4,931 hours during p.m. peak hour
			Safety	Reduced volume and conflict points at intersections should reduce accidents	Reduced volume and conflict points at intersections, outside shoulders and median barrier should reduce accidents
			2020 Traffic unimpeded through intersections (on grade separations)	286,900 vehicles daily	376,700 vehicles daily
			2020 Traffic served by Grand	41,900 vehicles per segment	50,900 vehicles per segment

Impacts Evaluation Summary

Both options have significant impacts on the land uses within the corridor (see Exhibit 8.2). Option 4 impacts the most businesses and neighborhoods while Option 5 impacts the most residences. Option 5 requires more right-of-way acquisition than Option 4. There is relatively little difference between the two options in terms of environmental considerations. Both options have approximately the same number of sites potentially affected by hazardous materials, 100-year floodplain, and cultural resources.

Exhibit 8.2 Impacts Evaluation Summary

<i>Criteria</i>	<i>Option 4</i>	<i>Option 5</i>	<i>Measures</i>	<i>Option 4</i>	<i>Option 5</i>
Residences Taken or Impacted	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Number of residential units taken	144 Residential units will be acquired by ADOT	180 Residential units will be acquired by ADOT
Businesses Taken or Impacted	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Number of businesses taken	76 Businesses will be acquired by ADOT	58 Businesses will be acquired by ADOT
Neighborhoods Impacted	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Environmental Impacts of overpass on Neighborhood Residential Areas	Total Length of Overpass is 22,500 LF The Overpasses would pass within 200 LF of three (3) neighborhoods	Total Length of Overpass is 31,350 LF The Overpasses would pass within 200 LF of four (4) neighborhoods
			Number of Community Services Taken	16 community services will be acquired	7 community services will be acquired
			Accessibility impacts	Travel (ease of accessibility) will be impacted at five intersections	Travel (ease of accessibility) will be impacted at two intersections
			Increased traffic volumes	Traffic would increase in four residential areas	Traffic will increase in three residential areas
Hazardous Materials	<input type="checkbox"/>	<input type="checkbox"/>	Number of sites potentially impacted	15 sites potentially impacted	13 sites potentially impacted
Cultural Resources	<input type="checkbox"/>	<input type="checkbox"/>	Number of sites potentially impacted	11 sites potentially impacted	12 sites potentially impacted
100-Year Floodplain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Number of sites potentially impacted	4 sites within 100-year floodplain	5 sites within 100-year floodplain
Acreage of New Right-of-Way Needed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Acreage needed for right-of-way	128 acres of new right-of-way needed	202 acres of new right-of-way needed



Worst

Best

Implementation Evaluation Summary

Option 4 costs \$56 million less than Option 5 but has more major utility conflicts and access issues that could increase costs and delay the projects than Option 5. Option 4 provides eight complete independent projects while Option 5 will require additional funds for the completion of the portions of Grand between the eight projects. Option 5 is easier to upgrade to a full expressway.

Exhibit 8.3 Implementation Evaluation Summary

Criteria	Option 4	Option 5	Measures	Option 4	Option 5
Cost of Construction and Right-of-Way	■	▣	1999 cost estimate	\$168.2 million	\$224.5 million
Engineering Issues and Uncertainties	▣	■	Major utility conflicts	Has more utility conflicts than Option 5 especially with the 230 kV line and the MCI fiber optic line in railroad right-of-way	Option 5 has fewer utility conflicts than Option 4
			Drainage features	Less opportunity to share costs with the FCDMC to improve flooding conditions than Option 5	Greater opportunity to share costs with the FCDMC to improve flooding conditions than Option 4
			Design complexity	Access issues have a greater potential to increase costs and delay projects under Option 4	Requires less coordination with the railroad company which can impact project schedule than Option 4
Phased Construction Opportunities	■	▣	Provide finished roadway project with consistent roadway design features	Provides eight complete independent projects	Cross sections are not compatible with existing Grand and will require completion of the portions of Grand between the 8 projects
Future Expansion Potential	▣	■	Footage needed to obtain full access control	46,500 linear feet (37%)	32,000 linear feet (26%)
			# of signals that cannot be removed from Grand	14 signals	9 signals



Worst



Best

Overall Summary

Overall the two options are rated very nearly the same. Each option has advantages and disadvantages. Option 5 meets most of the service criteria slightly better than Option 4; however, Option 4 provides four more grade separations with the railroad. These grade separations are very important in the high train activity area between Glendale Avenue and Camelback Road.

Option 5 provides a higher type roadway with full inside and outside shoulders. This type roadway is generally safer and more pleasant for motorists. These factors are difficult to quantify.

The two options have similar impacts. Option 4 takes more businesses but Option 5 takes more residences and impacts one more neighborhood.

For implementation, Option 4 costs less and lends itself better to the phased construction needs while Option 5 has fewer uncertainties that could affect cost and schedule and is better suited for future expansion. The cost of obtaining full access control along Grand Avenue has not been included in the cost estimates. The additional cost is greater for Option 4.

8.1 EVALUATION PROCESS

Three categories of evaluation criteria were defined:

- Service — How well does the option meet the project goals
- Impact — What are the consequences of the proposed project
- Implementation — What are the costs and other impediments to implementing the project

For each category, several criteria were defined. The criteria are not intended to be equal in importance; instead, they are intended to identify the differences between the two options. No attempt has been made to add up scores for the several criteria to arrive at a bottom line score. 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 and advantages and disadvantages of the two options are summarized for each of the three categories of criteria and the end of each section.

Reasonable people may place different weights of importance on the criteria and therefore reach different conclusions from the analyses. Through the steering committee, stakeholders and public meetings, a consensus for one option should emerge based on the data and analyses presented herein. The preferred option will be discussed in Chapter 9.

Chapter 2 identified eight objectives for the Grand Avenue MIS. These objectives were developed based on extensive input during the previously concluded Grand Avenue Corridor Study and the review and input provided by the Steering Committee and the public and stakeholders during the early months of this Major Investment Study. The objectives are:

1. Eliminate six-legged intersections
2. Eliminate railroad crossings
3. Improve regional mobility
4. Promote development opportunities
5. Improve aesthetics of the corridor
6. Serve the statewide function of US 60
7. Promote multi-modal uses in the corridor
8. Accommodate the projected travel demand in the corridor.

These eight categories form the primary function of the proposed Grand Avenue Project. Accordingly, they form the “Service” evaluation criteria. In other words, the corridor option that is scored the highest in the evaluation of the service criteria best meets the intended purpose and need of the project. During the evaluation, it was decided to combine the regional mobility and statewide function criteria because they use the same measures. In addition, input from the committees and public indicated that the statewide function was of lesser importance compared to the other criteria. The criteria and measures are included in Section 8.2.

The category of impact criteria is derived from the environmental and socio-economic considerations. The number of residences, businesses, industries taken by the project and the impacts on neighborhoods are consequences of the proposed project. Criteria and measures for each were defined and included in Section 8.3. Potential impacts to the environment are included in four categories: hazardous material, 100-year floodplain encroachment, cultural resources, and 4(f) properties. Another criterion was added to show the total acreage of land required to obtain the right-of-way for the project.

The final category is implementation and is presented in Section 8.4. Criteria in this category include project costs, uncertainties that could affect cost or schedule, phased construction opportunities, future expansion opportunities, and funding constraints. The final criterion is the public and agency preferences. This criterion cannot be measured until after the Steering Committee, stakeholder, and public meetings.

The final summary of evaluation was presented in Exhibits 8.1 through 8.3. This summary utilizes a symbolic comparative rating for each criterion. Key quantitative and narrative differences are noted in the exhibits.

8.2 SERVICE EVALUATION

This section evaluates the two roadway options against the seven service criteria to determine which option best meets the project goals. Each service criterion is defined in this section along with the performance measures and methodology used to evaluate both options. The options are evaluated as a whole against all of the service criteria. If applicable, the options are also evaluated separately against the service criteria at each of the eight project locations proposed in each option. Exhibit 8.4 provides a summary of the criteria and measures used in the service evaluation.

8.2.1 Eliminate Six-Legged Intersections

The six-legged intersections on Grand Avenue were identified by the public as the top concern in the corridor. The existing six-legged intersections are signalized and create a number of traffic operation problems. The intersections are a major source of traffic delay, congestion, air pollution, and frustration to motorists. It is a prime objective of both options to reduce the complexity or eliminate these major six-legged intersections.

The two options will be evaluated using two measures to determine which option provides the most improvement in reducing the complexity or eliminating the six-legged intersections. The two measures are:

1. Change in intersection complexity
2. Change in number of intersections

The option that reduces the intersection complexities the most and results in the least number of signals would be considered the preferred option for this service criterion. For the evaluation of

Exhibit 8.4
Service Criteria and Measures

<i>Criterion</i>	<i>Measures</i>
Eliminate Six-Legged Intersections	<ul style="list-style-type: none"> • Change in intersection complexity • Change in number of traffic signals
Eliminate Railroad Crossings	<ul style="list-style-type: none"> • Number of grade separated railroad crossings
Improve Regional Mobility and Serve the Statewide Function of US 60	<ul style="list-style-type: none"> • Number of signals on Grand • Travel time on Grand • Access control on Grand
Promote Development Opportunities	<ul style="list-style-type: none"> • Street frontage gains and losses • Quantity of redevelopable property acquired • Accessibility to developable or redevelopable land
Improve Aesthetics of the Corridor	<ul style="list-style-type: none"> • Amount of unattractive land uses removed • Amount of land available for landscaping
Promote Multi-modal Uses in the Corridor	<ul style="list-style-type: none"> • Promotion of local bus travel • Promotion of express bus travel • Promotion of non-motorized travel • Compatibility with proposed LRT alignment
Accommodate Projected Travel Demand in the Corridor	<ul style="list-style-type: none"> • Intersection level of service • Intersection total delay • Safety

the measures, the analysis area includes the six-legged intersections and any new signals or intersections proposed under the two options. New intersections include the connection of frontage roads, ramps, and local access streets to the overpasses and the connection of existing collector streets to Grand Avenue to provide access.

Change in Intersection Complexity

Possible intersection complexity configurations are listed below in order from least desirable to most desirable:

1. Six-legged signalized intersection
2. Five-legged signalized intersection
3. Four-legged 45-degree skewed signalized intersection
4. Four-legged 90-degree signalized intersection
5. Unsignalized intersection
6. Intersection eliminated

A 90-degree intersection is preferred in the engineering profession over a 45-degree skewed intersection. According to the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*, 1990 (Green Book), roadways should intersect at approximately right angles (90-degrees) for the following reasons:

- Acute angles require extensive turning roadway areas and limit visibility for drivers, particularly drivers of trucks.
- When a truck turns on an obtuse angle, the driver has blind areas on the right side of the vehicle.
- Acute-angle intersections increase the exposure time of vehicles crossing the main traffic flow, thus may increase the accident potential.

Skewed intersections tend to be wider than right angle intersections and thus require additional clearance time to clear intersections. This results in slightly poorer operating conditions at the skewed intersections.

There are eight six-legged intersections within the study corridor. Six of them are formed by the intersection of Grand Avenue with two other arterial streets while the other two are formed by the intersection of Grand Avenue with two collector streets. As shown in Exhibit 8.5 both options reduce the complexity of all of the six-legged intersections. However, under Option 4, the consolidation of two signals along Grand Avenue (31st / Osborn West and Grand / Osborn East) would create a new six-legged signalized intersection at the Osborn / 31st / Grand intersection. Option 4 also leaves three skewed intersections while Option 5 leaves none.

Change in Number of Traffic Signals

Each of the eight six-legged intersections within the study corridor are signalized. Overpasses have been proposed to reduce the complexity of the six-legged intersections. To provide local access or turn movements, new frontage roads, collector streets, and ramps are proposed as part of Options 4 and 5. The intersection of these with the existing roadway network will result in new traffic signals. Traffic signals are also removed under both options. This measure evaluates the number of signals that are removed and added to the roadway option under each option. Exhibit 8.6 summarizes the change in number of signals for each option. A summary of the change in number of signals by street for additional information is included in the Appendix.

Under Option 4, a total of twelve new signals are added to the roadway network while three signals are removed. The new signals would be minor signals at intersections between arterial streets and frontage roads or collector streets.

Under Option 5, a total of thirteen new signals are added to the roadway network while two signals are removed. These new signals would be minor signals at intersections between ramps from Grand Avenue and the crossing arterial streets.

Exhibit 8.5 Intersection Complexity

Criterion: Eliminate six-legged intersections

Measure: Change in intersection complexity

	<i>Location</i>	<i>Existing</i>	<i>Option 4</i>	<i>Option 5</i>
	27th / Thomas / Grand	6-legged signalized	4-legged 90° signalized	5-legged signalized
	31st / Osborn / Grand	5-legged signalized	6-legged signalized	5-legged signalized
	43rd / Camelback / Grand	6-legged signalized	4-legged 45° skewed signalized	4-legged 90° signalized
	51st / Bethany Home / Grand	6-legged signalized	4-legged 45° skewed signalized	4-legged 90° signalized
	55th / Maryland / Grand	6-legged signalized	Intersection and signal are removed	Intersection and signal are removed
	59th / Glendale / Grand	6-legged signalized	4-legged 90° signalized	4-legged 90° signalized
	61st / Myrtle / Grand	6-legged signalized	4-legged unsignalized with left turns prohibited	4-legged unsignalized with left turns prohibited
	67th / Northern / Grand	6-legged signalized	5-legged 45° skewed signalized	4-legged 90° signalized
	75th / Olive / Grand	6-legged signalized	4-legged 45° skewed signalized	4-legged 90° signalized
	Corridor Total	Existing Number (points)	Option 4 Number (points)	Option 5 Number (points)
← More Desirable	6-Legged Signalized (1 pt)	8 (8)	1 (1)	0 (0)
	5-Legged Signalized (2 pt)	1 (2)	1 (2)	2 (4)
	4-Legged 45° Skewed Signalized (3 pt)	0 (0)	3 (9)	0 (0)
	4-Legged 90° Signalized (4 pt)	0 (0)	2 (8)	5 (20)
	4-Legged Unsignalized (5 pt)	0 (0)	1 (5)	1 (5)
	Intersection Removed (6 pt)	0 (0)	1 (6)	1 (6)
	Total	9 (10)	9 (31)	9 (35)

Summary of Eliminate Six-Legged Intersection Criterion

Both options significantly reduce the complexity and negative impacts associated with the six-legged intersections. However, Option 5 creates more desirable intersections overall than Option 4. As discussed earlier, 90-degree four-legged intersections are preferred over 45-degree

skewed intersections, and Option 5 has three fewer skewed intersections than Option 4. Option 4 also creates a six-legged intersection (31st / Osborn /Grand), which is not created in Option 5.

Exhibit 8.6 **Change in Number of Traffic Signals**

Criterion: Eliminate six-legged intersections

Measure: Change in number of traffic signals

<i>Signal Changes</i>	<i>Option 4</i>	<i>Option 5</i>
Signals Added	Thomas / 31 st Grand / 41 st Drive Camelback / 41 st Drive Camelback / Frontage Road 51 st / Montebello 51 st / Frontage Road Bethany Home / Frontage Road Grand / 57 th Glendale / 61 st Grand / Orangewood 67 th / Frier Drive 91 st / Cactus	43 rd / NWB On-Ramp and SEB Off-Ramp Camelback / NWB Off-Ramp 51 st / NWB On-Ramp and SEB Off-Ramp Bethany Home / NWB Off-Ramp Grand / 57 th Glendale / 61 st Grand / Orangewood 67 th / NWB On-Ramp and SEB Off-Ramp Northern / SEB On-Ramp and NWB Off-Ramp 75 th / SEB On-Ramp Olive / NWB Off-Ramp Olive / SWB Off-Ramp 91 st / Cactus
Total Signals Added	+12	+13
Signals Removed	Grand / Osborn East Maryland / 55 th / Grand Grand / Myrtle / 61 st	Maryland / 55 th / Grand Grand / Myrtle / 61 st
Total Signals Removed	-3	-2
Net Total	+9	+11

Option 5 adds two more signals to the roadway network (11 signals versus 9 signals) than does Option 4. However, these signals are minor signals that restore turn movements that are removed by the overpasses. Overall, Option 5 is the preferred option at meeting the service criterion of eliminating or reducing the complexity of the six-legged intersections.

8.2.2 Eliminate Railroad Crossings

The BNSF railroad parallels Grand Avenue and crosses two of the approaches at each of the six-legged intersections. The railroad crossings are a major irritant to drivers. When a train crosses the intersection, additional delays of up to 3 minutes occur for the north-south and east-west arterial streets. Emergency vehicles are also not able to cross the tracks during these times. In addition, a third of the accidents at the six-legged intersections occurred when trains crossed the intersection. The future plans of the BNSF are not known; however, every indication points to increased rail traffic within the corridor. Improving or reducing crossings of the railroad was identified by the public as the second most important issue or concern to be addressed by the Grand Avenue MIS.

The two options will be evaluated using one measure to determine which one offers the best opportunity to reduce or improve crossings of the railroad. The measure is:

- Number of grade separation railroad crossings

The option that provides the greatest number of grade separations over the railroad tracks will be the preferred option for this service criterion.

Number of Grade Separated Railroad Crossings

There is only one existing grade separation with the railroad other than the freeways within the study area. Indian School Road passes over the railroad tracks at 35th Avenue providing an east-west crossing. Exhibit 8.7 lists the streets that would have a grade separation over the railroad tracks proposed under each option.

Option 4 would create five new grade separations over the railroad. Three of these grade separations would provide crossings in the east-west direction and two in the north-south direction. Maryvale Medical Center is located on the northwest corner of Campbell Avenue and 51st Avenue. The overpasses along 51st Avenue and Camelback Road would reduce the railroad as a possible barrier for emergency vehicles traveling between the hospital and northeast of the railroad tracks including downtown Glendale. Railroad activity is very high across 55th Avenue and Maryland Avenue because of the proximity of the railroad yard. The Maryland Avenue overpass will eliminate these at-grade crossings which could reduce the frequency of the trains crossing Bethany Home Road and 43rd Avenue. The overpasses crossing the railroad tracks in Option 4 also provide sidewalks and in some cases bike lanes across the tracks.

Only one new grade separation would be created by Option 5. The grade separation would occur along Maryland Avenue at 55th Avenue. As stated above, railroad activity is very high across 55th Avenue and Maryland Avenue because of the proximity of the railroad yard. The Maryland overpass will eliminate these at-grade crossings which could reduce the frequency of the trains crossing 51st Avenue, Bethany Home Road, 43rd Avenue and Camelback Road. The Maryland Avenue overpass also provides sidewalks and bike lanes across the railroad tracks.

Exhibit 8.7
Number of Grade Separations Over Railroad Tracks

Criterion: Eliminate railroad crossings

Measure: Number of grade separated railroad crossings

<i>Existing Location</i>	<i>Option 4</i>	<i>Option 5</i>
Indian School Road	Indian School Road Camelback Road 51 st Avenue Maryland Avenue 67 th Avenue Olive Avenue	Indian School Road Maryland Avenue
Total Corridor	6	2

Summary of Eliminate Railroad Crossing Criterion

Option 4 clearly provides the greater benefit to drivers, bicycles, pedestrians and emergency vehicles in reducing the number of railroad crossings and reducing the impacts of the railroad on travel within the corridor than does Option 5. Therefore, Option 4 is the preferred option in meeting the service criterion for eliminating railroad crossings.

8.2.3 Improve Regional Mobility and Serve Statewide Function

Grand Avenue, designated US 60, is a State Highway that connects Wickenburg with the Phoenix metropolitan area. In addition, Grand Avenue connects to US 93 (which is part of the CANAMEX corridor for NAFTA) in Wickenburg. Grand Avenue also provides the shortest route in distance from Peoria and Glendale to downtown Phoenix. However, limited capacity and delay prevent the corridor from providing reasonable travel times among these cities. Improving regional mobility and serving the statewide function of US 60 is another objective of the Grand Avenue MIS.

The two options will be evaluated using three measures to determine which one is better in improving regional mobility and preserving the statewide function of Grand Avenue. The measures are:

1. Number of signals on Grand Avenue
2. Travel time on Grand Avenue
3. Access control on Grand Avenue

The option that has the fewest number of signals on Grand Avenue, the lowest travel time on Grand Avenue and the greatest amount of access control will be the preferred option for this service criterion.

Number of Signals on Grand Avenue

There are 18 traffic signals (including the two at the Loop 101 / Grand interchange) on Grand Avenue between I-17 and Loop 101. Six of these signals are at six-legged intersections with two other arterial streets. In addition, there are two signals at six-legged intersections with collector streets. The locations of the existing traffic signals along Grand Avenue and the proposed locations of traffic signals for both options are shown in Exhibit 8.8.

The Option 4 concept reduces the number of traffic signals on Grand Avenue within the study area from 18 to 16 (five signals are removed and three are added). Two of the intersections would be five-legged intersections and one a six-legged intersection. The number of signal phases and cycle lengths could be reduced at a majority of the intersections.

Exhibit 8.8 **Traffic Signals on Grand Avenue**

Criterion: Improve regional mobility and serve the statewide function of US 60

Measure: Number of signals on Grand Avenue

<i>Existing</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	31 st / Osborn	Osborn East
Osborn East	33 rd	31 st / Osborn West
31 st / Osborn West	35 th / Indian School	33 rd
33 rd	41 st (new)	35 th / Indian School
35 th / Indian School	43 rd	57 th or 57 th Drive (new)
43 rd / Camelback	Bethany Home	63 rd / Orangewood (new)
51 st / Bethany Home	57 th or 57 th Drive (new)	83 rd
55 th / Maryland	63 rd / Orangewood (new)	Peoria
59 th / Glendale	Northern	85 th
61 st / Myrtle	75 th	91 st
67 th / Northern	83 rd	Loop 101 NB Off-Ramp
75 th / Olive	Peoria	Loop 101 SB On-Ramp
83 rd	85 th	
Peoria	91 st	
85 th	Loop 101 NB Off-Ramp	
91 st	Loop 101 SB On-Ramp	
Loop 101 NB Off-Ramp		
Loop 101 SB On-Ramp		
18 Total	16 Total	12 Total

Under Option 5, the number of traffic signals on Grand Avenue will be reduced from 18 to 12 (eight signals are removed and two are added). The resulting limited expressway would have stretches of up to 3 miles with no traffic signals; only two minor signals would exist along Grand Avenue between 83rd Avenue and 35th Avenue. There would not be any six-legged intersections, and the majority of the traffic signals would be at collector street intersections. The new signals at the collector streets could be timed to provide the majority of the cycle length for traffic progression along Grand Avenue.

Travel Time on Grand Avenue

P.M. peak hour travel time along Grand Avenue was estimated between I-17 and Loop 101 for four operating conditions: Existing conditions, 2020 under base case conditions, 2020 under Option 4, and 2020 under Option 5. Travel times were also broken down into three segments: between Loop 101 and downtown Peoria (83rd / Grand), between downtown Peoria and downtown Glendale (Glendale / 59th), and between downtown Glendale and I-17.

Travel times along the corridor were estimated by adding the free flow running time plus total delay at signalized intersections. Free flow running times were calculated using the speed limit (45 mph) for existing and base conditions and the design speeds for each option (50 mph for Option 4 and 60 mph for Option 5). Total delay at signalized intersections was based on the level of service (LOS) estimated by the MAG EMME2 model, an assumed delay per vehicle value for each LOS, and the forecast traffic volumes entering the intersection. A more detailed description of the methodology, assumptions, and calculations used to estimate travel times is provided in the Appendix. The estimated P.M. peak hour travel times along the corridor are shown in Exhibit 8.9.

Existing peak hour travel time between I-17 and Loop 101 on Grand Avenue is almost 25 minutes with an average travel speed of 29 mph. This compares favorably to the 1993 average travel time of 24 minutes between Thomas Road and 91st Avenue documented in Working Paper No. 3, Transportation Conditions. Under 2020 base case conditions, travel time to traverse the study corridor is expected to increase by one minute to almost 26 minutes.

Under Option 4, travel time between I-17 and Loop 101 is expected to be 5.4 minutes faster than the base case. Average travel speed is expected to increase 7 mph from 27.8 mph to 35.1 mph.

In Option 5, travel time between I-17 and Loop 101 is expected to decrease 9.7 minutes versus the base case. Average travel speed is expected to increase over 16 mph to 44.4 mph.

Access Control on Grand Avenue

The number of access points along a highway can affect the capacity of the roadway. The higher the number of access points the greater the reduction in capacity. Limiting access points to a highway can also improve the safety of the highway by minimize the number of vehicle conflict points associated with the use of driveways and intersecting streets.

Exhibit 8.9

P.M. Peak Hour Travel Time

Criterion: Improve regional mobility and serve the statewide function of US 60

Measure: Travel time on Grand Avenue

<i>Location</i>	<i>Existing</i>	<i>2020 Base Case</i>	<i>2020 Option 4</i>	<i>2020 Option 5</i>
I-17 to Downtown Glendale ¹	13.0	13.0	10.2	7.9
Downtown Glendale ¹ to Downtown Peoria ²	9.1	9.1	6.4	4.5
Downtown Peoria ² to Loop 101	2.8	3.8	3.8	3.8
Total Travel Time (minutes)	24.9	25.9	20.5	16.2
Average Travel Speed (mph)	28.9	27.8	35.1	44.4

¹Downtown Glendale was considered at 59th and Glendale.

²Downtown Peoria was considered at Grand and 83rd.

Generally, access to Grand Avenue is prohibited on the railroad side except at mile and half mile streets. Access is not limited on the side opposite the railroad. Curb cuts are prohibited on approximately 54% of the linear footage of land bordering Grand Avenue between mile and half mile streets. A total of 47 collector or local streets intersect Grand Avenue. Exhibit 8.10 summarizes the access control and number of intersecting street proposed under both options. Calculations used to determine access control are provided in the Appendix.

Under Option 4, access to Grand Avenue would still be prohibited on the railroad side except at mile and half mile arterial streets. Access would be prohibited on the overpasses between the point where the overpass begins to ascend to the point downstream where the overpass returns to existing grade. Curb cuts on Grand Avenue would be prohibited on 63% of the linear footage of land border Grand Avenue between the mile and half mile streets. A total of 25 collector or local streets would intersect Grand Avenue.

Under Option 5, access to Grand Avenue would still be prohibited on the railroad side except at mile and half mile arterial streets. Access would be prohibited on the overpasses between the point where the overpass begins to ascend to the point downstream where the overpass returns to existing grade. Curb cuts on Grand Avenue would be prohibited on 74% of the linear footage of land bordering Grand Avenue between the mile and half mile streets. Because the remaining distance between consecutive overpasses is short, access could eventually be eliminated along Grand Avenue except at mile and half-mile streets. A total of 24 collector or local streets intersect Grand Avenue.

Exhibit 8.10 Access Control

Criterion: Improve regional mobility and serve the statewide function of US 60

Measure: Access control on Grand Avenue

	<i>Existing</i>	<i>Option 4</i>	<i>Option 5</i>
Access Controlled Frontage			
Southwest Side	70%	70%	70%
Northeast Side	38%	55%	78%
Total – Both Sides	54%	63%	74%
Non-Access Controlled Frontage			
Southwest Side	30%	30%	30%
Northeast Side	62%	45%	22%
Total – Both Sides	46%	37%	26%
Number of Intersecting Streets			
Southwest Side	19	11	11
Northeast Side	28	14	13
Total – Both Sides	47	25	24

Summary of Improve Regional Mobility Criterion

There are six more traffic signals along Grand Avenue in Option 4 than in Option 5. Travel time along Grand Avenue between I-17 and Loop 101 is expected to be approximately 4.3 minutes shorter under Option 5 than Option 4. Option 5 provides access control along 11% more of the linear footage on Grand Avenue than does Option 4. There is one fewer roadway intersecting Grand Avenue in Option 5 than Option 4. Therefore, Option 5 is the preferred option in meeting the service criterion to improve regional mobility and serve the statewide function of US 60.

8.2.4 Promote Development Opportunities

Grand Avenue serves as a commercial corridor for the West Valley. There are many viable businesses and industries along Grand Avenue. However, development in the corridor has lagged compared to the rest of the Phoenix metropolitan area. Development and redevelopment opportunities were identified within the corridor in order to consider potential job creation and employment opportunities that will over time become available due to transportation investment within the corridor. Providing development and redevelopment opportunities is an objective of the Grand Avenue MIS.

The two options will be evaluated using three measures to determine which one provides the most development opportunities for the corridor. The measures used in the evaluation include the following:

1. Street frontage gains and losses
2. Quantity of redevelopable property acquired
3. Accessibility to developable or redevelopable land

The option that promotes the most development and redevelopment of both ADOT acquired land and other land within the study area and provides the best accessibility to the land is the preferred option for this service criterion.

Street Frontage Gains and Losses

A measure of the net street frontage calculated by subtracting the total frontage lost from the total frontage gained was used to compare the two options. The frontage was established by using the following assumptions. Construction of an overpass would result in the loss of street frontage for some parcels of land. All the street frontage losses would be from two-way streets. In turn, construction of new access roads would add street frontage to other parcels, creating additional development opportunities. Frontage would be gained from both one way and two-way service roads. Since frontage on one-way streets is not as viable for redevelopment, it was counted at 50% of the distance in linear feet.

Exhibit 8.11 identifies for each option the amount of two-way street frontage lost or gained and one-way street frontage lost or gained. The results for each intersection location concluded a net loss in two-way street frontage and a net gain in one-way street frontage.

Under Option 4, nearly 29,000 linear feet of two-way street frontage would be lost. With the exception of the 91st / Loop 101 location, which did not lose or gain any road frontage; the loss of two-way street frontage at each intersection segment ranged from 2,400 linear feet (59th / Glendale) to 5,600 linear feet (75th / Olive). Over 11,000 linear feet of one-way street frontage would be gained under Option 4. The one-way street frontage gained at each intersection segment ranged from 0 linear feet (27th / Thomas, 51st / Bethany Home, 59th / Glendale, 91st / Loop 101) to 3,200 linear feet (43rd / Camelback).

Under Option 5, nearly 32,000 linear feet of two-way street frontage would be lost. With the exception of the 91st / Loop 101 location, which did not lose or gain any street frontage; the loss of two-way street frontage at each intersection location ranged from 2,400 linear feet (59th / Glendale) to 6,700 linear feet (67th / Northern). Only 2,500 linear feet of one-way street frontage would be gained under Option 5. The only intersection location with one-way service road frontage would be 55th / Maryland. The one-way streets at the other intersection locations are on access controlled ramps to the limited expressway, which do not enhance the development potential of adjacent property.

Overall, less two-way street frontage is lost under Option 4 (28,675 linear feet versus 31,775 linear feet for Option 5). In addition, significantly more one-way street frontage is gained under Option 4 (11,250 linear feet versus 2,500 linear feet for Option 5).

Exhibit 8.11 Street Frontage (in Linear Feet)

Criterion: Promote development opportunities

Measure: Street frontage gains and losses

<i>Location</i>	<i>Option 4</i>		<i>Option 5</i>	
27th / Thomas	Two-Way Streets Lost:	3,800	Two-Way Streets Lost:	3,900
	One-Way Streets Gained:	0	One-Way Streets Gained:	0
43rd / Camelback	Two-Way Streets Lost:	4,600	Two-Way Streets Lost:	5,350
	One-Way Streets Gained:	3,200	One-Way Streets Gained:	0
51st / Bethany Home	Two-Way Streets Lost:	3,250	Two-Way Streets Lost:	5,675
	One-Way Streets Gained:	0	One-Way Streets Gained:	0
55th / Maryland	Two-Way Streets Lost:	4,700	Two-Way Streets Lost:	4,700
	One-Way Streets Gained:	2,500	One-Way Streets Gained:	2,500
59th / Glendale	Two-Way Streets Lost:	2,400	Two-Way Streets Lost:	2,400
	One-Way Streets Gained:	0	One-Way Streets Gained:	0
67th / Northern	Two-Way Streets Lost:	4,275	Two-Way Streets Lost:	6,750
	One-Way Streets Gained:	2,600	One-Way Streets Gained:	0
75th / Olive	Two-Way Streets Lost:	5,650	Two-Way Streets Lost:	3,000
	One-Way Streets Gained:	2,950	One-Way Streets Gained:	0
91st / Loop 101	Two-Way Streets Lost:	0	Two-Way Streets Lost:	0
	One-Way Streets Gained:	0	One-Way Streets Gained:	0
Total Corridor	Two-Way Streets Lost:	28,675	Two-Way Streets Lost:	31,775
	One-Way Streets Gained:	11,250	One-Way Streets Gained:	2,500

Note: Numbers are in linear feet

Quantity of Redevelopable Property Acquired

A measure of the quantity of ADOT acquired property that is suitable for redevelopment was also used to compare the two options. A portion of the property being acquired by ADOT will be needed for the overpass right-of-way. The remaining portions of those parcels were evaluated to determine if they would be suitable for redevelopment, based on the size, shape and accessibility. A property is considered to be suitable for redevelopment if it fronts on a two-way street with convenient accessibility to the primary roadways. In addition, larger properties that are close in shape to a rectangle are considered more viable for redevelopment than long thin and irregular parcels. Exhibit 8.12 identifies for each intersection location, the acreage of property acquired by ADOT that has a potential for development or redevelopment.

Overall, more developable acres are acquired by ADOT under Option 5 (56.4 acres versus 47.3 acres for Option 4). The largest quantity of developable property would be acquired (under both options) at the 55th/ Maryland intersection (12.1 acres).

Exhibit 8.12 Redevelopable Property

Criterion: Promote development opportunities

Measure: Quantity of redevelopable property acquired

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas	11.6 acres (3 parcels)	10.8 acres (2 parcels)
43rd / Camelback	8.4 acres (5 parcels)	9.3 acres (3 parcels)
51st / Bethany Home	8.1 acres (3 parcels)	8.7 acres (2 parcels)
55th / Maryland	12.1 acres (1 parcel)	12.1 acres (1 parcel)
59th / Glendale	5.0 acres (1 parcel)	5.0 acres (1 parcel)
67th / Northern	2.1 acres (2 parcels)	6.8 acres (3 parcels)
75th / Olive	0.0 acres	3.7 acres (1 parcel)
91st / Loop 101	0.0 acres	0.0 acres
Total Corridor	47.3 acres	56.4 acres

Accessibility to Developable or Redevelopable Land

Accessibility to areas with development or redevelopment potential is important in the actual development of those parcels. The areas with development or redevelopment potential consist of vacant or underdeveloped properties, fronting on two-way streets, which are located near each intersection location. Exhibit 8.13 describes the approximate location of the properties with development potential by intersection location. The accessibility of these properties are evaluated based on the connectivity of the overpass/ underpass with the other two arterial streets comprising the current six-legged intersection.

As shown in Exhibit 8.13, connectivity to Grand Avenue at the eight project locations would be diminished over the current situation under Option 4. The project locations would lack full accessibility between the overpass/ underpass and the other two arterial streets that currently comprise the six-legged intersection. Accessibility would be maintained at five of the eight project locations under Option 5.

Overall, Option 5 provides equal or better vehicular accessibility to the potentially developable parcels at all eight project locations. New on- and off-ramps would make access to the developing sites more efficient than Option 4. Only at the 67th and Northern Avenue intersection is Option 4 considered to provide better accessibility, as the service road that provides the direct

accessibility creates a five-legged intersection. An enhanced speed of travel on Grand Avenue would also contribute to improving development opportunities along the Grand Avenue Corridor.

Exhibit 8.13 Land Accessibility

Criterion: Promote development opportunities

Measure: Accessibility to developable or redevelopable land

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas <i>A few small sites exist west of Grand between 27th and 35th.</i>	Direct south-eastbound and north-westbound movements from Grand to 27 th and Thomas would be eliminated and shifted to Osborn, 31 st , and 23 rd	Ramps provided for north-westbound travel and south-eastbound access to 27 th and Thomas would expedite traffic flow and reduce potential traffic conflicts.
43rd / Camelback <i>Two large parcels (one is a large industrial park) straddling 45th are located on the south side of Camelback, west of Grand along with three small sites; two small sites are located east of Grand, and south of Camelback</i>	Eastbound and westbound Camelback to 43 rd northbound would be eliminated; traffic would be shifted to new service road east of 43 rd . Northbound travel on Grand and 43 rd from Santa Fe Industrial Park on south side of Camelback would become circuitous.	North-westbound and south-eastbound on- and off-ramps would expedite traffic flow and reduce congestion. All direct turning movements would be retained for all developed and developing areas.
51st / Bethany Home <i>Several large developable sites are located south of Bethany Home and west of 51st; there are two sites east of Grand; one small site north of Bethany Home and one large but irregular site adjacent to Grand south of Bethany Home</i>	Direct access from Grand and Bethany Home would be maintained. Access from 51 st would be altered. New routing would have direct impacts on the desirability of developing sites, due to circuitous traffic patterns. An access road between Montebello Ave. and Bethany Home would facilitate travel on 51 st .	Direct access between Bethany Home and 51 st would be maintained. Access from Grand would be altered. New routing would not significantly impair development potential of sites. More efficient access would be provided to large site east of Grand on the south side of Bethany Home.
55th / Maryland <i>One large and several small developable sites are located west of Grand and south of Maryland; a few smaller sites are located north of Maryland east of Grand</i>	Direct access to Grand would be eliminated with 55 th being connected to Maryland east and west of Grand. The southbound 55 th to westbound Maryland and northbound 55 th to eastbound Maryland movements would be eliminated. One large site would be isolated from the principal travel facilities and distance to other sites would be extended more than one mile.	Same as Option 4.
59th / Glendale <i>Numerous small sites are located between Grand and 59th; four potentially developable sites are located west of Grand (two on Glendale); three small sites are located south of Glendale, east of Grand</i>	Direct access to Grand from Glendale and 59 th would be eliminated. New routing of traffic would have direct negative impacts on the desirability of developing sites, due to circuitous traffic patterns on non-arterial streets.	Same as Option 4.
67th / Northern <i>Numerous large developable sites exist east and west of Grand north of Northern</i>	Service roads provide access to Grand from 67 th , but these service roads form a five-legged intersection with 67 th and Grand, contributing to continue traffic congestion.	Direct access to south-eastbound Grand from 67 th would be eliminated. New routing would have direct impacts on the desirability of developing sites, due to circuitous traffic patterns.
75th / Olive <i>Numerous large sites exist east and west of Grand</i>	Direct access to Grand from Olive would be eliminated. The eastbound Olive to southbound 75th and westbound Olive to northbound 75th movements would be eliminated. The distance to all sites would be extended, as access would be rerouted to Northern / 67 th (south of the sites) or Peoria / 83 rd (north of the sites).	Direct access between Olive and 75th would be maintained. Access from Grand would be altered. New routing would not significantly impair development potential of sites. More efficient access would be provided to sites east and west of Grand along the south side of Olive and east of 67 th , and sites north and south of Olive west of Grand.
91st / Loop 101 <i>One site is located east of 91st south of Grand, and several large sites are located north of Grand</i>	Access would be enhanced with new northbound and southbound access ramps connecting 91 st to Loop 101 north of Cactus.	Same as Option 4.

Summary of Promote Development Opportunities Criterion

Overall, less two-way street frontage is lost under Option 4 (28,675 linear feet versus 31,775 linear feet for Option 5). In addition, significantly more one-way street frontage is gained under Option 4 (11,250 linear feet versus 2,500 linear feet for Option 5). However, more developable acres are acquired under Option 5 (56.4 acres versus 47.3 acres for Option 4). Option 5 also provides equal or better vehicular accessibility to the potentially developable parcels at all eight intersection locations. Therefore, Option 5 is the preferred option in meeting the service criterion to promote development opportunities within the corridor.

8.2.5 Improve Aesthetics of the Corridor

During the Grand Avenue Corridor Study, there was a desire expressed to improve the overall appearance of the Grand Avenue Corridor. Currently, much of the corridor is characterized by older industrial-type land uses, vacant property, large older commercial signage and the railroad. There is little landscaping and no buffering from the railroad. The City of Glendale has installed street lighting along Grand Avenue north of Camelback Road. ADOT has provided landscaping along Grand north of Olive Avenue.

The project options as developed in the MIS are not in sufficient detail to identify landscaping and aesthetic treatment opportunities. Therefore, the two options were evaluated based on the following measures:

1. Amount of unattractive land uses that would be removed by each option
2. Amount of land that might be available for landscaping

The option that removes the largest amount of unattractive land uses and provides the greatest amount of land for landscaping will be the preferred option for this service criterion.

Unattractive Land Use Removed and Land Available for Landscaping

These measures deal only with the view from the road. The view of the road from the neighborhoods is dealt with in Section 8.3.3.

The measures used in this criterion are very subjective. In general, the land uses along Grand Avenue are perceived to be less attractive and less viable than those along the east-west and north-south arterial streets. Therefore, options that remove land uses along Grand Avenue are favored over those that remove land uses along the other arterial streets. The amount of land taken for each option at each location is quantified in Section 8.3.7 in the impact evaluation. These data were used in this subjective analysis of aesthetics. The results are presented in Exhibit 8.14.

Under both options, land for landscaping would be available because of excess land from parcels acquired to provide the new right-of-way for the project. In many cases, large land parcels are encountered. The proposed options would eliminate or severely alter the access available to the remainder of the parcel that is not needed for roadway right-of-way. The remaining property may

be used for detention basins at some locations. Typically, the detention basins would have some landscaping and aesthetic treatment. All of the excess land may not be developable and could be used for landscaping. The cities could also require developable land to be landscaped when it is improved. The excess land may also provide opportunities to flatten embankment slopes to be more conducive to landscaping.

Exhibit 8.14 Aesthetics

Criterion: Enhance aesthetics. Improve the view from the roadway.

Measure: Opportunities to provide landscaped areas that are visible from the road; eliminate unattractive land uses that are visible from the roadway.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas	Eliminates existing unattractive land uses along Grand and provides land on old Pioneer Ford for landscaping	Same as Option 4
43rd / Camelback	Eliminates unattractive land uses on south side of Camelback east of 43rd; opportunity of landscaping south of overpass	Eliminates unattractive land uses along Grand; provides land that can be landscaped
51st / Bethany Home	Eliminates some unattractive land uses north of Bethany Home; some land available for landscaping	Eliminates more unattractive land uses and provides more opportunities for landscaping
55th / Maryland	Provides opportunity for reuse of Sands Chevrolet property	Same as Option 4
59th / Glendale	Provides some opportunity for aesthetic treatment of underpass and for area northeast of underpass	Has less opportunity because of limited space available because of wider roadway
67th / Northern	Eliminates some unattractive land uses north of Northern; has some limited space for landscaping	Eliminates more unattractive land uses along Grand; provides more land for landscaping
75th / Olive	Provides limited opportunities for landscaping	Provides more opportunities for landscaping
91st / Loop 101	Provides some opportunity for landscaping between and along ramps	Same as Option 4
Total Corridor		Eliminates more unattractive land uses and more opportunities for landscaping

Summary of Improve Aesthetics Criterion

As shown in Exhibit 8.14, both options eliminate unattractive land uses along Grand Avenue and provide opportunities for landscaping. However, Option 5 eliminates more unattractive land uses and provides more opportunities for landscaping than Option 4. Therefore, Option 5 is the preferred option in meeting the service criterion to improve aesthetics along the corridor.

8.2.6 Promote Multi-modal Uses in the Corridor

Grand Avenue is a multi-modal corridor. Transit, pedestrians and bicycles either use or cross the corridor. Promoting multi-modal use within the corridor is another objective of the Grand Avenue MIS. This portion of the service evaluation addresses the extent to which each roadway improvement option promotes travel via transit and non-motorized (bicycle, pedestrian) transportation modes. Four measures have been developed for this criterion:

1. Promotion of local bus travel
2. Promotion of express bus travel
3. Promotion of non-motorized travel
4. Compatibility with proposed LRT alignment

For the first three measures, the two options are evaluated by location. For the fourth measure, analysis by location is not applicable. Instead, the two options are comparatively evaluated according to their ability to meet each of five objectives.

The option that promotes local bus travel, express bus travel, and non-motorized travel the most and is compatible with the proposed LRT alignment will be the preferred option for this service criterion.

Promotion of Local Bus Travel

This measure addresses the extent to which each option facilitates or impedes local bus travel by riders using routes that run along Grand Avenue or cross the corridor. The major effect of either option on local bus riders consists of the impact on transfers between bus routes. By grade separating roadways that carry transit buses, Options 4 and 5 would facilitate some local bus transfers and impede others.

When comparing the two options, one point was awarded for each pair of existing routes between which transfers are facilitated. One point was deducted for each pair of existing routes between which transfers are impeded. Transfers involving a potential future route count one-half point. Exhibit 8.15 summarizes the effect each option has on local bus travel.

Both options impede more route transfers than they facilitate. Overall, Option 4 has less negative impact on local bus travel than Option 5 (-5.5 points versus -6.5 points).

Exhibit 8.15
Promotion of Local Bus Service

Criterion: Promote Multi-modal Travel
Measure: Promotion of Local Bus Travel

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th /Thomas	Impedes G-Y Impedes Y-27 Facilitates G-27 Score: -1	Same as Option 4 Score: -1
43 rd Camelback	Impedes Y-50 Impedes 43-50 Facilitates Y-43 Score: -1	Impedes Y-50 Impedes Y-43 Facilitates 43-50 Score: -1
51 st /Bethany Home	Impedes Y-51* Impedes 51*-60 Facilitates Y-60 Score: 0	Impedes Y-51* Impedes Y-60 Facilitates 51*-60 Score: -1
59 th /Glendale	Impedes Y-24 Impedes Y-59 Score: -2	Same as Option 4 Score: -2
67 th /Northern	Impedes Y-67 Impedes 67-80* Facilitates Y-80* Score: -1	Impedes Y-67 Impedes Y-80* Facilitates 67-80* Score: -1
75 th /Olive	Impedes Y-90* Impedes 75*-90* Facilitates Y-75* Score: -.5	Impedes Y-75* Impedes Y-90* Facilitates 75*-90* Score: -.5
Total Corridor	Score: -5.5	Score: -6.5

*Denotes potential future bus route or future extension of existing route.

Promotion of Express Bus Travel

This measure deals specifically with the impact of each roadway option on proposed express bus service that would use Grand Avenue between SR 101L and I-17. Reduction in the number of traffic signals along Grand would speed express bus travel and hence make express bus service

(operating in mixed traffic) more attractive to choice riders. When comparing the two options, one point was deducted for each signalized intersection (within study area) on the proposed Grand Avenue express route. Exhibit 8.16 summarizes the effect each option has on express bus travel. Option 5 has four less signals along the express bus route than does Option 4 (11 versus 15).

Exhibit 8.16 Promotion of Express Bus Service

Criterion: Promote Multi-modal Travel

Measure: Promotion of Grand Avenue Express Bus

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
91 st /Cactus	Signal (-1)	Signal (-1)
91 st /Grand	Signal (-1)	Signal (-1)
85 th	Signal (-1)	Signal (-1)
Peoria	Signal (-1)	Signal (-1)
83 rd	Signal (-1)	Signal (-1)
75 th	Signal (-1)	No Signal (0)
Northern	Signal (-1)	No Signal (0)
Orangewood	Signal (-1)	Signal (-1)
57 th	Signal (-1)	Signal (-1)
Bethany Home	Signal (-1)	No Signal (0)
43 rd	Signal (-1)	No Signal (0)
41 st	Signal (-1)	No Signal (0)
35 th	Signal (-1)	Signal (-1)
33 rd	Signal (-1)	Signal (-1)
31 st /Osborn	Signal (-1)	No Signal (0)
31 st	No Signal (0)	Signal (-1)
Osborn	No Signal (0)	Signal (-1)
Total Corridor	-15	-11

Promotion of Non-Motorized Travel

This measure considers the impact of the two options on existing and planned bikeways that cross Grand Avenue in the study area. Bicycle travel across Grand Avenue would be facilitated in some cases and impeded in others. (Pedestrian trails are not an issue, as the only trail crossing

the corridor runs along the Grand Canal, where neither option would change the current condition.)

When comparing the two options, one point was awarded for each (existing or planned) bikeway or other non-motorized facility on which travel across the corridor is facilitated by removing a traffic signal. One-half point was awarded for each such facility on which travel is facilitated by simplification of an intersection. One point was deducted for each facility on which direct travel across Grand Avenue is eliminated. Exhibit 8.17 summarizes the effect each option has on non-motorized travel.

Option 4 promotes non-motorized travel within the corridor slightly better than Option 5 (3.5 points versus 2.5 points).

Exhibit 8.17 **Promotion of Non-Motorized Travel**

Criterion: Promote Multi-modal Travel

Measure: Promotion of Non-Motorized Travel

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
51 st /Bethany Home	Overpass removes signal on planned 51 st bikeway. Score: 1	Grand overpass expedites 51 st bike travel across intersection. Score: .5
55 th /Maryland	Overpass removes signal for Maryland bike lanes. No direct access across Grand for future 55 th bike lanes. Score: 0	Same as Option 4 Score: 0
59 th /Glendale	Underpass benefits future 59 th /Glendale bike lanes. Score: .5	Same as Option 4 Score: .5
61 st /Myrtle	61 st access across corridor removed. Score: -1	Same as Option 4 Score: -1
63 rd /Orangewood	New signal benefits planned Orangewood & 63 rd bike lanes. Score: 2	Same as Option 4 Score: 2
67 th /Northern	Overpass removes signal for planned 67 th bikeway. Score: 1	Grand overpass simplifies 67 th bike travel across intersection. Score: .5
Total Corridor	3.5	2.5

Compatibility with Proposed LRT Alignment

This measure compares the two roadway options with respect to a potential light rail transit (LRT) alignment using the Grand Avenue Corridor between Downtown Glendale and Downtown Peoria. Each option has distinct advantages and disadvantages from the standpoint of a future LRT line.

When comparing the two options, one point (per objective) was awarded to the option that best meets each of the following objectives:

- Maintain existing access (especially right-turn).
- Maximize LRT operating speed and convenience to riders.
- Minimize construction costs.
- Minimize impact on vehicular traffic operations.
- Avoid acquisition of additional right-of-way for LRT.

Exhibit 8.18 summarizes the compatibility of each option with the LRT alignment. Option 5 is slightly more compatible with the LRT alignment than Option 4 (3 points versus 2 points).

Summary of Promote Multi-modal Use Criterion

In summary, Option 4 performs slightly better than Option 5 with respect to promotion of local bus and non-motorized travel, but worse with respect to promotion of express bus use and compatibility with a future Glendale-Peoria LRT route. A summation of the total points (shown in Exhibit 8.18 shows that Option 5 is slightly better than Option 4 in promoting multi-modal use within the corridor. Therefore, Option 5 is the preferred option to meet this service criterion.

8.2.7 Accommodate Projected Travel Demand in the Corridor

Traffic volumes along Grand Avenue have remained stable over the last 13 years due to the lack of capacity through the six-legged intersections. Any improvements to the roadway network within the study area are likely to add capacity to the network and attract more traffic. Accommodating projected travel demand is another objective of the Grand Avenue MIS. Both options need to be able to accommodate 2020 traffic forecast volumes.

The two options will be evaluated using five measures to determine which one is better in accommodating projected travel demand. The measures are:

1. Intersection Level of Service
2. Intersection Total Delay
3. Safety
4. Amount of 2020 traffic with unimpeded flow through intersection
5. 2020 daily weekday volumes served by Grand Avenue

Exhibit 8.18 LRT Compatibility

Criterion: Promote Multi-modal Travel

Measure: Compatibility with Proposed Glendale-Peoria LRT Alignment

<i>Objective</i>	<i>Option 4</i>	<i>Option 5</i>
Maintain Street/Driveway Access	On-street alternatives preserve maximum right turn access. Score: 1	Direct alignment via NE side of Grand eliminates much existing access. Score: 0
Maximize LRT Speed & Convenience	Both on- & off-street alignments cross many intersections at grade. Score: 0	NE side alignment is partially grade separated, maximizing speed & well serving proposed park/ride. Score: 1
Minimize Construction Cost	At-grade alignment & direct route, Glendale-Peoria Score: 1	Requires extensive grade separation or indirect routing. Score: 0
Minimize Impact on Roadway Traffic	LRT grade crossings require special signal phases at several locations; on street options also affect traffic between intersections. Score: 0	Options on NE side with extensive grade separation minimize impact on roadway traffic. Score: 1
Avoid R/W Acquisition	Due to modest R/W acquisition along Grand for roadway improvements, extensive additional R/W required later for LRT. Score: 0	Much of the needed R/W near intersections will already have been acquired for roadway. Score: 1
Total Corridor	Score: 2	Score: 3
GRAND TOTAL	Score: -15	Score: -12

The option that has the lowest total delay, overall better level of service at intersections, provides the most safety enhancements, and accommodates the most future volume within the study area is the preferred option for this service criterion. For the evaluation of the measures, project locations include the six-legged intersections and any new signals or intersections proposed under the two options. New intersections include the connection of frontage roads, ramps, and local access streets to the overpasses and the connection of existing collector streets to Grand Avenue to provide access.

Intersection Level of Service

As presented in Chapter 3, Transportation Conditions, the current level of service (LOS) at the six-legged intersections are LOS E-F. The MAG EMME2 model calculated P.M. peak hour LOS at intersections within the study area for the two options and at the intersection of major arterial streets within the study area. Exhibit 8.19 shows a summary of the P.M. peak hour LOS at the intersections that replace the six-legged intersections and other intersections within the study area.

All of the intersections between two major arterial streets within the corridor are expected to operate at LOS E-F under both options. The two options are relatively equal in the LOS provided at the collector street intersections. For the whole study area, Option 4 has two more intersections operating at LOS E-F while Option 5 has one more intersection operating at LOS D.

Intersection Delay

Existing P.M. peak hour total delay, presented in Chapter 3, totals over 1,300 hours of total delay at the six-legged intersections. Existing stopped delay was calculated from observed queue lengths. Queue lengths for future conditions are not available. Therefore, a general comparison of the expected amount of delay that will occur at the project locations under each option was made by comparing the P.M. peak hour volumes that enter the intersections to the level of service estimated by the MAG EMME2 model. An average total delay per vehicle value was assumed for each level of service. Additional delay was also added for the train. It was assumed that one long train would interrupt traffic during the P.M. peak hour at each project location. A more detailed description of the methodology, assumptions, and calculations used to estimate total delay is provided in the Appendix.

Total delay for the eight project locations is expected to increase to over 1,900 hours during the P.M. peak hour in 2020 under the base case conditions. The estimated P.M. peak hour total delay along the corridor under each option is shown in Exhibit 8.20. Overall P.M. peak hour total delay in the study area is expected to approach 5,500 hours.

The total 2020 P.M. peak hour delay under both options for the eight project locations is almost equal and approximately 30% lower than under the base case. Under Option 4, total delay for the eight project locations is approximately 2% higher than Option 5 (1,358 hours versus 1,336 hours). Within the study area, vehicle miles of travel increase 2% and 3%, respectively, under Options 4 and 5; while total delay in the study area decreases 3% and 10%, respectively, for Options 4 and 5.

Safety

An attempt to quantify the improvement in safety that would be gained at the two intersections was made. However, it was difficult to establish expected accident rates for the new facilities and new intersections created under both options. Therefore, only the advantages and disadvantages associated with each option as they pertain to safety are discussed here.

Exhibit 8.20
2020 P.M. Peak Hour Total Delay

Criterion: Accommodate projected travel demand in the corridor

Measure: Intersection delay

<i>Location</i>	<i>Type of Delay</i>	<i>Base Case</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Non-Train Delay	347	221	262
	Train Delay	13	17	17
	Total Delay	360	238	279
43 rd / Camelback	Non-Train Delay	281	238	188
	Train Delay	12	7	16
	Total Delay	293	245	204
51 st / Bethany Home	Non-Train Delay	270	210	164
	Train Delay	11	7	14
	Total Delay	281	217	178
55 th / Maryland	Non-Train Delay	35	0	0
	Train Delay	1	0	0
	Total Delay	36	0	0
59 th / Glendale	Non-Train Delay	304	215	231
	Train Delay	11	13	13
	Total Delay	315	228	244
67 th / Northern	Non-Train Delay	290	212	150
	Train Delay	13	9	15
	Total Delay	303	220	165
75 th / Olive	Non-Train Delay	275	147	193
	Train Delay	12	6	16
	Total Delay	287	153	209
91 st / Loop 101	Non-Train Delay	48	54	54
	Train Delay	3	3	3
	Total Delay	51	57	57
Total of Eight Project Locations	Non-Train Delay	1,850	1,297	1,242
	Train Delay	76	61	94
	Total Delay	1,926	1,358	1,336
Delay at Other Intersections in Study Area ¹		3,573	3,681	3,595
Grand Total Delay		5,499	5,039	4,931
2020 P.M. Peak Hour VMT²		683,200	698,400	704,900

¹Includes new intersections between frontage roads, collector streets or ramps and an arterial street that are created under the options.

²VMT = Vehicle miles of travel. VMT totals are from the MAG EMME2 Model for geographic locations #7, #14, #16, and #24.

Safety is expected to improve over existing conditions in Option 4 and Option 5. By removing a street from the six-legged intersections, the number of vehicles entering the intersection and the number of potential conflict points are significantly reduced which should result in a large reduction in accidents. The overpasses are access controlled, which should also reduce accidents as potential conflicts at access points are eliminated. The addition of new intersections (nine under Option 4 and eleven under Option 5) and the increase in vehicles miles of travel over the base case, increase the potential vehicle conflicts along the arterial streets, however, this should not have a major impact on safety in the corridor.

Under Option 5, the overpasses also provide inside and outside shoulders and a median barrier, which has a positive impact on the safety of a facility. However, the transition areas between existing Grand Avenue and the overpasses could create driver discomfort and have a negative impact on safety, as could the increase in speeds associated with elimination of traffic signals on Grand Avenue.

Amount of 2020 traffic with unimpeded flow through intersection

The options were compared to determine which option provided unimpeded flow through the former six-legged intersections for the most vehicles. MAG 2020 forecast traffic volumes for the overpasses were summed for the eight overpass locations and are shown in Exhibit 8.21. Option 5 is expected to provide more daily vehicles in 2020 with unimpeded flow than Option 4 (376,700 vehicles versus 286,900).

Exhibit 8.21
2020 Daily Traffic Volumes on Grade Separations

Criterion: Accommodate Future Traffic Volume

Measure: Amount of 2020 traffic with unimpeded flow through intersection

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas	48,500	47,500
35 th / Indian School	56,200	56,600
43rd / Camelback	39,200	59,900
51st / Bethany Home	30,600	56,000
55th / Maryland	7,800	16,300
59th / Glendale	35,100	53,000
67th / Northern	36,700	50,200
75th / Olive	32,800	37,200
Corridor Total	286,900	376,700

Source: MAG EMME2 2020 forecasts. Volumes are weekday daily volumes.

2020 daily weekday volumes served by Grand Avenue

The options were also compared to see which option was expected to serve the most traffic by Grand Avenue in 2020. MAG 2020 forecast traffic volumes were used for the analysis. Forecast traffic volumes for each segment of Grand Avenue for both options and the base case are shown in Exhibit 8.22.

Both options serve much greater volumes than the forecast 29,900 vehicles expected under the base case. Option 5 is expected to carry an average of 50,900 vehicles daily per roadway segment in 2020, while Option 4 is expected to carry only 41,900 vehicles daily.

Exhibit 8.22
2020 Daily Weekday Traffic Volumes on Grand Avenue

Criterion: Accommodate Future Traffic Volume

Measure: 2020 daily weekday volumes served by Grand Avenue

<i>Segment Location</i>	<i>Base Case</i>	<i>Option 4</i>	<i>Option 5</i>
SR 101 to 91st Ave.	43,400	45,900	48,300
91st Ave. to Peoria Ave.	28,700	29,800	31,600
Peoria Ave. to 83 rd Ave.	32,900	35,500	38,400
83rd Ave. to 75th Ave.	22,800	32,900	40,700
75th Ave. to 67th Ave.	21,100	35,500	50,400
67th Ave. to 59th Ave.	24,700	43,200	61,700
59th Ave. to 51st Ave.	24,500	41,400	58,700
51st Ave. to 43rd Ave.	30,400	47,300	66,600
43rd Ave. to 35th Ave.	36,700	56,700	66,000
35th Ave. to 27th Ave.	34,600	49,500	54,400
27th Ave. to 19th Ave.	29,500	42,700	43,100
Average Segment Volume	29,900	41,900	50,900

Source: MAG EMME2 2020 forecasts. Volumes are weekday daily volumes.

Summary of Accommodate Projected Travel Demand Criterion

Both options produce significant decreases in delay and higher level of service over the base case for the 2020 P.M. peak hour. Option 5 has slightly lower delay and higher level of service for the overall study area. However, for the eight project locations, the total delay and overall level of service are not significantly different. Option 5 is expected to serve a higher daily volume on both Grand Avenue and the overpasses. Therefore, Option 5 is the preferred option for this service criterion.

8.2.8 Summary of Service Evaluation

The primary advantages to Option 4 over Option 5 in meeting the service criteria are as follows:

- Provides five additional grade separations over the railroad tracks (four more than Option 5)
- Gains two-way street frontage (8,750 feet more than Option 5)
- Promotes non-motorized travel (better than Option 5)

The primary disadvantages to Option 4 in meeting the service criteria are as follows:

- Creates a six-legged intersection at 31st Avenue / Osborn Road / Grand Avenue
- Leaves three 45-degree skewed intersections (none in Option 5)
- Reduces accessibility to Grand Avenue from the arterial street system

The primary advantages to Option 5 over Option 4 in meeting the service criteria are as follows:

- Reduces the complexity of all the six-legged intersections
- Reduces number of traffic signals on Grand Avenue (eliminates six more than Option 4)
- Reduces travel time on Grand Avenue (reduces 4.3 minutes more than Option 4)
- Increases access control on Grand Avenue (11% more than Option 4)
- Provides developable land (9.1 acres more than Option 4)
- Maintains accessibility to developable parcels (better than Option 4)
- Eliminates unattractive land uses along Grand Avenue (more than Option 4)
- Provides opportunities for landscaping (more than Option 4)
- Promotes express bus service (better than Option 4)
- Compatible with light rail transit (better than Option 4)
- Accommodates future traffic volumes (more than Option 4)

The primary disadvantages to Option 5 in meeting the service criteria are as follows:

- Only additional grade separation over the railroad is on a collector street
- Loses two-way street frontage (3,100 feet more than Option 4)
- Impedes local bus travel (more than Option 4)

8.3 IMPACT EVALUATION

This section will address the Impact Evaluation Criteria discussed in Section 8.1; focusing on displacement of residences and businesses located on land acquired by ADOT, impacts to neighborhoods resulting from this project, environmental considerations, and the overall acreage needed for the right-of-way. Exhibit 8.23 provides a summary of the criteria and measures used in the impact evaluation.

Exhibit 8.23 Impact Criteria and Measures

<i>Criterion</i>	<i>Measures</i>
Residences Taken or Impacted	<ul style="list-style-type: none"> • Number of residential units taken
Businesses Taken or Impacted	<ul style="list-style-type: none"> • Number of businesses taken
Neighborhoods Impacted	<ul style="list-style-type: none"> • Environmental Impacts of overpass on Neighborhood Residential Areas • Number of Community Services Taken • Accessibility impacts • Increased traffic volumes
Hazardous Materials	<ul style="list-style-type: none"> • Number of sites potentially impacted
Cultural Resources	<ul style="list-style-type: none"> • Number of sites potentially impacted
100-Year Floodplain	<ul style="list-style-type: none"> • Number of sites potentially impacted
Acreage of New Right-of-Way Needed	<ul style="list-style-type: none"> • Acreage needed for right-of-way

In Chapter 4, the existing environment of the Grand Avenue study area was evaluated based on available information provided by local, State and Federal agencies. Potential environmental concerns were identified as part of the Environmental Overview and are the basis for the following impact evaluation. Although there would be environmental impacts with the implementation of either proposed option, the potential impacts on air quality, noise and 4(f) properties would be relatively the same. In addition, the level of existing information used to describe Title VI/Environmental Justice does not provide the level of detail for evaluation of one proposed option relative to the other. Therefore, the Title VI/Environmental Justice impacts have not been included in this evaluation but will be evaluated as part of the environmental documentation accompanying the design of individual projects.

8.3.1 Residences Taken

The measure used to evaluate the options under this criterion quantified the number of single and multi-family residential units that would need to be acquired by ADOT. The number of residential units were identified and compared among the two options. The preferred option under this criterion required the least number of residential units to be acquired. Residential units were identified using assessor parcel map data, aerial photography, and field investigation. Professional judgement was used to determine the number of units in a multi-family complex, if the information was not available in the assessor parcel maps or apparent after field

investigation. Exhibit 8.24 identifies the number of single and multi-family units that would need to be acquired under each option.

Under Option 4, a total of 24 single family and 120 multi-family units would have to be acquired.

- **Multi-Family** - A predominate number of multi-family units can be attributed to motels converted into low-income apartments. These were identified by project area and are located as follows: Phoenix -- 27th/Thomas (1 motel – 30 units), Glendale -- 43rd/Camelback (El Rancho Motel – 30 units), 51st/Bethany Home (2 motels – 60 units), and 67th/Northern (Two Palms Motel – 30 units).
- **Single Family** - Between one and eight single family units would need to be acquired at all project areas except, 27th/Thomas, 55th/Maryland, and 91st/Loop 101, where single family residences do not need to be acquired.

Under Option 5, a total of 30 single-family and 150 multi-family residences would have to be acquired under this option.

- **Multi-Family** - As with Option 4, a predominate number of multi-family units can be attributed to motels converted into low-income apartments. These were identified by project area and are located as follows: Phoenix - 43rd/Camelback (Horseshoe Motel – 30 units), Glendale - 43rd/Camelback (El Rancho Motel – 30 units), 51st/Bethany Home (2 motels – 60 units), and 67th/Northern (Two Palms Motel – 30 units).
- **Single Family** - Between one and 15 single-family units would need to be acquired at all project areas except, 27th/Thomas, 55th/Maryland, and 91st/Loop 101. At 67th/Northern six of the 15 single-family units are mobile homes.

Summary of Residences Taken Criterion

When viewed from the prospective of project cost, Option 4 is preferred. A smaller amount of residential units would need to be acquired under Option 4 (144 units) than Option 5 (180 units).

When viewed from a redevelopment perspective, Option 5 is preferred. The residential units that would be acquired are poorly sited in areas with predominately commercial and industrial land uses. Highway project funds, not ordinarily available for redevelopment of residential properties, would be available to relocate primarily low-income individuals and families into more suitable housing at more appropriate locations. This conclusion is based on the assumption that adequate project funds are available to purchase or construct more suitable replacement housing and that appropriate sites exist for this replacement housing.

Exhibit 8.24

Number of Residential Units Taken

Criterion Residences Taken
Measure The number of single and multi-family residential units that would be acquired for the project

<i>Location</i>	<i>Option 4</i>		<i>Option 5</i>	
	Multi-Family	Single Family	Multi-Family	Single Family
27 th / Thomas	30	0	0	0
43 rd / Camelback	30	4	60	5
51 st / Bethany Home	60	5	60	1
55 th / Maryland	0	0	0	0
59 th / Glendale	0	8	0	8
67 th / Northern	0	6	30	15
75 th / Olive	0	1	0	1
91 st / Loop 101	0	0	0	0
Total Corridor	120	24	150	30

8.3.2 Businesses Taken

This criterion evaluates the two options according to the number of businesses that would need to be acquired. The preferred option under this criterion would require the least number of businesses to be acquired. Two performance measures were considered to evaluate this criterion, they include the number of commercial businesses and the number of industrial businesses that need to be acquired. As with residential units, commercial and industrial businesses were identified using assessor parcel map data, aerial photography, and field investigation. Professional judgement was used to determine the number of businesses in a strip commercial building or business park when not apparent after visiting the site.

None of the businesses taken were viewed to be rail dependent, but the locations of several business types are enhanced by their dual rail and road access. Rail access is not considered essential because nearby competitors do not have rail access. Therefore, it is not considered that relocation of these businesses would be more difficult. These businesses include mobile home sales, automobile sales, plumbing supplies, sign makers, and warehouses.

Number of Commercial Businesses Taken

A measure of the number of operating commercial businesses acquired was used to compare the two options. As shown in Exhibit 8.25, the commercial businesses that ADOT would need to acquire were identified by project area. Examples of the types of businesses classified as commercial that may be acquired include:

- Adult business/night club
- Automobile services
- Automobile, truck, RV sales
- Bank/financial
- Beauty/cosmetics
- Convenience
- Dining and entertainment
- Gas station
- Hotel/motel
- Insurance company
- Liquor store
- Medical, dental, or veterinary
- Mixed retail and downtown services
- Mortuary
- Real estate sales
- Shopping center
- Single retail services
- Strip retail services
- Technical and professional offices
- Multi-Office complex

Exhibit 8.25
Number of Commercial Businesses Taken

Criterion Measure Businesses Taken
The number of commercial businesses that would be acquired for the project

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Full – 4 Partial – 1	Full – 4 Partial – 1
43 rd / Camelback	Full – 6 Partial – 0	Full – 5 Partial – 0
51 st / Bethany Home	Full – 13 Partial – 0	Full – 7 Partial – 1
55 th / Maryland	Full – 2 Partial – 0	Same as Option 4
59 th / Glendale	Full – 11 Partial – 0	Same as Option 4
67 th / Northern	Full – 28 Partial – 0	Full – 5 Partial – 0
75 th / Olive	Full – 0 Partial – 0	Full – 0 Partial – 0
91 st / Loop 101	Full – 0 Partial – 0	Same as Option 4
Total Corridor	Full – 64 Partial – 1	Full – 34 Partial – 2

Under Option 4, ADOT would need to fully acquire a total of 64 commercial businesses and partially acquire one business. The most prevalent business type that would be acquired throughout the Grand Avenue Corridor is related to the sale, maintenance, or repair of automobiles.

There would be three businesses acquired by Option 4 that are currently sited to benefit from their dual railroad and highway access. All of these businesses would also be acquired under Option 5; they include McDaniels Signs, American Plumbing Supplies, (27th/ Thomas), and Sand Chevrolet (55th/ Maryland).

Project areas where more than ten commercial businesses would need to be acquired are all located in the City of Glendale. These businesses are identified below.

- **51st/Bethany Home** - 13 businesses that would need to be acquired are located within this project area. Seven of these businesses are located in the Bethany Commercial Plaza at the intersection of Grand Avenue and Bethany Home Road. Most of the remaining businesses are located along Grand Avenue.
- **59th/Glendale** - 11 businesses that would need to be acquired are located within this project area. Most of these businesses are auto-repair related and are located along the north side of Grand Avenue.
- **67th/Northern** - This project area contains the most business (28) that would need to be acquired. The majority of these businesses are located in three strip centers, located along Grand Avenue, south of Northern Avenue. Another concentration of businesses is located in the Canyon Business Park, located on 67th Avenue, north of Grand Avenue.

Under Option 5, ADOT would need to fully acquire a total of 34 commercial businesses. In addition to the three commercial businesses acquired by Option 4 that are currently sited to benefit from their dual railroad and highway access, the Electric Rewinding Company (27th/Thomas) would need to be acquired under Option 5.

As with Option 4, the most prevalent business type throughout the Grand Avenue Corridor involves the sale, maintenance, or repair of automobiles. The 59th/Glendale project area has the same number (11) of commercial businesses to acquire as Option 4.

The remaining project areas have seven or less commercial businesses to acquire.

- **43rd/Camelback** - 5 businesses that would need to be acquired are located within this project area (3 of the businesses are in Phoenix and 2 in Glendale). These businesses are a mixture of automobile dealers, a retail store and nightclub. The businesses are primarily located along the north side of Grand Avenue.
- **51st/Bethany Home** - 7 businesses in Glendale that would need to be acquired are located within this project area. These businesses are primarily automobile sale/service-related and are located along the north side of Grand Avenue, north of Bethany Home Road.
- **67th/Northern** - 5 businesses in Glendale that would need to be acquired are located within this project area. This is significantly less than the 28 businesses that would need to be acquired under Option 4. The primary reason is that the strip retail centers and the Canyon Business Center, located within the Option 4 alignment right-of-way, would not need to be acquired.

Number of Industrial Businesses Taken

A measure of the number of the operating industrial businesses acquired was also used to compare the two options. As shown in Exhibit 8.26 the industrial businesses that ADOT would need to acquire were identified for each project area. Examples of the types of businesses classified as industrial that may be acquired include:

- Distribution/Warehouse
- Equipment storage

- Manufacturing
- Manufactured (mobile) home sales
- Office warehouse complex
- Rail dependant businesses
- Recycling centers
- Self-storage, mini-storage units

Exhibit 8.26
Number of Industrial Businesses Taken

Criterion Businesses Taken
Measure The number of industrial businesses that would be acquired for the project were identified

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Full – 4 Partial – 0	Full – 3 Partial – 1
43 rd / Camelback	Full – 1 Partial – 0	Full – 3 Partial – 0
51 st / Bethany Home	Full – 2 Partial – 0	Full – 1 Partial – 0
55 th / Maryland	Full – 2 Partial – 0	Same as Option 4
59 th / Glendale	Full – 1 Partial – 0	Same as Option 4
67 th / Northern	Full – 2 Partial – 0	Full – 12 Partial – 0
75 th / Olive	Full – 0 Partial – 0	Full – 1 Partial – 1
91 st / Loop 101	Full – 0 Partial – 0	Same as Option 4
Total Corridor	Full – 12 Partial – 0	Full – 23 Partial – 2

Under Option 4, ADOT would need to fully acquire a total of 12 industrial businesses. Warehouse/storage is the most prevalent industrial-type businesses throughout the project areas under Option 4. In the City of Phoenix, the 27th/ Thomas project area has the most industrial businesses that would need to be acquired. This segment contains four industrial businesses; they include Distribution Motors, P.J. Bennick Equipment Storage, National Dry Goods Supply, and Electric Rewinding Company. These businesses are primarily located along Grand Avenue, west of 27th Avenue. The remaining 8 industrial businesses that would be acquired are in the City of Glendale. These businesses are dispersed throughout 5 project areas.

Under Option 5, ADOT would need to fully acquire a total of 23 industrial businesses and partially acquire 2 businesses. Warehouse/storage and mobile homes sales are the most prevalent industrial-type businesses that would be acquired. Four industrial businesses would be acquired in the City of Phoenix. These businesses include three at the 27th/Thomas project area (P.J. Bennick Equipment Storage, National Dry Goods Supply, and Electric Rewinding Company) and one at the 43rd / Camelback Road project area (Michigan Trailer Sales). In the City of Glendale, the 67th/Northern Avenue project area has the most industrial businesses to acquire. This segment contains 12 industrial businesses; which include mobile homes sales/storage (5), utility/self-storage (2), automobile salvage yard, lumber salvage yard, Baseline Coolers, Webb Distributor, and Castle Rock Industries. These businesses are primarily located along the north side of Grand Avenue. In addition, industrial businesses in the City of Glendale would be acquired at the 43rd /Camelback, 51st / Bethany Home, 55th / Maryland, 59th Glendale

project areas. Finally, in the City of Peoria, one full acquisition, a mini-storage facility and one partial acquisition (a portion of a warehouse site) would need to be acquired at the 75th/ Olive project area.

Summary of Businesses Taken Criterion

Based on the number of businesses that would need to be acquired, Option 5 is preferred for this impact criterion, with only 57 businesses that would be acquired, versus 76 businesses acquired under Option 4.

8.3.3 Neighborhoods Impacted

The two options were evaluated based on their impact to neighborhoods surrounding the project area. Four measures were used to evaluate the options under this criterion. They include the following:

1. Environmental impacts of the overpass on the neighborhood residential areas
2. Number of community services taken
3. Accessibility impacts on the neighborhood
4. Traffic volume impacts

The preferred option under this criterion would have the fewest environmental impacts associated with the overpass on neighborhood residential areas, take the fewest number of community services, affect the accessibility of neighborhoods the least, and result in the least amount of traffic cutting through neighborhoods.

Environmental Impacts

This measure evaluated the visibility of the overpass from residential areas and air quality near neighborhoods.

Visual Impacts

The visual impacts of the proposed overpasses were evaluated according to the overall length of the overpasses and the proximity of the overpasses to neighborhoods. This measure compares the overpass length at each project area and identifies residential areas in the vicinity of the overpass. Exhibit 8.27 summarizes the comparison.

Exhibit 8.27
View Impacts to Neighborhoods

Criterion Neighborhoods Impacted
Measure Identifies whether the overpass would be visible from residential areas as a result of the project.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Overpass length: 4,000 LF Overpass would be adjacent to residential neighborhood	Same as Option 4 Same as Option 4
43 rd / Camelback	Overpass length: 4,900 LF Overpass would be visible to residential area northeast of project area	Overpass length: 4,350 LF Overpass would be slightly visible to residential neighborhood
51 st / Bethany Home	Overpass length: 3,200 LF Overpass would be visible to residential neighborhood northeast of project area, but further from residential areas than Option 5	Overpass length: 4,900 LF Overpass would be visible to residential area east and northeast of project area
55 th / Maryland	Overpass length: 3,100 LF East side portion of overpass would be visible to residences east of 54 th Ave.	Same as Option 4 Same as Option 4
59 th / Glendale	Underpass length: 4,900 LF Underpass would improve visual aesthetics	Same as Option 4 Same as Option 4
67 th / Northern	Overpass length: 3,800 LF North end of overpass would be visible and very near mobile home park and apartments west of 67 th Ave.	Overpass length: 6,500 LF Overpass would be slightly visible to apartments on west side of 67 th Ave.
75 th / Olive	Overpass length: 3,500 LF Overpass would be visible to residences along 75 th Ave. (north of Olive Ave.) and residences on north side of Olive Ave. at 73 rd Dr.	Overpass length: 8,500 LF Same as Option 4
91 st / Loop 101	No discernible community impacts.	Same as Option 4
Total Corridor	Total overpass length: 22,500 LF Overpasses are slightly less visible to residential neighborhoods than Option 5	Overpass length: 31,350 LF Overpasses are slightly more visible to residential neighborhoods than Option 4

The following visual impacts to the residential neighborhoods are encountered under Option 4.

- **Overpass length** - The total length of roadway along the Grand Avenue corridor that would be elevated is 22,500 linear feet (this does not include the length of the underpass at 59th / Glendale). The overpass would be longest at the 43rd / Camelback intersection (4,900 linear feet) and shortest at the 55th / Maryland intersection (3,100 linear feet).
- **Vicinity to residential neighborhood** - The overpasses would pass nearest to residential areas at the project areas described below.
 - 27th / Thomas – the overpass, at its highest elevation, would pass within 50 feet of a residential neighborhood of single family homes.
 - 43rd / Camelback – the eastern portion of the overpass would be adjacent to single family residences and apartments complex on the north side of Grand Avenue. The overpass would also pass next to the residential area near the intersection of Grand Avenue and Camelback Road, but most of these residences would be acquired for this project.
 - 67th / Northern – the northern portion of the overpass would be adjacent to a residential neighborhood of single family residences on the east side of 67th Avenue.

The following visual impacts to the residential neighborhoods are encountered under Option 5.

- **Overpass length** - The total length of roadway along the Grand Avenue corridor that would be elevated is 31,350 linear feet (this does not include the length of the underpass at 59th / Glendale). The overpass would be longest at the 75th / Olive intersection (8,500 linear feet) and shortest at the 55th / Maryland intersection (3,100 linear feet).
- **Vicinity to residential neighborhood** - The overpasses would pass within 200 feet of residential areas at the project areas described below.
 - 27th / Thomas – as with Option 4, the overpass, at its highest elevation, would pass within 50 feet of the residential neighborhood.
 - 43rd / Camelback – the south end of the overpass would be adjacent to an apartment complex on the north side of Grand Avenue. The overpass would also pass next to the residential area near the intersection of Grand Avenue and Camelback Road, but most of these residences would be acquired for this project.
 - 51st / Bethany Home – the southern end of the overpass would be approximately 200 feet from a residential neighborhood, with agricultural land between the overpass and residential area.
 - 75th / Olive – the overpass, at its highest elevation, would pass near (150-500 linear feet) to two residential neighborhoods.

Air Quality Impacts

Air quality impacts on neighborhoods were evaluated based on expected delay at the intersections. Traffic flow would improve by eliminating the six-legged intersections. When a direction of travel is removed from the six-legged intersection, the length of delay to motorists

would be reduced at the intersection. This reduction in traffic stopped at red lights would improve the air quality around the intersections. This measure compared the options according to the total projected peak hour delay for each intersection for the year 2020. A summary of air quality impacts to neighborhoods is shown in Exhibit 8.28.

Exhibit 8.28 **Air Quality Impacts to Neighborhoods**

Criterion Neighborhoods Impacted
Measure Determines which option has the greatest decrease in CO₂ concentrations due to reduced traffic delays at intersections as a result of the project.

Location	Option 4	Option 5
27 th / Thomas	Decrease in CO ₂ concentrations due to reduced intersection travel time delay	Intersection travel time delay would be greater, thus CO ₂ concentrations would not decrease as much as Option 4
43 rd / Camelback	Intersection travel time delay would be greater than Option 5, thus CO ₂ concentrations would not decrease as much	Decrease in CO ₂ concentrations due to reduced intersection travel time delay
51 st / Bethany Home	Intersection travel time delay would be greater than Option 5, thus CO ₂ concentrations would not decrease as much	Decrease in CO ₂ concentrations due to reduced intersection travel time delay
55 th / Maryland	Decrease in CO ₂ concentrations at intersections due to reduced travel time delay	Same as Option 4
59 th / Glendale	Decrease in CO ₂ concentrations due to reduced intersection travel time delay	Intersection travel time delay would be greater than Option 4, thus CO ₂ concentrations would not decrease as much
67 th / Northern	Intersection travel time delay would be greater, thus CO ₂ concentrations would not decrease as much as Option 5	Decrease in CO ₂ concentrations due to reduced intersection travel time delay
75 th / Olive	Decrease in CO ₂ concentrations due to reduced intersection travel time delay	Intersection travel time delay would be greater than Option 4, thus CO ₂ concentrations would not decrease as much
91 st / Loop 101	Slight increase in CO ₂ concentrations due to increased intersection travel time delay	Same as Option 4
Total Corridor	Overall intersection travel time delay is slightly greater than Option 5, thus CO ₂ concentrations would not decrease as much as Option 5	Intersection travel time delay is slightly less than Option 4, thus CO ₂ concentrations would decrease slightly more than Option 4

The estimated traffic delay for Option 4 would be less than the estimated delay for Option 5 at three of the project areas. Based on this reduction in the delay time of traffic stopping at the intersections, the air quality would improve at these intersections more under Option 4 than Option 5. Likewise, the estimated traffic delay for Option 5 would be less than the estimated delay for Option 4 at three of the project areas, thus the air quality would improve at these intersections more under Option 5 than Option 4. Option 5 is marginally preferred over Option 4 because the overall corridor-wide traffic delay is reduced more in Option 5 than in Option 4. The project locations are listed below under the option that improves the air quality the most for that location.

Option 4

- 27th/ Thomas
- 59th/ Glendale
- 75th/ Olive

Option 5

- 43rd/ Camelback
- 51st/ Bethany Home
- 67th/ Northern

Community Services Taken

Some of the businesses that would be acquired to construct the project serve the neighborhoods. This measure determines which of the businesses acquired by ADOT (refer to Section 8.3.2) are community serving businesses. Community serving businesses are defined as commercial businesses that cater to the needs of residents of the community on a regular basis (approximately once a month or more frequently) and are located within (1 mile) of residential areas in the community. The preferred option would take the least number of community serving businesses. Community serving businesses acquired at each project area are identified in Exhibit 8.29

Under Option 4, ADOT would need to fully acquire a total of 17 community services. Nearly all of these community services would be acquired at three project areas. These include:

- **Phoenix** – a Burger King would be acquired at the 27th / Thomas project area.
- **Glendale** – 7 community serving businesses would be acquired at the Bethany Commercial Plaza at the 51st / Bethany Home project area, along with a Family Food Service. Community serving businesses that would be acquired at the other project areas include a retail store (55th / Maryland), a Circle K convenience market and an attorney's office (59th / Glendale), and five retail stores in a strip center (67th / Northern).

Under Option 5, ADOT would need to fully acquire a total of 8 community serving businesses. These businesses include:

- **Phoenix** – a Burger King would be acquired at the 27th / Thomas project area.
- **Glendale** – a nightclub would be acquired at the 43rd / Camelback project area. Community serving businesses that would be acquired at the other project areas include a retail store (55th / Maryland), a Circle K convenience market and an attorney's office (59th / Glendale), and a service station, veterinary clinic, and family lodge (67th / Northern).

Exhibit 8.29 Community Services Taken

Criterion: Neighborhoods Impacted

Measure: Neighborhood-serving businesses that would be acquired (taken) as a result of the project.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Burger King	Burger King
43 rd / Camelback	None	Night Club
51 st / Bethany Home	Bethany Commercial Plaza (7) Family Food Service	None
55 th / Maryland	Retail Store	Same as Option 4
59 th / Glendale	Circle K Convenience Market	Same as Option 4
67 th / Northern	Strip Retail (5)	Service Station Veterinary Clinic Family Lodge
75 th / Olive	None	
91 st / Loop 101	None	None
Total Corridor	16 Community Services	7 Community Services

Note: (#) Indicates when multiple businesses exist

Accessibility to Neighborhoods

Different impacts to accessibility to and from residential neighborhoods along the Grand Avenue Corridor would result under each option. This measure evaluates changes to the accessibility of residential neighborhoods under each option. Specific accessibility impacts were identified and compared for each option. Exhibit 8.30 compares the accessibility impacts for each option.

Accessibility impacts to and from residential neighborhoods under Option 4 are addressed below.

- **27th / Thomas** – no discernible accessibility impacts.
- **43rd / Camelback** – access to southbound 51st Avenue from the residential area (east of 51st Avenue, north and south of Bethany Home Road) would require a 1/4 mile diversion to the north. Access from northbound 51st Avenue to the residential area (east of 51st Avenue, north and south of Bethany Home Road) would be eliminated.

Exhibit 8.30
Impacts on Accessibility to Neighborhoods

Criterion: Neighborhoods Impacted

Measure: Identifies changes in traffic routes for neighborhoods and residential areas caused by the project.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	No discernible accessibility impacts	No discernible accessibility impacts
43 rd / Camelback	Access in all directions would be maintained.	Access in all directions would be maintained
51 st / Bethany Home	Access to southbound 51 st Ave. from residential area (east of 51 st Ave., north and south of Bethany Home Rd.) would require a ¼ mile diversion to the north Access from northbound 51 st Ave. to residential area (east of 51 st Ave., north and south of Bethany Home Rd.) would be eliminated	Access in all directions would be maintained Access from southbound Grand Ave. to residential area east of 51 st Ave.) would involve travel through two intersections Access from the southern portion of the Grand Ave. corridor to sites along 51 st Ave. (north of Bethany Home Rd.) would travel through two intersections.
55 th / Maryland	Travel between residential area (east of 55 th Ave.) and northbound 55 th Ave. (south of Maryland Ave.) would be eliminated	Same as Option 4
59 th / Glendale	Southbound travel on Grand Ave. from residential areas (west of Grand Ave.) would be required to pass through the 59 th Ave./Glendale Ave. intersection to the 56 th Ave. on ramp Northbound travel on Grand Ave. from residential areas (west of Grand Ave.) would be required to pass through the 59 th Ave./Glendale Ave. intersection to the Myrtle Ave. or 56 th Ave. on ramp	Same as Option 4
67 th / Northern	No discernible accessibility impacts	Access to/from residential area (east of 67 th / north of Northern Ave.) would involve traveling through two intersections to the Grand Ave. southbound on ramp and returning via the northbound off ramp.
75 th / Olive	Travel would be eliminated from eastbound Olive Ave. (south of 75 th) to residential area (north of Olive Ave., east of 75 th Ave.)	No discernible accessibility impacts
91 st / Loop 101	Accessibility would be improved to Loop 101, north of Grand Ave.	Same as Option 4
Total Corridor	Travel routes between residential areas and the underpass/overpass would be eliminated at three intersections	Accessibility from the residential neighborhoods to the route with the under/over pass would be eliminated at one intersection.

- **55th / Maryland** – travel between residential area (east of 55th Avenue) and northbound 55th Avenue (south of Maryland Avenue) would be eliminated.
- **59th / Glendale** – southbound travel on Grand Avenue from the residential areas (west of Grand Avenue) to the 56th Avenue on-ramp would be required to pass through the 59th / Glendale intersection. Northbound travel on Grand Avenue from residential areas (west of Grand Avenue) to the Myrtle Avenue or 56th Avenue on ramp would be required to pass through the 59th / Glendale intersection.
- **75th / Olive** – travel would be eliminated from eastbound Olive Avenue (south of 75th Avenue) to the residential area (north of Olive Avenue, east of 75th Avenue)

Under Option 5, accessibility would be maintained in all directions, at all the project areas, with the exception of the 55th / Maryland and 59th / Glendale project areas. These locations would have the same impacts to accessibility as described for Option 4.

Neighborhood Traffic Volume Impacts

Although the elimination of six-legged intersections will improve traffic flow along Grand Avenue and the arterial streets, it will require some traffic to be rerouted. Potential increased traffic volumes to residential neighborhoods as a result of traffic flow changes were identified and compared for each option. Exhibit 8.31 compares the potential increased traffic volumes adjacent to the neighborhoods for each option.

Under option 4, traffic circulation changes would potentially result in increased traffic volumes for neighborhoods as follows:

- **27th / Thomas** – Vehicles from the industrial area north of Grand Avenue would likely travel via Cherry Lynn Drive and 27th Avenue to access the southbound Grand Avenue on-ramp. This would likely increase traffic (especially trucks) on southbound 27th Avenue, adjacent to the residential neighborhood on 27th Avenue, north of Thomas Road.
- **43rd / Camelback** – Direct access between Camelback Road and 43rd Avenue would be eliminated. Westbound Camelback Road travel to 55th Avenue would require travel via 41st Drive and Medlock Drive, which are located in a residential area.
- **55th / Maryland** – Direct access between Maryland Avenue and 55th Avenue would be eliminated. Eastbound Maryland Avenue travel to 55th Avenue would require travel via 54th Avenue and McLellan Boulevard, which are also located in a residential area.
- **59th / Glendale** – A new on/off ramp would provide the direct access to north and southbound Grand Avenue. Traffic to and from this ramp would travel through a residential neighborhood.

As with Option 4, traffic would increase in residential neighborhoods in the 27th / Thomas, 55th / Maryland, and 59th / Glendale project areas under Option 5. Unlike Option 4, traffic would not increase in residential neighborhoods in the 43rd / Camelback project area.

Exhibit 8.31

Neighborhood Traffic Volume Impacts

Criterion: Neighborhoods Impacted

Measure: Identifies neighborhoods and residential areas what would likely experience increases in traffic volumes as a result of the project.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	Potential for increased traffic on southbound 27 th Ave. (adjacent to residential neighborhood) traveling to the Grand Ave. on ramp.	Same as Option 4
43 rd / Camelback	Traffic would likely increase through residential area on 41 st Dr. and Medlock Ave. to accommodate southbound 43 rd Ave. travel	No discernible impacts to neighborhoods
51 st / Bethany Home	No discernible impacts	Same as Option 4
55 th / Maryland	Traffic from eastbound Maryland Ave. to northbound 55 th Ave. would travel through the residential neighborhood (east of 55 th Ave.), causing increased traffic in the neighborhood	Same as Option 4
59 th / Glendale	Traffic would likely increase in residential areas due the requirement to take circuitous routes through the neighborhood to access Grand Ave.	Same as Option 4
67 th / Northern	No discernible impacts to neighborhoods	No discernible impacts to neighborhoods
75 th / Olive	No discernible impacts to neighborhoods	No discernible impacts to neighborhoods
91 st / Loop 101	No discernible impacts to neighborhoods	No discernible impacts to neighborhoods
Total Corridor	Traffic would likely increase on roads within three residential areas and adjacent to another residential area	Traffic would likely increase on roads within two residential areas and adjacent to another residential area

Summary of Neighborhood Impacts Criterion

The total amount of elevated roadway is less under Option 4 (22,500 linear feet) than Option 5 (31,350 linear feet). The overpasses would pass in close vicinity (less than 200 feet) to residential neighborhoods at three project areas under Option 4 and at four project areas under Option 5. Air quality would improve more under Option 4 at three intersections and more under Option 5 at three other intersections, however, the overall corridor-wide air quality would be improved more in Option 5 than in Option 4. A fewer number of community services would need to be acquired under Option 5 than Option 4 (8 businesses versus 17 businesses). Option 4 has numerous project areas that would negatively impact the accessibility to the neighborhood, while Option 5 maintains accessibility in all directions at most project locations. These are also fewer residential neighborhoods with traffic volume increases in Option 5 than Option 4. Overall, Option 5 has less impacts on neighborhoods in the study area than Option 4 and therefore, is the preferred option for this criterion.

8.3.4 Hazardous Materials

The Grand Avenue Corridor retains a total of 118 hazardous materials sites. These hazardous materials sites are composed of listings from more than one environmental record, or database. Between the two options, there is little difference in the number of sites affected within the corridor (15 sites under Option 4 versus 13 sites for Option 5). However, at the intersection of 51st Avenue and Bethany Home Road, Option 5 will not impact any known hazardous material concerns as compared to two sites affected in Option 4. Exhibit 8.32 summarizes the number of hazardous material sites affected at each project location.

Exhibit 8.32 Hazardous Materials

Criterion: Hazardous Materials

Measure: Hazardous materials sites affected by each proposed option within the general limits of construction

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	1 Site	1 Site
43 rd / Camelback	2 Sites	2 Sites
51 st / Bethany Home	2 Sites	None
55 th / Maryland	2 Sites	2 Sites
59 th / Glendale	4 Sites	4 Sites
67 th / Northern	1 Site	2 Sites
75 th / Olive	2 Sites	1 Site
91 st / Loop 101	1 Site	1 Site
Total Corridor	15 Sites	13 Sites

8.3.5 100-Year Flood Plain

A review of the Federal Emergency Management Agency Flood Insurance Rate Maps indicates that portions of the corridor are located within the 100-year floodplain. All 100-year floodplain areas, except those associated with the Grand Canal, are located along the northern side of Grand Avenue. Both options will encroach upon the floodplain at various locations along the study corridor. Option 4 will not affect the 100-year floodplain at 51st Avenue and Bethany Home Road intersection while Option 5 will impinge on the floodplain at that location. Exhibit 8.33 summarizes whether the floodplain is encroached upon at each project location. Option 4 encroaches upon the floodplain at 4 project locations while Option 5 encroaches at 5 project locations.

Exhibit 8.33 100-Year Floodplain

Criterion: 100-Year Floodplain

Measure: Potential impacts to existing floodplains relative to each proposed option within the general limits of construction were described in terms of whether or not the option encroached within the floodplain.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	None	None
43 rd / Camelback	Yes	Yes
51 st / Bethany Home	None	Yes
55 th / Maryland	None	None
59 th / Glendale	Yes	Yes
67 th / Northern	Yes	Yes
75 th / Olive	Yes	Yes
91 st / Loop 101	None	None
Total Corridor	4 Locations	5 Locations

8.3.6 Cultural Resources

There are numerous identified historic and prehistoric cultural sites within the Grand Avenue Corridor. Exhibit 8.4 identifies the number of listed, eligible / potentially eligible sites for the National Register of Historic Places (NRHP).

Historic features include historic habitations, structures / foundations, and historic districts. Prehistoric features include prehistoric villages, compounds, pit houses, platform and trash mounds, ball courts, burials, canals, agricultural features, artifact scatters, and sites of unknown types. All sites are eligible or potentially eligible for listing on the NRHP. A total of 11 sites are impacted under Option 4 while 12 sites are impacted under Option 5. The only difference in the two options is at the 51st/ Bethany Home Road project location. At this location, there are no known sites impacted under Option 4 as compared to one site being affected under Option 5. There are no historic / potentially historic districts impacted by either option.

As shown in Exhibit 8.35, there are no historic districts impacted by either option.

8.3.7 Section 4(f) Properties

There are numerous Section 4(f) properties within the study area. Section 4(f) properties in the study area include publicly-owned parks, public schools with open campuses, recreation areas, or wildlife and waterfowl refuges, or any significant historic site that is either listed on, or eligible

for, listing on the NRHP. Exhibit 8.35 tabulates the Section 4(f) properties impacted at each project location. Option 4 impacts 11 sites while option 5 impacts 12 sites.

Exhibit 8.34
Listed, Eligible/Potentially-Eligible Sites for NRHP

Criterion: Cultural Resources – Listed, Eligible/Potentially-Eligible Sites for NRHP

Measure: The number of listed, eligible/potentially-eligible sites for the National Register of Historic Places (NRHP) relative to each proposed option within the general limits of construction

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	3 Sites	3 Sites
43 rd / Camelback	1 Site	1 Site
51 st / Bethany Home	None	1 Site
55 th / Maryland	1 Site	1 Site
59 th / Glendale	5 Sites	5 Sites
67 th / Northern	None	None
75 th / Olive	1 Site	1 Site
91 st / Loop 101	None	None
Total Corridor	11 Sites	12 Sites

Exhibit 8.35
Section 4(f) Properties

Criterion: Section 4(f) Properties

Measure: The number of open campus schools, historic/potentially historic properties and/or districts, and public parks affected by either of the proposed options within the general limits of construction

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	3 Sites	3 Sites
43 rd / Camelback	1 Site	1 Site
51 st / Bethany Home	None	1 Site
55 th / Maryland	1 Site	1 Site
59 th / Glendale	5 Sites	5 Sites
67 th / Northern	None	None
75 th / Olive	1 Site	1 Site
91 st / Loop 101	None	None
Total Corridor	11 Sites	12 Sites

8.3.8 Acreage Needed for Right-of-Way

In order to construct either option, a substantial amount of property acquisition will be required to provide the right-of-way. The elimination of this property from the tax roles of the cities and county reduces their revenue. Use of this land for right-of-way, detention basins, landscaping and other related purposes eliminates the land from being used for other purposes. Accordingly, the option that requires more land is viewed less favorably. The cost of acquiring the land is dealt with in Section 8.4.1 and the elimination of the land uses on the property is dealt with in Sections 8.3.1, 8.3.2, and 8.3.3 above.

The acreage required for each option (see Exhibit 8.36) was measured from the CADD files developed for the project. The acquisition line was determined to include the approximate right-of-way requirements and, where appropriate the entire parcel if the function or access to the property would be substantially altered by the acquisition of the right-of-way. In many cases, the determination of whole takes versus partial takes is very preliminary. During the preparation of design concept reports and final design, decisions will be made on the most appropriate and cost effective disposition of each property.

Option 5 requires 74 acres more right-of-way than Option 4 (202 acres versus 128 acres). Large differences in required right-of-way for Option 5 over Option 4 occur at the 43rd/ Camelback, 51st/ Bethany Home, and 67th/ Northern project locations. Exhibit 8.37 summarizes required right-of-way at each project location.

Exhibit 8.36 Acreage Needed for Right-of-Way

Criterion: Minimize the land required for new right-of-way

Measure: Acreage of land required including land already purchased by ADOT for this project.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	24.2	22.4
43 rd / Camelback	27.8	44.5
51 st / Bethany Home	12.3	35.7
55 th / Maryland	22.8	22.9
59 th / Glendale	6.0	6.0
67 th / Northern	15.9	47.5
75 th / Olive	6.9	10.9
91 st / Loop 101	12.2	12.2
Total Corridor	128.2	202.3

8.3.9 Summary of Impact Evaluation

The primary advantages of Option 4 based on impacts are as follows:

- Acquisition of 144 residential units (36 residential units less than Option 5)
- Acquisition of 128 acres of land (74 acres less than Option 5)

The primary disadvantages of Option 4 based on impacts are as follows:

- Acquisition of 76 businesses (18 more businesses than Option 5)
- Acquisition of 63 businesses that serve the adjacent neighborhoods (33 more neighborhood businesses than Option 5)
- Increases the difficulty of accessibility to and from the neighborhoods at five project area locations (three more than Option 5)

The primary advantages of Option 5 based on impacts are as follows:

- Acquisition of 58 businesses (18 fewer businesses than Option 4)
- Acquisition of 30 businesses that serve the adjacent neighborhood (33 fewer neighborhood businesses than Option 4)
- Increases the difficulty of accessibility to and from the neighborhoods at only two project area locations (three less than Option 4)

The primary disadvantages of Option 5 based on impacts are as follows:

- Acquisition of 180 residential units (36 more residential units than Option 4)
- Acquisition of 202 acres of land would be required (74 more than Option 4)

There is relatively little difference between the two proposed options in terms of environmental considerations. The proposed intersection improvements at 51st Avenue and Bethany Home Road are the only location where subtle differences in the two options were identified in terms of environmental considerations. At this time, it is not possible to distinguish the difference among the magnitude of impacts to hazardous materials sites versus 100-year floodplain encroachment versus cultural resource sites. This level of evaluation will occur during the National Environmental Policy Act (NEPA) process.

8.4 IMPLEMENTATION CRITERIA

The third set of criteria to be used in the evaluation of the two options for Grand Avenue is termed "Implementation." This group of criteria contains costs, uncertainties, phasing, future expansion, funding and public and agency opinions. These criteria identify and compare the complications of trying to implement either of the options.

The measures used for each criterion are listed in Exhibit 8.37. The following sections will describe the criteria and the evaluation of the two options. Section 8.4.7 contains a summary of the evaluation based on the implementation criteria.

Exhibit 8.37
Service Criteria and Measures

<i>Criterion</i>	<i>Measures</i>
Cost of Construction and Right-of-Way	<ul style="list-style-type: none"> • 1999 cost estimate
Engineering Issues and Uncertainties	<ul style="list-style-type: none"> • Major utility conflicts • Drainage features • Design complexity
Phased Construction Opportunities	<ul style="list-style-type: none"> • Provide finished roadway project with consistent roadway design features
Future Expansion Potential	<ul style="list-style-type: none"> • Footage needed to obtain full access control • # of signals that cannot be removed from Grand

8.4.1 Cost of Construction and Right-of-Way

Preliminary cost estimates have been completed for each of the Option 4 and 5 intersection locations. The unit prices are based on recent ADOT bid results with adjustments made to reflect the project location and difficulty of the work anticipated. The right-of-way cost was derived using data from a previous right-of-way estimate along Grand Avenue and judgement by the consultant team. ADOT Right-of-Way Section is doing an updated estimate. The results will be incorporated when they are available. A summary of the costs associated for each of the Option 4 and 5 intersections is presented in Exhibit 8.39. The potential LRT system and right-of-way, park and ride facilities, and local bus transfer facilities are not included in the estimates. The costs have been developed using “today’s” costs and have not been adjusted to reflect future inflation.

8.4.2 Engineering Issues and Uncertainties

The project options as developed for the MIS have been developed to a concept level. Based on this level of development, there are bound to be a number of areas where there is a high degree of unknowns that could result in higher costs or jeopardize the project schedule. The two options were evaluated subjectively to determine which one provides the least uncertainties that could lead to cost and schedule increases. The following factors were used for evaluating the two options, which is summarized in Exhibit 8.39:

- **Major Utility Conflicts:** Major utility conflicts may impact project costs and project schedule due to the type and complexity of utility impacted and prior rights. Coordination with the impacted utilities will require long lead time to minimize impacts to schedule and costs.

- **Drainage Features:** The Flood Control District of Maricopa County (FCDMC) has recently completed the Maryvale Area Drainage Master Study (ADMS), which included the area along Grand Avenue. The ADMS identified seven ponding areas along Grand Avenue and identified mitigation options to the flooding potential. The mitigation option includes a series of detention basins and interceptor storm drains along Grand Avenue. The alternatives will be evaluated to determine if the impacts to the ponding areas and the feasibility of improving the ponding conditions through joint ventures with ADOT and the FCDMC.
- **Design Complexity:** Local access issues near each grade separation could escalate construction and right-of-way costs and create project delays due to resistance of property owners and local governments.

Railroad crossing restrictions and long lead time coordination will be required with the railroad company, which may impact project schedule.

Exhibit 8.38 Cost Estimate Summary

Criterion: Cost of Construction and Right-of-Way

Measure: 1999 Cost

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas		
Total Construction Cost	\$15,215,000	\$16,180,000
Total Right-of-Way Cost	\$8,465,000	\$7,681,000
Contingency (5%)	\$1,184,000	\$1,193,000
Total Project Cost	\$24,864,000	\$25,054,000
43rd / Camelback		
Total Construction Cost	\$14,209,000	\$15,586,000
Total Right-of-Way Cost	\$10,238,000	\$11,599,000
Contingency (5%)	\$1,222,000	\$1,359,000
Total Project Cost	\$25,669,000	\$28,544,000
51st / Bethany Home		
Total Construction Cost	\$9,433,000	\$15,831,000
Total Right-of-Way Cost	\$6,927,000	\$14,074,000
Contingency (5%)	\$818,000	\$1,495,000
Total Project Cost	\$17,178,000	\$31,400,000
55th / Maryland		
Total Construction Cost	\$7,833,000	\$9,445,000
Total Right-of-Way Cost	\$9,748,000	\$9,870,000
Contingency (5%)	\$879,000	\$966,000
Total Project Cost	\$18,460,000	\$20,281,000
59th / Glendale		
Total Construction Cost	\$19,660,000	\$24,833,000
Total Right-of-Way Cost	\$4,693,000	\$4,699,000
Contingency (5%)	\$1,218,000	\$1,477,000
Total Project Cost	\$25,571,000	\$31,009,000
67th / Northern		
Total Construction Cost	\$12,305,000	\$26,211,000
Total Right-of-Way Cost	\$11,564,000	\$21,950,000
Contingency (5%)	\$1,193,000	\$2,408,000
Total Project Cost	\$25,062,000	\$50,569,000
75th / Olive		
Total Construction Cost	\$14,639,000	\$20,771,000
Total Right-of-Way Cost	\$5,681,000	\$5,422,000
Contingency (5%)	\$1,016,000	\$1,310,000
Total Project Cost	\$21,336,000	\$27,503,000
91st / Loop 101		
Total Construction Cost	\$6,970,000	\$6,970,000
Total Right-of-Way Cost	\$2,652,000	\$2,652,000
Contingency (5%)	\$481,000	\$481,000
Total Project Cost	\$10,103,000	\$10,103,000
Total Corridor		
Total Construction Cost	\$100,264,000	\$135,827,000
Total Right-of-Way Cost	\$59,968,000	\$77,947,000
Contingency (5%)	\$8,011,000	\$10,689,000
Total Project Cost	\$168,243,000	\$224,463,000

Exhibit 8.39

Uncertainties That Could Increase Cost or Affect Schedule

Criterion: Uncertainties that could increase cost and impact project schedule.

Measure: Major utility conflicts, drainage features, design complexities.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27 th / Thomas	<p>Major Utility Conflicts: APS overhead power along Thomas and 27th Ave will need to be relocated. Prior rights will need to be determined to assess additional costs.</p> <p>Drainage Features: The improvements encroach into a ponding area and a proposed FCDMC detention basin. Opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Railroad Spur crossing restrictions and long lead time coordination is required. Requires routing traffic onto city collector streets.</p>	<p>Same as Option 4. The north-westbound Grand traffic does not have the same level of access to Thomas and 27th as the south-eastbound Grand traffic.</p>
43 rd / Camelback	<p>Major Utility Conflicts: Overpass profile will conflict with the 230 kV power line and local power distribution lines. Potential bridge pier conflicts the MCI fiber optic cable and SRP irrigation lines.</p> <p>Drainage Features: The improvements encroach into a proposed FCDMC detention basin. Lower opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Local access issues and railroad crossing coordination.</p>	<p>Major Utility Conflicts: Potential conflicts with SRP irrigation.</p> <p>Drainage Features: Opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Local access issues are minimized.</p>
51 st / Bethany Home	<p>Major Utility Conflicts: Overpass profile will conflict with the 230 kV power line and local distribution power line. Potential bridge pier conflicts with the MCI fiber optic cable.</p> <p>Drainage Features: The improvements encroach into a ponding area. Lower opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: local access issues and railroad crossing coordination.</p>	<p>Major Utility Conflicts: Overpass profile will conflict with the local distribution power line.</p> <p>Drainage Features: The improvements encroach into a proposed FCDMC detention basin. Opportunity for cost sharing for flood mitigation improvements.</p>
55 th / Maryland	<p>Major Utility Conflicts: Overpass profile will conflict with the 230 kV power line. Potential bridge pier conflicts with the MCI fiber optic cable.</p> <p>Design Complexity: Local access issues and railroad mainline and yard crossing coordination.</p>	<p>Same as Option 4</p>

Exhibit 8.39 (cont.)
Uncertainties That Could Increase Cost or Affect Schedule

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
59 th / Glendale	<p>Major Utility Conflicts: Requires relocation and rerouting of all underground utilities and relocation of the 230 kV power line and local distribution power lines.</p> <p>Drainage Features: Requires a pump station and a storm drain collector system.</p> <p>Design Complexity: Local access issues. Requires a new railroad at-grade crossing for 61st, and significant local / collector street modifications. Maintenance of the traffic will be a significant issues with local agencies and public.</p>	Same as Option 4, plus 230 kV power line, shoring for historical building
67 th / Northern	<p>Major Utility Conflicts: Overpass profile will conflict with the 230 kV power line and local power distribution lines. Potential conflicts with the MCI fiber optic cable and SRP well site and irrigation lines.</p> <p>Drainage Features: Lower opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Local access issues and railroad crossing coordination.</p>	<p>Major Utility Conflicts: Overpass profile will conflict with the local power distribution lines and SRP well site and irrigation lines.</p> <p>Drainage Features: The improvements encroach into a proposed FCDMC detention basin. Opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: railroad spur crossing coordination.</p>
75 th / Olive	<p>Major Utility Conflicts: Overpass profile will conflict with the 230 kV power line. Potential conflicts with the MCI fiber optic cable and SRP irrigation lines.</p> <p>Drainage Features: The improvements encroach into a ponding area and a proposed FCDMC detention basin. Opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Local access issues and railroad crossing coordination.</p>	<p>Major Utility Conflicts: Potential conflicts with the MCI fiber optic cable and SRP irrigation lines.</p> <p>Drainage Features: The improvements encroach into a ponding area and a proposed FCDMC detention basin. Opportunity for cost sharing for flood mitigation improvements.</p> <p>Design Complexity: Railroad crossing coordination.</p>
91 st / Loop 101	<p>Major Utility Conflicts: Potential conflicts with the MCI fiber optic cable, SRP irrigation lines and SRP 69 kV power line.</p> <p>Design Complexity: Local access issues. Railroad crossing coordination for the at-grade crossing improvements.</p>	Same as Option 4
Total Corridor	Option 4 has more utility conflicts especially with the 230 kV line and coordination with the railroad and the MCI fiber optic line in railroad right-of-way. Access issues have a greater potential to increase costs and delay projects. Lower opportunity to share cost with the FCDMC to improve the flooding conditions. Requires more coordination effort with the railroad company, which can impact project schedule.	

8.4.3 Phased Construction Opportunities

Phasing of the project is important because of funding limitations and the time needed to prepare the projects for construction and to purchase right-of-way. Funding for the project is included in the 10-year program for ADOT and the funds appear to be available over the next decade. However, the funding will not be available at one time so that it is necessary to phase the construction of improvements along Grand Avenue. ADOT plans to move forward with the project development process following the conclusion of this Major Investment Study. The development process including final design and right-of-way acquisition will take several years to accomplish. ADOT plans to move forward with one or more intersections at a time based upon funding availability.

The two options for Grand Avenue as defined in Chapter 6 each consists of projects at eight separate locations. Therefore, by definition, either option can be constructed in phases. The differences between the options is in the compatibility of the newly constructed project with the existing roadways that will remain in service. Option 4 is planned to result in finished projects. The typical sections and design elements are generally compatible with the existing roadways. The result will be completed projects that are expected to function for many years.

Option 5 proposes to build sections of new expressway and tie those sections into existing Grand Avenue. The design speed, outside shoulder, and inside shoulder with median barrier are not consistent with existing Grand Avenue. Although Option 5 can be built in phases and expected to function adequately, there will be inconsistencies in the new and old roadways. This situation could create some driver confusion and could cause some drivers to drive the older sections at the same speed and level of awareness as they drive the new sections of roadway. As a result, Option 4 is rated higher than Option 5 for this criterion as indicated in Exhibit 8.40.

8.4.4 Future Expansion Potential

As indicated in the previous section, the two options have each been defined as a series of eight separate projects. One of these options is currently expected to be completed by 2010. Growth and development are expected to continue long after this date so that the need to continue improvements in the corridor will continue. The ultimate goal of the project is to create an expressway in the corridor as well as accomplish the more immediate goals and objectives as identified in Chapter 2. This criterion is established to identify and measure how well the two options can be improved beyond the projects defined in this study and evolved into a higher type roadway.

Before defining the measures for this criterion, it is pertinent to define an “expressway.” The term expressway has a variety of meanings as used in various parts of the nation. There is no common definition for expressway as there is for “freeway.” In general, an expressway in an urban environment is a roadway that has less property access and fewer traffic signals than a typical arterial or major street. Having complete control of access and no traffic signals is not necessary for a roadway to be called an “expressway.”

Exhibit 8.40

Phased Construction

Criterion: Phased Construction – Provide opportunities to phase construction improvements to Grand Avenue Corridor to meet funding availability and project development time frames. The options have been defined to be eight separate projects; therefore, the options are the same for the primary measure of this criterion.

Measure: Provide finished roadway project with consistent roadway design features.

<i>Location</i>	<i>Option 4</i>	<i>Option 5</i>
27th / Thomas	Roadway cross section compatible with existing Grand	Shoulders, median barrier, design speed are different than existing Grand; new sections have full access control while existing Grand does not
43rd / Camelback	Roadway cross section compatible with Camelback	Shoulders, median barrier, design speed are different than existing Grand; new sections have full access control while existing Grand does not
51st / Bethany Home	Roadway cross section compatible with 51st	Shoulders, median barrier, design speed are different than existing Grand; new sections have full access control while existing Grand does not
55th / Maryland	Roadway cross section compatible with Maryland	Four-lane arterial cross section is not compatible with existing street; additional improvements to Maryland are desired
59th / Glendale	Four-lane underpass on Grand will require land drop at 57th Drive and 61st	Cross section is compatible with existing Grand
67th / Northern	Roadway cross section compatible with 67th	Shoulders, median barrier, design speed are different than existing Grand; new sections have full access control while existing Grand does not
75th / Olive	Roadway cross section compatible with Olive	Shoulders, median barrier, design speed are different than existing Grand; new sections have full access control while existing Grand does not
91st / Loop 101	Options are the same and are compatible with 91st and Loop 101	Options are the same and are compatible with 91st and Loop 101
Total Corridor	Provides eight complete independent projects	Provide eight independent projects but cross sections and concept are not compatible with existing Grand and will require completion of the portions of Grand between projects

Two measures for this criterion have been developed. The first is the linear footage along one side of the road that would have private property access after the eight projects have been completed. The second measure is the number of traffic signals that would remain on Grand Avenue. After the eight projects are completed for either of the options, it is possible to continue to improve Grand Avenue by buying additional abutting property to eliminate driveway access and to disconnect local and collector streets from Grand Avenue. To accomplish the latter, additional right-of-way would be needed to reroute the streets to connect with each other rather than to intersect with Grand Avenue. Examples of such streets include Osborn Road and 31st Avenue east of Grand Avenue and west of Grand Avenue, 33rd Street and Weldon Avenue (just north of Grand Canal), 37th and 39th Avenues, 47th Avenue and Missouri Avenue, and 71st Avenue and Butler Drive. Disconnecting these streets from Grand Avenue would eliminate three existing traffic signals and eliminate pressure for additional traffic signals in the future.

In Section 8.2.3, the extent of access control that would be established along Grand Avenue was quantified. A table is included in the Appendix that lists the linear footage along Grand Avenue that would have access control with each option. With Option 4, 63% of the frontage along Grand Avenue would have access control. With Option 5, 74% of the frontage would have access control. One measure of the potential to expand Grand Avenue is the additional linear footage that would be needed to establish full control of access from abutting property. Option 5 would require obtaining 14,000 less additional footage to have full control access as compared to Option 4. The difference is due to the fact that the Option 5 improvements are along Grand Avenue and include full access control in the individual project areas. Four of the projects in Option 4 are on cross streets and do not increase the access control on Grand Avenue.

The second measure is the number of traffic signals that cannot be removed from Grand Avenue. As indicated above, it appears possible through additional right-of-way acquisition to eliminate existing traffic signals at Osborn Road, 31st Avenue, and 33rd Avenue. These signals could be eliminated with either Option 4 or 5. Signals that do not appear possible to eliminate with either option include 35th Avenue, 57th Drive and Orangewood Drive (proposed with both options), the three signals near downtown Peoria (no improvements are planned), 91st Avenue, and the two with existing ramps for Loop 101. Therefore, there are nine signals that cannot be removed with either option as currently envisioned. In addition, Option 4 will require traffic signals on Grand Avenue at 43rd Avenue, a new connector road from Camelback Road, Bethany Home Road, Northern Avenue, and 75th Avenue. Accordingly, these five signals bring the total number of signals on Option 4 to 14 compared to 9 on Option 5.

Based on this criterion and these two measures, Option 5 has greater potential to be extended and improved to meet long-term future needs than does Option 4. The evaluation by measure is shown in Exhibit 8.41.

Exhibit 8.41

Future Expansion Opportunities

Criterion: Future Expansion Opportunities – Provide an interim project that can be expanded to meet future capacity needs and that can be upgraded to a controlled access facility. This criterion must be evaluated on the options as a whole instead of by project location.

Measure: The lineal footage of abutting property needed to control access and the number of signals that cannot be eliminated from Grand.

<i>Measure</i>	<i>Option 4</i>	<i>Option 5</i>
Footage Needed for Access Control	46,530 linear feet (37%)	32,010 linear feet (26%)
Number of Signals that Cannot Be Removed from Grand	14 signals	9 signals
Total Corridor		Option 5 can more easily be upgraded to provide a controlled access expressway from Loop 101 to the over-crossing of I-17

8.4.5 Summary of Implementation Evaluation

The primary advantages of Option 4 for implementation are as follows:

- Cost is \$56 million less than Option 5.
- Provides eight complete projects that fit with the remaining streets.

The primary disadvantages of Option 4 for implementation are as follows:

- Local access issues near each grade separation could escalate construction and right-of-way costs and create some project delays due to resistance of property owners and potentially local governments.
- More utilities will be encountered with Option 4, particularly the 230 kV power line.

The primary advantages of Option 5 for implementation are as follows:

- Fits better with long-term goal of creating an expressway that has limited access and few traffic signals along the Grand Avenue corridor.

The primary disadvantages of Option 5 for implementation are as follows:

- The high cost compared to Option 4.
- The eight phased projects produce roadway sections on Grand Avenue that are inconsistent with existing Grand Avenue. Some driver confusion may result.

8.5 FUNDING AVAILABILITY

In 1999, the Arizona Legislature passed an accelerated funding program for highways. ADOT has a total of \$161.4 million for improvements to Grand Avenue corridor in the ten year MAG System Life Cycle Program. The intent is to complete in the next decade improvements at the eight locations being studied as part of this project.

In addition, MAG has included projections of an additional \$352 million for Grand Avenue between 2008 and 2019. This money is intended to complete the expressway between Loop 101 and I-17.

Based upon this information, there appears to be adequate funds to complete either Option 4 or 5.

Most of the programmed or projected funds will come from the Regional Area Road Funds (1/2 cent sales tax) for Maricopa County. This funding program was established in 1986 and is anticipated to be continued beyond the 2006 sunset date. According to the *Arizona Revised Statutes*, 1996 Edition, *Arizona Criminal and Traffic Law Manual*, the monies in this fund must be spent on:

- The design, right-of-way purchase or construction of controlled-access highways which are included in the regional transportation plan of the county and which are accepted into the state highway system either as a state route or as a state highway or related grade separations of controlled-access highways which are included in the regional transportation plan of the county.
- The design and construction of interim roadways within the adopted corridors of the regional transportation plan of the county pursuant to subsection O of this section.

A “controlled access highway” is defined by statute as follows:

- A highway, street or roadway in respect to which owners or occupants of abutting lands and other persons have no legal right of access to or from except at such points only and in the manner determined by the public authority having jurisdiction over the highway, street or roadway.

Based on the above information, it appears that either Option 4 or Option 5 would be eligible for RARF monies. This interpretation is enhanced if the intent is to acquire the remaining properties along Grand Avenue so that full access control is obtained at some future date.

8.6 SUMMARY OF EVALUATION

In the preceding sections, the two options were evaluated based upon three groups of criteria: service, impacts and implementation. This evaluation was further summarized in Exhibits 8.1 through 8.3 at the beginning of this chapter.

Overall the two options are rated very nearly the same. Each option has advantages and disadvantages. Option 5 meets most of the service criteria slightly better than Option 4, however, Option 4 provides four more grade separations with the railroad. These grade separations are very important in the high train activity area between Glendale Avenue and Camelback Road.

Option 5 provides a higher type roadway with full inside and outside shoulders. This type roadway is generally safer and more pleasant for motorists. These factors are difficult to quantify.

The two options have similar impacts. Option 4 takes more businesses but Option 5 takes more residences and impacts one more neighborhood.

For implementation, Option 4 costs less and lends itself better to the phased construction needs while Option 5 has fewer uncertainties that could affect cost and schedule and is better suited for future expansion. The cost of obtaining full access control along Grand Avenue has not been included in the cost estimates. The additional cost is greater for Option 4.

If the decision is for Option 4, then the choices at each location should be examined. With Option 4, it may be better to use the Option 5 concept at a given location. Such mixing and matching is possible with Option 4 and not with Option 5.

Based on the premise that Option 4 is selected, the following comments are offered for each location:

27th / Thomas

The options differ only in the way that access is provided between Grand Avenue and the two arterial streets. Option 4 utilizes Osborn Road and 31st Avenue for connections to 27th Avenue and Thomas Road respectively on the northwest side and 23rd Avenue to connect to Thomas Road on the southeast side. Option 5 provides on and off ramps to and from the northwest and an on ramp to the southeast. 23rd Avenue would be used to connect to Thomas Road from the southeast. These localized access issues should be explored more completely in a Design Concept Report (DCR).

43rd / Camelback

The cost of Option 5 at this location is about 10% more than Option 4. This difference is not large given the large right-of-way costs and the uncertainty in these cost estimates. The Option 4 concept would take a new Airborne Express facility, alter the access to Staples retail store and disrupt the relocation plans of Home Depot. The Option 5 concept would also take some businesses but they are not as large and not as viable as those on Camelback. With Option 4 the

remaining Grand / Camelback intersection would be a 45 degree skew. Option 4 would provide a railroad grade separation that would be parallel to the Indian School Road grade separation located one mile south. In summary, consideration of the Option 5 concept with Option 4 in the remainder of the corridor has merit.

51st / Bethany Home

The 51st Avenue overpass would be considerably cheaper than Grand Avenue over Bethany Home Road and 51st Avenue. This grade separation would provide valued access to downtown Glendale. The Option 4 concept appears superior.

55th / Maryland

With Option 4, this grade separation loses a lot of importance. With new grade separations at 51st Avenue and at 67th Avenue, and given the very low traffic volume on Maryland Avenue and the high cost, this grade separation would be a very low priority. When it is constructed, the three-lane concept in Option 4 appears adequate.

If the overpass construction is delayed, consideration should be given to modifying the six legged intersection by removing one or more legs. The timing of the removals will be affected by the construction of the Grand Avenue underpass at the 59th / Glendale location, see below.

59th / Glendale

The cost differential between a six-lane and four-lane underpass for Grand Avenue is \$6 million or 22%. It appears that this cost may be justified to maintain lane continuity on Grand Avenue and to provide for the long term needs of the corridor. A lot of support for six lanes was obtained through the public meeting and public outreach process.

Construction of this underpass will require closure of Grand Avenue for an extended period of time. Traffic on Glendale and 59th Avenues will also be affected extensively. Such traffic disruption could impact downtown Glendale. The city should consider this potential impact and may want to consider a 59th Avenue overpass. An underpass for 59th Avenue is not considered to be feasible because of the need to maintain rail traffic during construction.

67th / Northern

The cost of the Option 5 concept is considerably more than Option 4. The railroad spur and the extensive right-of-way acquisition makes the Option 5 cost almost twice the cost of Option 4. If Option 4 is chosen, consideration should be given to moving the overpass to the east side of 67th Avenue. This variation can be considered during a DCR.

75th / Olive

The cost of Option 5 is estimated to be 33% more than Option 4. A portion of this cost difference is because Option 5 includes reconstruction of Grand Avenue to the Option 5 cross section from Olive Avenue to near Peoria Avenue. Option 4 includes widening Grand Avenue to six lanes to match existing Grand Avenue at Peoria Avenue.

The Option 4 concept with Olive Avenue going over provides a good east-west route connecting Loop 101 to the east. The Option 5 concept would enhance traffic between the downtown areas of Peoria and Glendale. Both options have merit.

91st / Loop 101

The options are the same. This connection has merit.



Chapter 9.0

PREFERRED OPTION

9.0 OVERVIEW

The Major Investment Study (MIS) has progressed through a series of tasks including identifying and analyzing existing transportation, socio-economic, and environmental conditions within the corridor. Eight project objectives were defined for the MIS:

1. Eliminate six-legged intersections
2. Eliminate railroad crossings
3. Improve regional mobility
4. Promote development opportunities
5. Improve aesthetics of the corridor
6. Serve the statewide function of US 60
7. Promote multi-modal uses in the corridor
8. Accommodate the projected travel demand in the corridor

There has also been extensive public involvement including public meetings held in April and July 1999, stakeholders meetings held in March and June 1999, agency briefings, public outreach presentations, and numerous telephone calls and e-mails from property owners, residents, and concerned citizens. The input from the public has been documented and presented to the Steering Committee. Based on responses to questionnaires, the public believes the first two objectives are the most important for this project.

The two roadway options are Option 4 – Alternative Grade Separations, and Option 5 – Limited Expressway. Both options eliminate the six-legged intersections. Option 4 emphasizes grade separations over the railroad, while Option 5 emphasizes travel along Grand Avenue.

As demonstrated in Chapter 8, both options meet the eight objectives to varying degrees, but Option 4 would do far more to eliminate railroad crossings and would cost less than Option 5. Option 4 provides much more flexibility in selecting the best direction for the grade separation at each individual location and enables the design features of the grade separations to better match the existing roadways that will remain in service.

This chapter presents the preferred option for the Grand Avenue Corridor, discusses the implementation strategies, and identifies issues that should be considered during the design process.

9.1 PUBLIC AND AGENCY OPINIONS

Public and agency participation has been a big part of this MIS. A Steering Committee was formed early in the process that consists of the affected cities, Maricopa Association of Governments, Maricopa County, Regional Public Transportation Authority, Burlington Northern Santa Fe Railroad, WestMarc and ADOT. This committee met six times during the study and served as a sounding board for agency opinions. In addition, a Stakeholder group was formed and two meetings were held, one in March and one in June 1999. This group represents property owners, community leaders, neighborhood associations, and others with a strong interest in the Grand Avenue Corridor. Public meetings were held in April and July. A questionnaire was administered at the public meetings to sample current opinions about the two options. In addition, a public outreach program was conducted in which project staff presented current project information to groups. Invitations to speak were actively pursued and 13 presentations were made. These presentations served to get project information to more people and to sample opinions. Chapter 10 provides a summary of the public input received during the study.

9.2 STEERING COMMITTEE RECOMMENDATION

Based on public input, the evaluation of the options, and their own agency input, the Steering Committee developed a recommendation to ADOT for improvements for the Grand Avenue Corridor. The following recommendation was adopted by the Grand Avenue Steering Committee on August 6, 1999:

The Grand Avenue Steering Committee recommends that Option 4 with modifications be implemented in the Grand Avenue Corridor. The modifications to Option 4 are to use the Option 5 concept at the 43rd / Camelback intersection and at the 59th / Glendale intersection. This recommendation allows Grand Avenue to be further upgraded to expressway standards by elimination of access and construction of additional grade separations along Grand Avenue as indicated in the MAG Long-Range Plan.

Priority guidelines for implementation of the eight projects are shown in Exhibit 9.1. The costs are based on the recommended direction for the grade separation. The eight projects are listed in recommended order of completion.

Exhibit 9.1
Priority Guidelines for Implementation

	Location	Recommended Grade Separation Direction	Estimated Cost 1999 (\$ millions)
1	27 th / Thomas	Grand	\$24.9
2	91 st / Loop 101	Ramps	\$10.1
3	51 st / Bethany Home	51 st Avenue	\$17.2
4	43 rd / Camelback	Grand*	\$28.5*
5	55 th / Maryland	Maryland	\$18.5
6	75 th / Olive	Olive	\$21.3
7	67 th / Northern	67 th Avenue	\$25.1
8	59 th / Glendale	Grand*	\$31.0*
Total			\$176.6

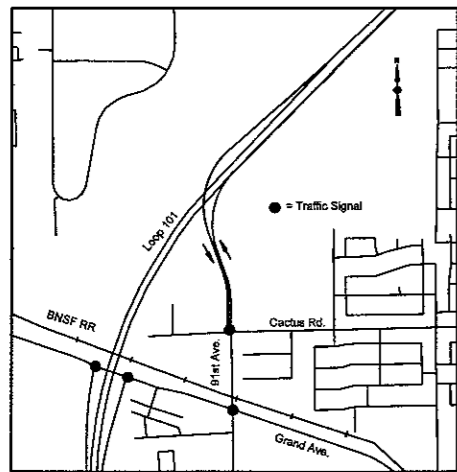
* Option 5 Concept

9.3 DESCRIPTION OF RECOMMENDED CONCEPT AT EACH LOCATION

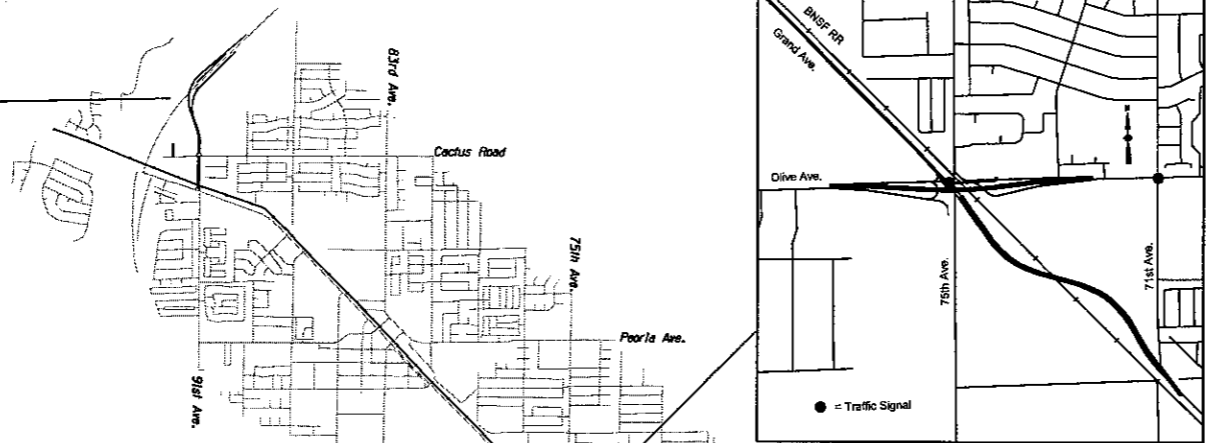
Following are descriptions of the recommendations at each of the eight locations. Please refer to Exhibit 9.2 for the overall general concept; to the slightly more detailed concepts in Chapter 6; and to the 200-scale drawings provided under separate cover. The recommendations are conceptual only and subject to refinement and modification during the preparation of design concept reports (DCRs) and final design.

27th / Thomas

The recommended concept is for Grand Avenue to be grade separated from 27th Avenue and Thomas Road. The general alignment swings Grand Avenue to the northeast of the existing Grand Avenue centerline in order to provide for reduced span lengths for the bridges crossing the two arterial streets and to enable the project to be built while traffic is maintained on existing Grand Avenue. The construction would begin just southeast of the Osborn Road intersection and would end at the existing Grand Avenue bridge over I-17.



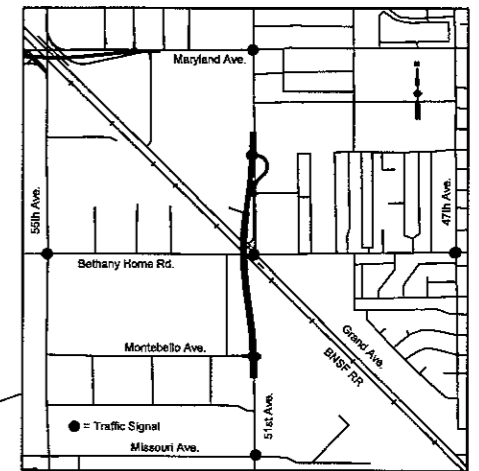
91st Ave. Ramps to Loop 101



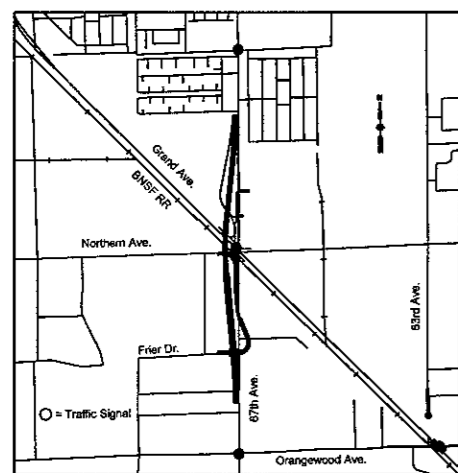
Olive Ave. Overpass at 75th / Grand



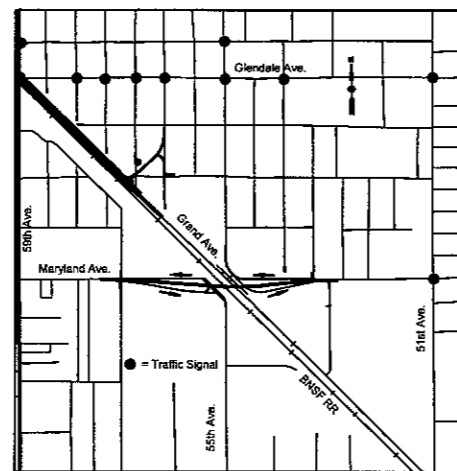
Grand Ave. Underpass at 59th / Glendale



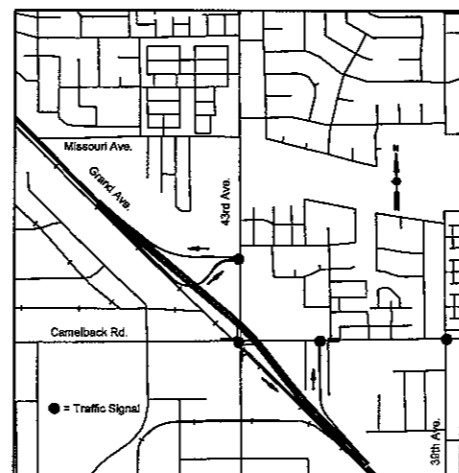
51st Ave. Overpass at Bethany Home / Grand



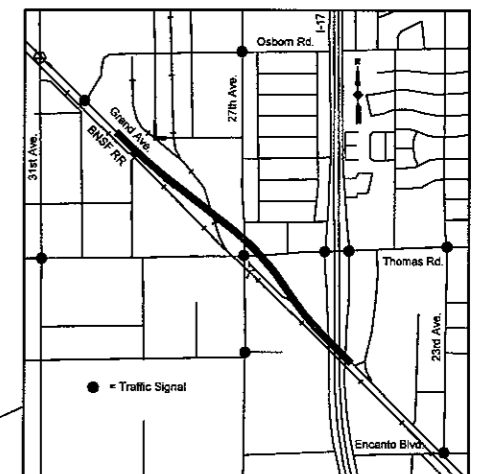
67th Ave. Overpass at Northern / Grand



Maryland Ave. Overpass at 55th / Grand



Grand Ave. Overpass at 43rd / Camelback



Grand Ave. Overpass at 27th / Thomas

GRAND AVENUE MAJOR INVESTMENT STUDY

Exhibit 9.2



URS Greiner Woodward Clyde

In Association With
BRW
Logan Simpson Design, Inc.
Partners for Strategic Action, Inc.

Recommended Roadway Concepts

- Traffic Signal
- Roadway Improvement

Exhibit 9-2 Blank

This project will eliminate the six-legged intersection and provide a standard four-legged intersection of 27th Avenue and Thomas Road. Depending on final decisions made in the DCR process, a fifth leg might be added to the intersection to accommodate southeast-bound traffic exiting from Grand Avenue.

The recommended cross sections for Grand Avenue are modified Section E (Exhibit 6.3) for the roadway and a modified Section J (Exhibit 6.5) for bridges and for the areas which require barrier at the edge of shoulder because of embankment slope steepness. These sections were identified for Option 5 but are recommended because they better fit the long-term needs on Grand Avenue. The recommended cross sections include three traffic lanes in each direction, 8-foot outside shoulder (plus 2 feet on bridges and where barrier is present), 4-foot inside shoulder, median barrier, and no sidewalk. The recommended shoulder widths are modified from those shown in Exhibit 6.3 and 6.5 to meet current ADOT design standards. Since there will be access control throughout the project length (a distance of approximately 4,300 feet), the shoulders are highly desirable to enable disabled vehicles to be moved out of the travel lane. The shoulders also provide space for bicycles and for pedestrians (in emergencies).

Connections between Grand Avenue and the two arterial streets (27th Avenue and Thomas Road) require additional study. Both Option 4 and Option 5 are included in the 200 scale recommended drawings and are shown in concept in Exhibits 6.8 and 6.17, respectively. Because of existing heavy turning movements, the southeast Grand to Thomas and northwest Grand to Thomas are of particular concern. The Option 4 concept would utilize collector streets Osborn Road, 31st Avenue and 23rd Avenues as the routes for traffic to or from Grand to either of the other two arterial streets. The configuration would increase traffic on these three collector streets and increase the travel distance and time for motorists. There is a school located along 23rd Avenue. Traffic that uses 31st Avenue will have to cross the railroad. The Option 4 concept includes realigning Osborn Road east of Grand so that it would intersect Grand at the 31st / Osborn west intersection. This configuration would eliminate a signal on Grand and provide a more direct connection between Grand and 27th Avenue; however, it would create a new six-legged intersection. Two of the six legs (31st north and Osborn west) would have very light traffic.

The Option 5 concept provides a direct southeast-bound ramp connection from Grand into the 27th / Thomas intersection. This ramp would introduce a fifth leg to the intersection but would directly accommodate the heavy southeast-bound movement to Thomas Road and to I-17. The northwest Grand to westbound Thomas or northbound 27th movement would utilize 23rd Avenue just as in Option 4. A potential alternative has been identified but requires further analyses in the design concept phase. The alternative would provide a northwest-bound off-ramp from Grand to Thomas Road. A new signal would be installed on Thomas to permit northbound Grand traffic to enter Thomas Road westbound. It may be possible to have this signal only interrupt eastbound Thomas traffic. The Grand traffic would enter a channelize area westbound on Thomas. The left turns from Thomas to 27th would remain prohibited as they are today. This configuration would not provide a connection from northwest-bound Grand to northbound 27th Avenue other than via 23rd Avenue and Thomas.

All of the above concepts and ideas have some drawbacks as well as some advantages. It is recommended that this issue be thoroughly analyzed during the DCR when specific public input can be received on the issue.

The 27th / Thomas area was identified by FCDMC as flood prone, and a concept for a retention basin was developed as part of the Maryvale Area Drainage Master Study (ADMS). Because of the high cost of land acquisition for the retention basin, the project was determined by FCDMC to be not cost effective. Subsequently, ADOT has purchased the old Pioneer Ford property and is in the process of trying to acquire some large parcels north of Thomas and west of 27th Avenue that will be needed for the roadway grade separation project. During the DCR, the potential of a joint project between ADOT and FCDMC should be explored. The joint project potentially could meet the drainage needs of the roadway project and help to mitigate the flood-prone condition in the area.

Existing pedestrian traffic in the area is limited. Sidewalks are intermittent along the northeast side of Grand and non-existent on the railroad side. Sidewalks are provided on the Grand Avenue bridge over I-17 and unpaved footpaths are evident southeast of I-17 along both sides of Grand. Pedestrian traffic should be discouraged on the new Grand Avenue overpass. Pedestrians should be routed to local and collector streets. Additional input from public meetings during the DCR is needed to finalize the recommendations.

There are local bus routes on each of the three arterial streets in the project area: Yellow route on Grand; Green route on Thomas; and 27 route on 27th Avenue. The Grand Avenue grade separation would disconnect the Yellow route from the other two or at least require long walking distances for those riders who transfer between the Yellow route and the other two. RPTA should be consulted during the DCR to determine the resolution of this issue.

The Environmental Overview identified three cultural resource / 4(f) sites and one hazardous material site that could be potentially impacted by the project. These issues will be further explored and evaluated in the DCR / Environmental Document process.

43rd / Camelback

The recommended concept is for Grand Avenue to be grade separated from 43rd Avenue and Camelback Road. The concept is drawn from Option 5 and was selected over the Option 4 concept, which would grade separate Camelback Road. The impacts to local businesses and the awkward connections between Camelback and the other two streets in the Option 4 concept were the main reasons for selecting the Option 5 concept.

This project will eliminate the six-legged intersection and provide a standard four-legged intersection between 43rd Avenue and Camelback Road. The concept is shown in more detail in Exhibit 6.18.

Grand Avenue will be realigned to the northeast of the existing Grand Avenue centerline to bridge over Camelback Road and 43rd Avenue. This realignment will reduce the span lengths of the bridges and will allow Grand Avenue to remain open to traffic during construction. Ramps

will be provided to connect Grand to the two arterial streets. The southeast-bound off-ramp and remaining on-ramp will connect with 43rd Avenue while the northwest-bound off-ramp will connect with Camelback Road. The southeast-bound on-ramp will depart from the intersection of 43rd / Camelback. New signalized intersections will be created on the two arterial streets at the ramp terminals.

The recommended cross sections for Grand are the same as recommended at 27th / Thomas and are modified from those shown in Exhibits 6.3 and 6.5 as Sections E and J, respectively. The recommended cross section provides three lanes of traffic in each direction, 8-foot outside and 4-foot inside shoulders, a median barrier, and no sidewalks. The recommended shoulder widths are modified from those shown in Exhibits 6.3 and 6.5 to meet ADOT design standards.

Missouri Avenue intersects Grand northwest of the end of construction while 39th Avenue intersects southeast of the proposed construction. These intersections are close to the end of the overpasses and could pose a safety hazard. Neither intersection is signalized, and both intersections are skewed at 45°. Consideration should be given to elimination of both intersections through cul-de-sacs or rerouting the streets to connect with another collector street.

The 43rd / Camelback area is in the 100-year flood plain. Through the Maryvale ADMS, the FCDMC proposed a retention basin in the southwest quadrant of the intersection. However, due to the high cost, the project was determined to be not cost effective. ADOT already owns several parcels in the project area and will have to acquire several more to construct the overpass. Because of the orientation of the parcels along Grand northwest of the 43rd / Camelback intersection, ADOT will probably have to purchase more land than will be needed for the project. During the DCR process, the potential for a joint project between ADOT and FCDMC should be explored. The joint project potentially could meet the drainage needs of the roadway project and help to mitigate the flood-prone condition.

Pedestrian traffic on the Grand overpass should be discouraged. Pedestrians should be routed onto local or collector streets or possibly along walkways constructed outside the roadway. Public input during the DCR process is needed to finalize this recommendation.

Each of the three intersecting arterial streets has a local bus route: Yellow route on Grand; 43 route on 43rd and 50 route on Camelback. The Grand Avenue grade separation will disconnect the Yellow route from the other two. Connecting service could be maintained by having the Yellow route exit via the ramps, travel 43rd and Camelback to connect with the 43 and 50 routes, and re-enter Grand via the ramps. This movement would add travel time to the Yellow route. RPTA should be consulted during the DCR process to resolve the issue.

The Environmental Overview identified one cultural resource / 4(f) site and two hazardous materials sites in the project area. These issues will be further explored and re-evaluated in the DCR / Environmental Document process.

51st / Bethany Home

The recommended concept is for 51st Avenue to be grade separated from the railroad, Grand Avenue and Bethany Home Road. This concept will provide a valued direct north-south route to downtown Glendale from the western portion of Phoenix and will provide a new grade separation with the BNSF. The six-legged intersection will be eliminated, and the remaining Grand / Bethany Home intersection would have four legs. The project construction area will extend from south of Montebello Avenue to south of Marlette Avenue, a distance of approximately 3,200 feet. The new 51st Avenue grade separation would be aligned to the west of the existing centerline in order to reduce bridge span lengths and to enable 51st Avenue to remain in service during construction. The concept is illustrated in Exhibit 6.10.

The recommended cross sections for 51st Avenue are Section C (Exhibit 6.2) for roadway and Section I (Exhibit 6.5) for bridges. These sections provide a curb-face-to-curb-face distance of 68 feet, which matches the existing roadway. The cross section would provide two lanes in each direction and a two-way left-turn lane. Sidewalks would also be provided. A raised or flush median, barrier, or double centerline could be used on the structures to separate opposing directions of travel. The method selected could affect the structure width. Bicycle travel may be accommodated if 51st Avenue is striped as shown in Section C (Exhibit 6.2).

51st Avenue will not connect directly to Grand or to Bethany Home Road except for some right-turn movements. A new service road is proposed west of 51st that would extend southward from Bethany Home Road to Montebello. This service road would restore access to certain properties as well as provide a traffic connection between 51st Avenue and Bethany Home. A new service road would be provided from Bethany Home northward along the existing 51st street alignment to a point where 51st returns to existing grade. New traffic signals would be installed on 51st at the connection with the north service road and at Montebello. More public input is needed during the DCR process to work out the details of property access and local traffic circulation.

A portion of the intersection area is in the 100-year flood plain, and the remainder has been identified as flood prone in the FCDMC ADMS. A retention basin was proposed in the ADMS, but land acquisition cost rendered the project as not cost effective. During the DCR process, the potential for a joint project between ADOT and FCDMC should be explored. The joint project potentially could meet the drainage needs of the roadway project and help to mitigate the flooding condition.

Sidewalks would be included on the overpass for pedestrian traffic. No existing local bus routes would be affected.

The Environmental Overview identified two potential hazardous material sites in the project area. These sites will be further explored and evaluated in the DCR / Environmental Document process.

55th / Maryland

The recommended concept is for Maryland to be grade separated from the railroad, Grand Avenue and 55th Avenue. 55th Avenue would be eliminated from intersecting Grand or crossing the railroad. This project will completely eliminate a six-legged intersection on Grand and eliminate two at-grade crossings of the railroad at one of the most active portions of the railroad. The project area extends along Maryland from west of 57th Avenue to 53rd Avenue. The concept is illustrated in Exhibit 6.11.

The recommended cross sections for Maryland are Section A (Exhibit 6.2) for the roadway and a modified Section I (Exhibit 6.5) for the bridge. These cross-sections would provide a 48-foot curb-face-to-curb-face width. This width would provide one lane in each direction, and a two-way left-turn lane. Sidewalks would also be provided. A raised or flush median, barrier, or double centerline could be used on the structures to separate opposing directions of travel. The method selected could affect the structure width. Bicycle travel may be accommodated if Maryland is striped as shown in Section A (Exhibit 6.2). The Maryland overpass alignment is south of the existing Maryland centerline. This alignment will enable Maryland and 55th to remain in service during construction.

During the construction of the Grand Avenue underpass at 59th / Glendale, Maryland and 55th Avenues may be used as detour routes. Consideration should be given to leaving in service the 55th Avenue intersection with Grand and the railroad crossing until the underpass project has been completed. 55th Avenue could provide a much needed north-south route into downtown Glendale when 59th Avenue is closed for the underpass construction. Similarly, the Maryland overpass would provide an excellent east-west route when Glendale is closed for the underpass construction. The intersections of Maryland with 59th and 51st Avenues should be evaluated to determine the best interim and long-term configurations. Consideration may also be given to initially striping Maryland as four lanes until the underpass construction is completed.

The concept for 55th / Maryland includes connecting 55th Avenue to one-way frontage roads to be built on each side of Maryland and extending away from Grand and the railroad. These frontage roads would extend to 57th Avenue on the west and to 53rd Drive on the east. New traffic signals will probably be needed on Maryland at these two points.

The 55th / Maryland area is not designated as flood prone and is not in the 100-year flood plain.

The alignment of the Maryland overpass to the south of existing Maryland would encroach on the Sands Chevrolet property and would effectively require the relocation of this dealership. Acquisition of the total triangular property occupied by Sands has been assumed in the cost estimate. This acquisition significantly increases the cost of this project. If the Sands property is acquired, it may be used for a retention basin to accommodate the roadway drainage from this project as well as provide a basin for the drainage from the 59th / Glendale underpass project.

The construction of the Maryland overpass and the elimination of 55th Avenue from crossing the railroad will greatly assist BNSF yard operations in the area. Elimination of these at-grade

railroad crossings will enable BNSF to assemble longer trains in the reach between Bethany Home Road and Glendale Avenue. Participation by BNSF in this project should be sought.

No local bus routes would be affected. Pedestrians will be accommodated with sidewalks on the overpass. The planned bike route on 55th Avenue would not be provided across Grand and the railroad. Pedestrian movements along 55th Avenue across Grand would not be permitted because the signal will be removed.

The Environmental Overview identified two potential hazard material sites and one potential 4(f) site in the project area. These issues will be further evaluated during the DCR / Environmental Document process.

59th / Glendale

The recommended concept is for Grand Avenue to be rebuilt as an underpass under 59th and Glendale Avenues. This concept would eliminate the six-legged intersection and provide a standard four-way intersection of 59th and Glendale Avenues. The underpass would be constructed generally along existing Grand Avenue, but new right-of-way will be needed on the northeast side of Grand. The project construction will extend along Grand Avenue from south of Ocotillo Road to north of Myrtle Avenue. The concept is illustrated in Exhibit 6.21.

The recommended cross section for Grand Avenue is Section G (Exhibit 6.4). The cross section will provide six lanes of traffic on Grand, 16-foot outside lanes and a barrier median with 2-foot inside shy-distance. Pedestrians would be prohibited in the underpass.

Connections from Grand to 59th and Glendale and to downtown Glendale will be provided by intersections at each end of the underpass. On the south end, the intersection is proposed to be in the vicinity of Ocotillo Road and 57th Avenue. Realignment of these streets will be required. A new signal will be required on Grand for this new intersection. The concept indicates that the signal may only interrupt northwest-bound Grand Avenue traffic. Traffic from the new local connector street that desires to go southeast-bound on Grand would do so via a channelized area in the median that would enable the traffic to merge into the Grand traffic.

On the north end, the access to and from Grand would be provided at Orangewood. A new signal on Grand would be installed, and Orangewood should be reconstructed between Grand and 59th Avenues. Myrtle and 61st Avenue will also provide access to and from Grand. No signal on Grand is included in the concept at this location. Only right turns to and from Grand would be permitted. Myrtle and 61st Avenue may require reconstruction to accommodate the additional traffic. A new signal may be needed at 61st Avenue and Glendale Avenue. Traffic from Grand using 61st Avenue would have to cross the railroad at grade.

Several local street intersections on Grand would be eliminated in the underpass area. The local streets will either be terminated at Grand, realigned to connect with another local street, or cul-de-saced. Additional public comment and analyses are needed during the DCR process to finalize the connections from Grand and the local circulation system.

The 59th / Glendale project area is not in the 100-year flood plain and is not designated as flood prone. However flooding in the area has been observed. This flooding may be due to the storm drain system being overloaded and surcharged so that it discharges water into the project area during a heavy storm. With the proposed underpass, drainage in the area becomes very critical. Additional analyses is needed during the DCR process to develop a drainage system that will keep sheet flow storm water out of the underpass and will provide a means of accommodating the storm water that falls in the roadway prism. The benefits of the planned new Orangewood-Northern retention basis should be considered. The cost estimates have included a pump station and pipe conveyance of the storm water to an off-site location. As discussed in the 55th / Maryland area, the Sands Chevrolet property could possibly serve as a retention area for storm water from the 59th / Glendale area.

The underpass will also directly affect all underground utilities in Grand and in the 59th / Glendale intersection. The 230 kV transmission line pole located near the 59th / Glendale intersection will have to be moved because of its proximity to the underpass construction. The extent of relocation needs to be determined early so that the City of Glendale and other utility providers in the area can plan the needed system changes.

Construction of the underpass will require closure of Grand for an extended period of time and closure of both 59th and Glendale Avenues during construction of the bridge that will carry these two arterial streets over the underpass. A plan for rerouting traffic during construction is needed. As discussed in the 55th / Maryland area, those two streets may be instrumental in the maintenance of traffic plan. This issue needs to be fully examined in the design of the 55th / Maryland project as well as in the 59th / Glendale project.

The recommended underpass cross section is the widest that appears practical. The vertical walls of the underpass are approximately 7 feet from the historical building located south of Glendale and east of Grand. Special shoring construction techniques will be needed to avoid impacts to the historical building and other buildings that are to remain adjacent to the Grand Avenue underpass.

Pedestrians cannot be accommodated in the underpass. A sidewalk may be provided at existing ground level on the northeast side of the underpass. Sidewalks may be included along 59th and Glendale Avenues.

Although bicycles could utilize the 16-foot outside travel lanes, it is not desirable to designate bicycle paths. It may be possible to route bicycles on more local streets through downtown Glendale or, perhaps, include a bikeway in conjunction with the sidewalk on the northeast side of Grand. Opportunities should be explored with BNSF to provide sidewalks or bicycle paths within the railroad right-of-way.

There are local bus routes on all three arterial streets: Yellow route on Grand; 59 route on 59th; and 24 route on Glendale. The Grand Avenue underpass would disconnect the Yellow route from the other two or least require very long walk distances for those riders who transfer between the Yellow route and the other two. RPTA should be consulted during the DCR process to determine the resolution of this issue.

The Environmental Overview identified four potential hazardous material sites and five cultural resource / 4(f) sites, more than any of the other seven project sites. These issues will be further explored and evaluated in the DCR / Environmental Document process.

67th / Northern

The recommended concept is for 67th Avenue to be grade separated from the railroad, Grand Avenue and Northern Avenue. This project will expedite north-south travel between Glendale and Peoria and will eliminate the six-legged intersection. The remaining intersection between Grand and Northern will have four principal legs and, perhaps, a fifth leg to accommodate southbound left turns. The general alignment swings the new 67th Avenue overpass to the west of the existing centerline to reduce bridge span lengths and to enable 67th Avenue to remain in service during construction. The construction area will extend from near Morten Avenue south of Northern to a point south of Butler Drive north of Northern. The concept is illustrated in Exhibit 6.13.

The recommended cross sections are the same as for 51st Avenue with Section C (Exhibit 6.2) for the roadway and Section I (Exhibit 6.5) for bridges. These cross sections provide a 68-foot street, curb-face-to-curb-face, for two lanes in each direction and a two-way left-turn lane. Sidewalks would also be provided. Bicycle travel may be accommodated if 67th Avenue is striped as shown in Section C (Exhibit 6.2). A raised or flush median, barrier, or double centerline could be used on the structures to separate opposing directions of travel. The method selected could affect the structure width.

The southbound left-turn movement from 67th Avenue to Grand and Northern is fairly heavy. The concept includes a service roadway to accommodate this traffic. The service roadway would connect into the Grand / Northern intersection thus creating a fifth leg. An alternative configuration would be to curve the service road to the west and intersect Grand Avenue northwest of the Grand / Northern intersection. A new signal on Grand would be required, and this intersection would be in close proximity to the Grand / Northern intersection. Additional local traffic circulation and property access will be provided via service roads to be constructed in the existing 67th Avenue alignment. A new signal is proposed on 67th at Frier Drive to facilitate local circulation. These issues need further analyses and public input through the DCR process.

This project area is in the 100-year flood plain. The FCDMC is proceeding to construct the Orangewood-Northern retention basin south of Northern and east of Grand. The basin should help reduce the existing flood potential in the area. The roadway drainage for the project should be developed in cooperation with FCDMC.

Pedestrians will be accommodated by sidewalks on the overpass.

Local bus service includes the Yellow route on Grand and 67 route on 67th Avenue. The potential to transfer between these two bus routes will be eliminated or at least the walking distance would

be greatly increased. RPTA should be consulted during the DCR process to determine the resolution of this issue.

The long-term plans for LRT could extend a line along Grand Avenue from downtown Glendale to Peoria. Options for placement of the LRT in Grand Avenue or adjacent to Grand Avenue are presented in Exhibits 7.7 and 7.8. If the LRT is placed in the center of Grand and six lanes are maintained on Grand, the roadway prism would need to be increased by 22 feet. If the LRT is placed adjacent to Grand, an additional 30 feet will be needed. It appears that the bridge length shown for the 67th Avenue overpass is long enough to accommodate the LRT. If, during final design, a decision is made where to place the potential future LRT, the bridge piers can be located to accommodate one of the various LRT location options. The pier locations will vary the span lengths and may increase the structure depth slightly.

The Environmental Overview identified one potential hazardous materials site in the project area. This issue will be further explored and evaluated in the DCR / Environmental Document process.

75th / Olive

The recommended concept is for Olive Avenue to be grade separated from the railroad, Grand Avenue and 75th Avenue. This project will expedite east-west travel along Olive Avenue and eliminate the six-legged intersection. The remaining intersection of Grand / 75th will have four approach legs but will be skewed at 45°. The general alignment swings the new Olive overpass south of the existing Olive centerline to reduce span lengths and to enable Olive to remain in service during construction. The construction area will extend from 78th Avenue on the west to 71st Avenue on the east. This concept is illustrated in Exhibit 6.14.

The project also includes construction of a new northwest-bound roadway for Grand Avenue between 71st Avenue and 75th Avenue. The new roadway will be parallel to the existing southeast-bound roadway that has an overpass over the railroad. The existing underpass for northwest-bound traffic will be eliminated. In addition, the project includes widening Grand Avenue to six lanes from the existing four lanes from west of 75th Avenue to approximately Monroe Street where it currently widens to six lanes. It appears that this widening can be accomplished within existing Grand Avenue right-of-way; however, additional information is needed to be conclusive.

The recommended cross sections for Olive Avenue overpass are Section B (Exhibit 6.2) for the roadway and Section I (Exhibit 6.5) for bridges. These cross sections will provide two lanes of traffic in each direction and a two-way left-turn lane. Sidewalks would also be provided. A raised or flush median, barrier, or double centerline could be used on the structures to separate opposing directions of travel. The method selected could affect the structure width.

One-way frontage roads will be provided on each side of the Olive overpass to provide property access and local traffic circulation. The westbound frontage roads will be constructed in the existing Olive Avenue right-of-way. Some movements between Grand and Olive and some

movements between Olive and 75th Avenue would not be provided. Additional public input during the DCR process could lead to some refinements.

The project area is in the 100-year flood plain. The FCDMC identified a system of retention basins but determined that the cost of land acquisition made the project not cost effective. During the DCR process, the potential for a joint project between ADOT and FCDMC should be explored. The joint project potentially could meet the drainage needs of the roadway project and help to reduce the flooding prone condition.

Pedestrians would be accommodated with sidewalks on the Olive overpass. There is no planned bike route along Olive. No local bus service would be affected.

The Environmental Overview identified two potential hazardous material sites and one cultural resource / 4(f) site in the project area. These sites will be further explored and evaluated in the DCR / Environmental Document process.

91st / Loop 101

The recommended concept is to provide ramp connections to/from 91st Avenue to Loop 101. These ramps would enter and exit Loop 101 south of the Thunderbird Road interchange and will provide the north half to complement the existing south half diamond interchange on Loop 101 at Grand Avenue. This concept is illustrated in Exhibit 6.15.

The ramps will provide a connection from Loop 101 to downtown Peoria and provide a more direct means for traffic on Grand Avenue to access Loop 101 to the north. Traffic forecasts indicate that one lane ramps will meet the needs. Auxiliary lanes have been included on Loop 101 between the proposed ramps from 91st Avenue and the existing ramps at Thunderbird Road. There appears to be adequate distance to avoid creation of a weaving section. Further analysis is needed to determine the need for these auxiliary lanes.

The ramps will connect into the 91st / Cactus intersection. This intersection will need to be improved and signalized. 91st Avenue has recently been widened to a five-lane section south of Cactus across the railroad to Grand Avenue. No change to this section is expected. In order to maintain access to property west of the proposed ramps, a service road is proposed to extend north from Cactus Road near the Loop 101 right-of-way.

The project area is not in the 100-year flood plain and is not in a flood-prone area.

No pedestrian, bicycle or local bus service would be impacted or provided in the project. Express bus service originating further north could use the ramps to access Grand Avenue in order to travel to downtown Peoria, Glendale or Phoenix.

The City of Peoria has requested consideration for widening Grand Avenue to six lanes from the existing four lanes between 83rd Avenue and Loop 101. There appears to be sufficient right-of-way to accommodate the wider roadway. This widening is not included in this project cost estimate and should be considered as a separate project to be prioritized on its own merits.

The Environmental Overview identified one potential hazardous material site in the project area. This site will be evaluated further in the DCR / Environmental Documentation process.

9.4 IMPLEMENTATION STRATEGY

In 1999, the Arizona Legislature passed an accelerated funding program for highways. ADOT and MAG have allocated \$160 million for eight projects along Grand Avenue. These funds need to be expended by the end of 2007. The currently projected costs of the eight projects exceed the funds allocated to Grand Avenue. Additional funds need to be allocated to the corridor in order to meet the needs and public expectations. MAG has included projections of an additional \$352 million for Grand Avenue between 2008 and 2019. This money is intended to complete the expressway between Loop 101 and I-17.

Through this accelerated funding program, funds for Grand Avenue have moved up in the program. The Thomas / 27th grade separation is now programmed for completion in 2003 (previously 2004) and the Camelback / 43rd grade separation is programmed for completion in 2006 instead of 2009.

The next step in the process is the preparation of a design concept and environmental documentation for each location. This process will include more detailed engineering studies, traffic analyses, additional public meetings and direct contact with potentially affected property owners. Since the projects will affect a large number of property owners and development activity in the corridor appears to be accelerating, ADOT intends to move forward immediately with completion of the design concept reports (DCRs), environmental documents and right-of-way acquisition as needed to meet hardships and to preserve the corridor. Final engineering and design would follow the DCRs.

Upgraded Expressway

The recommendations for the Grand Avenue Corridor include major improvements at eight separate locations. It appears that these eight projects can be funded and constructed by the end of 2007. The recommendation from the Steering Committee as stated in Section 9.2 indicates that it may be desirable to continue to upgrade the Grand Avenue Corridor to eventually provide an expressway.

“Expressway” is not a precisely defined term; however, generally the term indicates a roadway that has little or no direct property access and is designed to carry larger volumes of faster moving traffic. Signalized intersections or interchanges are provided with arterial streets. Local and collector streets generally do not intersect with expressways.

Grand Avenue currently has 54% access control largely due to the presence of the railroad. With the implementation of the recommended eight projects, the access control would increase to 65%. Additional access control may be achieved by purchase of additional property that fronts on Grand. Local and collector street intersections with Grand can be removed by use of cul-de-sacs, frontage roads, rerouting streets away from Grand, and street termination. The largest

number of local street intersections is found near downtown Glendale. Many of these intersections will be removed with the construction of the Grand Avenue underpass at 59th / Glendale.

After the construction of the eight projects, there are 16 local and collector streets intersecting Grand Avenue that are not part of the access system developed as part of these projects. This list includes Osborn Road and 31st Avenue that may or may not be part of the access system for the 27th / Thomas project area. Elimination of all of these street intersections with Grand will be difficult and probably require purchase of many properties. The streets are listed below from southeast to northwest:

- Osborn Road east and west
- 31st Avenue north and south
- Weldon Avenue
- 33rd Avenue
- 37th Avenue
- 39th Avenue
- Missouri Avenue
- 53rd Avenue
- 56th Avenue
- 71st Avenue
- Monroe Street
- 84th Avenue
- 85th Avenue
- 87th Avenue
- 88th Avenue
- 92nd Drive

In most cases, the property abutting Grand would have to be acquired to eliminate access requirements to that property. Acquisition may be phased over many years and implemented as existing property uses are vacated or new uses are proposed. ADOT would need to have an accessible fund to accomplish this task.

With the implementation of the eight recommended projects, eleven existing traffic signals would remain on Grand and two new ones would be added. Elimination of some of these signals should be a goal in achieving the long-range expressway for the corridor. The signal locations are listed below:

- Osborn east
- Osborn west / 31st Avenue
- 33rd Avenue
- 35th Avenue / Indian School Road ramps
- Bethany Home Road
- 57th Avenue access street (new)
- Orangewood Avenue (new)
- Northern Avenue

75th Avenue
Peoria Avenue
83rd Avenue
85th Avenue
91st Avenue

Of the above signalized intersections, four would be at locations that were formerly six-legged intersections. In each of these locations, one of the east-west or north-south arterial streets would be grade separated from Grand and the other arterial street. These remaining signalized intersections pose the largest capacity limitation and source of traffic delay on Grand. The elimination of these intersections would require extensive additional construction in the corridor. The concept to accomplish this elimination proposed in the Grand Avenue Corridor Study included constructing Grand Avenue on a new alignment that would swing east of the arterial overpass and grade separate with both arterial streets that formerly created the six-legged intersection with Grand. This additional construction will require extensive right-of-way acquisition.

During the Grand Avenue Corridor Study, alternative concepts for connecting Grand Avenue to I-17 were explored. None of these concepts appears to be feasible or compatible with the eight projects proposed in this MIS. The absence of a direct connection to I-17 limits the potential effectiveness of a future expressway in the Grand Avenue Corridor.

Similarly, alternative concepts for extending an expressway along the corridor near downtown Peoria have been explored in several of the previous studies. None of these concepts appears to be acceptable to the City of Peoria at this time.

Chapter 10.0

PUBLIC INVOLVEMENT

10.0 OVERVIEW

Ensuring meaningful public involvement on all transportation projects is of utmost importance to ADOT. A pro-active approach to solicit public comments early and often was made during the Grand Avenue MIS. This chapter will outline the public involvement process followed and the steps that the URS Greiner Woodward Clyde Project Team took to ensure public involvement in the development of the Grand Avenue MIS. A compiled summary of the comments received from the public is also presented in this chapter. A detailed collection and summation of comments received from the public, as well as samples of meeting advertisements, are provided in a separately bound report titled *Grand Avenue Major Investment Study –Public Involvement*.

10.1 PUBLIC INVOLVEMENT PROCESS

The first step in the public involvement process was to develop a public involvement plan that would guide the process. The public involvement plan identified all project stakeholders, individuals and agencies that had an interest in being involved with the MIS and identified the means to contact and solicit information, opinions and concerns from them. The plan included public meetings, stakeholder meetings and a public outreach program. Each of these components of the plan are discussed in the following sections.

10.1.1 Project Steering Committee

A project Steering Committee was formed prior to beginning the study and met six times throughout the process. The purpose of the Steering Committee was to provide direction and guidance to ADOT and the consultant team during the process. The Steering Committee is a continuation of the Steering Committee established during the Grand Avenue Corridor Study. Additionally, the Steering Committee assisted the consultant team in ensuring that all interested parties were informed of and had the ability to participate in the process. The Steering Committee also reviewed project materials and selected and recommended the preferred option to ADOT. The Steering Committee is comprised of the following representatives and agencies:

Ken Martin, Chair, City of Glendale
Michael Dawson, Maricopa County Department of Transportation
John Dugan, Burlington Northern Santa Fe Railroad
Wulf Grote, Regional Public Transportation Authority
Don Herp, City of Phoenix
Steve Jimenez, Arizona Department of Transportation
Terry Johnson, Maricopa Association of Governments
Diane McCarthy, WestMarc
David Moody, City of Peoria

10.1.2 Agency Coordination

Due to the complexity of the project and interjurisdictional nature of the issues, a comprehensive agency coordination process occurred. Steering Committee members served as the main contact for many of the agencies; however, other representatives were invited to participate in the public involvement process.

In addition to the Steering Committee meetings, meetings on transportation, right-of-way, utility, land use, or drainage issues occurred with the following agencies: ADOT, Flood Control District of Maricopa County, City of Phoenix, City of Glendale, City of Peoria, Salt River Project, Arizona Public Service, and Maricopa Association of Governments.

10.1.3 Stakeholder Meetings

Public input was solicited from stakeholders within the Grand Avenue Corridor at two stakeholder meetings. Stakeholders were defined as individuals, agencies, or groups that have a “stake” in the outcome of the study. Stakeholders are a mix of representatives of neighborhood associations, chambers of commerce, economic development groups, cities, utilities, and other agencies. A comprehensive list of stakeholders developed during the Grand Avenue Corridor Study was utilized and updated during the MIS.

The first stakeholder meeting was held:

Wednesday, March 17, 1999
7:00 A.M.–8:30 A.M.
City of Glendale City Hall Complex
Room B-2
5850 West Glendale Avenue, Glendale, Arizona

Over 130 stakeholders were invited to the meeting. At the meeting, the project team introduced the Grand Avenue MIS project, discussed the project process, discussed the two options that were under development, and received input on the project from the stakeholders.

A second stakeholder meeting was held:

Tuesday, June 29, 1999
7:30 A.M.–9:00 A.M.
City of Glendale City Hall Complex
4th Floor Conference Room
5850 West Glendale Avenue, Glendale, Arizona

Over 150 stakeholders were invited to the second meeting. At the meeting, the project team presented the two options, discussed the evaluation of the two options, and received input on the project from the stakeholders.

10.1.4 Public Information Meetings

Public input was solicited from citizens, agencies, and interested parties within the Grand Avenue Corridor at two public information meetings. A mailing list was developed and updated throughout the MIS. Both public meetings were advertised extensively. Two advertisements per meeting were placed in the Arizona Republic. News releases and public service announcements were submitted to selected media outlets including those serving Spanish speaking persons. In addition, 15,000 flyers per meeting were distributed via "door hangers" to businesses and residences along the corridor. The public meetings were also advertised on the City of Glendale's web page. Over 300 people on the mailing list received an invitation to the public meetings in the mail.

The first public information meeting was held:

Wednesday, April 14, 1999
5:00 P.M.—7:00 P.M.
City of Glendale City Hall Complex
City Council Chambers
5850 West Glendale Avenue, Glendale, Arizona

The first public information meeting was attended by over 90 people (excluding ADOT staff and project team). Displays were set up presenting the existing land use, transportation, and socio-economic conditions within the corridor, and the two roadway options. The project team and ADOT staff were available to answer questions. An overview of the Grand Avenue MIS project, process, and two options that were under development was given. After the presentation, a question and answer session occurred with opportunities for the public to provide input and discuss the project. A project booklet and questionnaire were also provided to attendees.

The second public information meeting was held:

July 14, 1999
5:30 P.M.—7:30 P.M.
Isaac Imes Elementary School Gymnasium
6625 North 56th Avenue, Glendale, Arizona

The second public information meeting was conducted in an open house format with displays presenting the existing land use, transportation, and socio-economic conditions within the corridor, the two roadway options, and the evaluation of the two options. The project team and ADOT staff were available to answer questions. A presentation was made that discussed the two options and the evaluation of the options. A project booklet and questionnaire were also provided to attendees. The meeting was attended by over 90 people (excluding ADOT staff and project team).

10.1.5 Public Outreach Program

An extensive public outreach program was developed for the MIS. The outreach program actively solicited opportunities to speak at Chambers of Commerce, neighborhood associations, service clubs, and other civic organizations that might be interested in the study. The purpose of

this outreach was to allow the project team to communicate the progress of the study and provide additional opportunities to solicit input. Graphic materials were developed and used in overhead presentations and as handouts that were distributed at each meeting. A questionnaire was distributed at each meeting as a means to record public comment. Citizens wishing to discuss the project were invited to the consultant's office to review materials and to discuss the project with the appropriate staff members. Several business owners in the corridor took advantage of this opportunity.

A total of 13 presentations were given to various groups as part of the outreach program. Presentations were given to the following groups:

Peoria Old Town Development Corporation on May 6, 1999, at 5:30 P.M.
Bethany Heights Neighborhood Association on May 11, 1999, at 6:30 P.M.
City of Phoenix Neighborhoods That Work Event on May 11, 1999, from 5:00–7:00 P.M.
Peoria Kiwanis Club – Hi Noon on June 1, 1999, at 11:30 A.M.
Glendale Sisters Cities Program on June 1, 1999, at 7:30 P.M.
Peoria Senior Center on June 4, 1999, at 11:00 A.M.
Glendale West Maricopa Board of Realtors on June 8, 1999, at 2:00 P.M.
Epworth Neighborhood Association on June 15, 1999, at 7:00 P.M.
Glendale Chamber of Commerce Board of Directors on July 6, 1999, at 12:00 NOON
Peoria City Council on July 6, 1999, at 7:00 P.M.
Northwest Valley Chamber of Commerce on July 13, 1999, at 7:00 A.M.
Sun City Del Sol Rotary on July 15, 1999, at 7:00 A.M.
Granada Neighborhood Association on July 21, 1999, at 6:30 P.M.

10.2 SUMMATION OF QUESTIONNAIRE

Throughout the public involvement process, questionnaires were completed by the public. The questionnaires were completed at the stakeholder meetings, the public meetings, and the public outreach presentations. In addition to asking for public comments and input on the MIS, overall roadway options, and specific project locations, the questionnaire asked the public to rank the importance of the eight major issues presented in Chapter 2, and to chose their preferred option. A sample questionnaire is shown in Exhibit 10.1.

The results from the questionnaire are summarized in Exhibit 10.2. The eight major issues were ranked in order of importance on each completed questionnaire, a "1" being the most important and "8" being the least important. The ranking in Exhibit 10.2 shows the average score received for each issue. The public completed a total of 203 questionnaires.

The top two priority issues were the six-legged intersections and railroad crossings, respectively. Option 4 was chosen as the preferred option on 44% of the questionnaires while Option 5 was chosen on 49% of the questionnaires. The remaining 7% of the questionnaires indicated that neither option should be chosen or the participant did not know.

Exhibit 10.1 Sample Questionnaire

Grand Avenue Major Investment Study Questionnaire

The study is nearing completion and a decision will be made soon on the preferred alternative for the Grand Avenue Corridor. Your input is needed for this decision.

The following goals have been identified for the Grand Avenue Corridor Improvements. Not all goals can be met to the same degree. Please rank the goals in priority order of importance with "1" being most important and "8" being least important. Do not use a number more than once.

Project Goals	Rank (1-8)
1. Eliminate Six-Legged Intersections	_____
2. Eliminate Railroad Crossings	_____
3. Expedite Travel Along Grand Avenue	_____
4. Promote Development	_____
5. Improve Aesthetics	_____
6. Provide Statewide Highway	_____
7. Promote Travel Via Transit, Bicycle, Walking	_____
8. Serve Future Traffic Volumes	_____

Based on what you have seen to date, which of the two options do you prefer. Please check one.

Option 4 – Alternating Grade Separations – This Option Expedites Travel Across the Railroad. _____

At the six-legged intersections, one road (either the north-south or east-west or Grand Avenue) would be put on a grade separation (bridge) to remove that street from the intersection. Bridges would be provided for:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Grand over Thomas at 27th • Camelback over Grand, BNSF RR and 43rd • 51st over BNSF RR, Grand and Bethany Home • Maryland over Grand and BNSF RR | <ul style="list-style-type: none"> • Grand under Glendale and 59th • 67th over BNSF RR, Grand and Northern • Olive over Grand, BNSF RR and 75th • Connection to Loop 101 at 91st |
|---|--|

Option 5 – Limited Expressway – This Option Expedites Travel Along Grand Avenue. _____

Grand Avenue would be put on a grade separation (bridge) to remove it from the six-legged intersections. Traffic signals would exist on Grand Avenue at some minor streets. Ramp connections between Grand Avenue and the arterial streets would be included where needed to provide access. Bridges would be provided for:

- | | |
|--|--|
| <ul style="list-style-type: none"> • Grand over Thomas and 27th • Grand over Camelback and 43rd • Maryland over Grand and BNSF RR • Grand over Bethany Home and 51st | <ul style="list-style-type: none"> • Grand under Glendale and 59th • Grand over Northern and 67th • Grand over Olive and 75th • Connection to Loop 101 at 91st |
|--|--|

Neither _____

Do Not Know _____

**Exhibit 10.1 (cont.)
Sample Questionnaire**

Please give reasons why you prefer one option over another.

Do you have any specific comments related to the following intersections?

27th / Thomas _____
43rd / Camelback _____
51st / Bethany Home _____
55th / Maryland _____
59th / Glendale _____
67th / Northern _____
75th / Olive _____
91st Avenue / Loop 101 _____

Do you have any additional thoughts, ideas or comments related to the Grand Avenue Major Investment Study?

Please indicate which city you live in

Phoenix _____ Glendale _____ Peoria _____ Other _____

If you would like to be on the Grand Avenue Major Investment Study mailing list, please complete your name and address.

NAME: _____

ADDRESS: _____

PHONE NUMBER: _____

— THANK YOU FOR YOUR TIME —

Mail any additional comments to:

Partners For Strategic Action, Inc.
Attn: Peggy Fiandaca, Public Involvement Coordinator
13771 Fountain Hills Boulevard, Suite 360
Fountain Hills, AZ 85268
(480) 816-1811; FAX (480) 816-1813; psapsa@worldnet.ait.net

Exhibit 10.2
Summary of Questionnaire

<u>Major Issues</u>	<u>Ranking (1-8)</u>
1. Six-Legged Intersections	2.13
2. Railroad Crossings	2.94
3. Regional Mobility	3.66
4. Development Opportunities	3.95
5. Statewide Significance (Grand Avenue is designated as US 60 and connects Wickenburg with the Phoenix metropolitan area)	5.56
6. Projected Traffic	5.68
6. Aesthetics	5.68
7. Multi-Modal Use	5.81

Following are the tally of the responses received regarding the options preferred.

Option 4 – Alternating Grade Separations	44.0
Option 5 – Limited Expressway	49.2
Neither / Do Not Know	6.8



APPENDIX

Methodologies, Assumptions and Calculations

Travel Time - Methodology and Calculations

1. The corridor was broken down into three segments
 - I-17 to Downtown Glendale (59th Ave/Glendale Ave) distance of 6 miles
 - Downtown Glendale to Downtown Peoria (83rd Ave/Grand Ave) distance of 4.2 miles
 - Downtown Peoria to Loop 101 distance of 1.8 miles
2. The p.m. peak hour travel time was calculated by adding running travel time plus total delay at intersections.
3. Running travel time was calculated by dividing the segment distance by the assumed free flow travel speed.
 - The 45 mph speed limit was assumed for the existing conditions and the 2020 base case
 - The 50 mph design speed was assumed for Option 4
 - The 60 mph design speed was assumed for Option 5
4. Total delay at the intersections was calculated by
 - a. Using the intersection level of service for each intersection along Grand from the MAG EMME2 model for the p.m. peak hour period.
 - b. Assuming a total delay per vehicle value for each level of service (see table)
 - c. Summing the delay at each intersection to get total delay for a segment.

LOS		Stopped Delay ¹	Total Delay ²	Assumed Value ³
B-C	4-legged intersection	5	6.5	3
D	4-legged intersection	25	32.5	16
D	6-legged intersection	32.5	42.5	21
E-F	4-legged intersection	50	65	33
E-F	6-legged intersection	100	130	65

1. Stopped delay are values taken from the 1994 Highway Capacity Manual, values for four-legged intersections are the low end of the scale, values for six-legged intersections are a median value LOS for 4-legged intersections assumed that priority would be given to travel on Grand thus a lower delay value, LOS E-F for six-legged intersections was taken from existing conditions presented in WP # 3
2. Total delay includes stopped delay and delay from vehicle slowing down at intersections. It is equal to 1.3 times stopped delay.
3. It was assumed that a vehicle traveling down Grand would only stop on average at every other intersection, therefore delay values were halved.

P.M. Peak Hour Travel Time on Grand Avenue - Existing Conditions

Between I-17 and Downtown Glendale¹

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	6	45	480	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
	27th Ave./ Thomas Rd.	E-F	65	
	Osborn Rd. East	B-C	3	
	31st Ave./ Osborn Rd. West	D	16	
	33rd Ave.	B-C	3	
	35th Ave./ Indian School Rd.	E-F	65	
	43rd Ave./ Camelback Rd.	E-F	65	
	51st Ave./ Bethany Home Rd.	E-F	65	
	55th Ave./ Maryland Rd.	D	16	
	Total		298	seconds
	Total Section Travel Time (seconds)		778	seconds
	Total Section Travel Time (minutes)		13.0	minutes

Between Downtown Glendale¹ and Downtown Peoria²

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	4.2	45	336	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
	59th Ave./ Glendale Ave.	E-F	65	
	61st Ave./ Myrtle Ave.	D	16	
	67th Ave./ Northern Ave.	E-F	65	
	75th Ave./ Olive Ave.	E-F	65	
	Total		211	seconds
	Total Section Travel Time (seconds)		547	seconds
	Total Section Travel Time (minutes)		9.1	minutes

Between Downtown Peoria² and Loop 101

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	1.8	45	144	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
	83rd Ave.	B-C	3	
	Peoria Ave.	D	16	
	85th Ave.	B-C	3	
	91st Ave.	B-C	3	
	Total		25	seconds
	Total Section Travel Time (seconds)		169	seconds
	Total Section Travel Time (minutes)		2.8	minutes

Total Corridor Travel Time (minutes) **24.9** **minutes**

1. Downtown Glendale was assumed to be at 59th Avenue and Glendale Avenue

2. Downtown Peoria was assumed to be at 83rd Avenue and Grand Avenue

P.M. Peak Hour Travel Time on Grand Avenue - 2020 Base Conditions

Between I-17 and Downtown Glendale¹

Distance	miles	Speed (mph)	Time to traverse (seconds)
	6	45	480 seconds
Signals	LOS	Signal Delay (seconds per vehicle)	
27th Ave./ Thomas Rd.	E-F	65	
Osborn Rd. East	B-C	3	
31st Ave./ Osborn Rd. West	D	16	
33rd Ave.	B-C	3	
35th Ave./ Indian School Rd.	E-F	65	
43rd Ave./ Camelback Rd.	E-F	65	
51st Ave./ Bethany Home Rd.	E-F	65	
55th Ave./ Maryland Rd.	D	16	
Total		298	seconds
Total Section Travel Time (seconds)		778	seconds
Total Section Travel Time (minutes)		13.0	minutes

Between Downtown Glendale¹ and Downtown Peoria²

Distance	miles	Speed (mph)	Time to traverse (seconds)
	4.2	45	336 seconds
Signals	LOS	Signal Delay (seconds per vehicle)	
59th Ave./ Glendale Ave.	E-F	65	
61st Ave./ Myrtle Ave.	D	16	
67th Ave./ Northern Ave.	E-F	65	
75th Ave./ Olive Ave.	E-F	65	
Total		211	seconds
Total Section Travel Time (seconds)		547	seconds
Total Section Travel Time (minutes)		9.1	minutes

Between Downtown Peoria² and Loop 101

Distance	miles	Speed (mph)	Time to traverse (seconds)
	1.8	45	144 seconds
Signals	LOS	Signal Delay (seconds per vehicle)	
83rd Ave.	E-F	33	
Peoria Ave.	E-F	33	
85th Ave.	B-C	3	
91st Ave.	D	16	
Total		85	seconds
Total Section Travel Time (seconds)		229	seconds
Total Section Travel Time (minutes)		3.8	minutes
Total Corridor Travel Time (minutes)		25.9	minutes

1. Downtown Glendale was assumed to be at 59th Avenue and Glendale Avenue

2. Downtown Peoria was assumed to be at 83rd Avenue and Grand Avenue

P.M. Peak Hour Travel Time on Grand Avenue - Option 4

Between I-17 and Downtown Glendale¹

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	6	50	432	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
31st Ave./ Osborn Rd.		D	16	
33rd Ave.		B-C	3	
35th Ave./ Indian School Rd.		E-F	65	
41st Ave. (new)		D	16	
43rd Ave.		E-F	33	
Bethany Home Rd.		E-F	33	
57th Ave. or 57th Dr. (new)		D	16	
Total			182	seconds
Total Section Travel Time (seconds)			614	seconds
Total Section Travel Time (minutes)			10.2	minutes

Between Downtown Glendale¹ and Downtown Peoria²

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	4.2	50	302.4	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
63rd Ave./ Oranewood (new)		D	16	
Northern Ave.		E-F	33	
75th Ave.		E-F	33	
Total			82	seconds
Total Section Travel Time (seconds)			384.4	seconds
Total Section Travel Time (minutes)			6.4	minutes

Between Downtown Peoria² and Loop 101

Distance	miles	Speed (mph)	Time to traverse (seconds)	
	1.8	45	144	seconds
Signals		LOS	Signal Delay (seconds per vehicle)	
83rd Ave.		E-F	33	
Peoria Ave.		E-F	33	
85th Ave.		B-C	3	
91st Ave.		D	16	
Total			85	seconds
Total Section Travel Time (seconds)			229	seconds
Total Section Travel Time (minutes)			3.8	minutes

Total Corridor Travel Time (minutes) **20.5** **minutes**

1. Downtown Glendale was assumed to be at 59th Avenue and Glendale Avenue

2. Downtown Peoria was assumed to be at 83rd Avenue and Grand Avenue

P.M. Peak Hour Travel Time on Grand Avenue - Option 5

Between I-17 and Downtown Glendale¹

Distance	miles	Speed (mph)	Time to traverse (seconds)
	6	60	360 seconds
Signals		LOS	Signal Delay (seconds per vehicle)
Osborn Rd. East		D	16
31st Ave./ Osborn Rd. West		D	16
33rd Ave.		B-C	3
35th Ave./ Indian School Rd.		E-F	65
57th Ave. or 57th Dr. (new)		D	16
Total			116 seconds
Total Section Travel Time (seconds)			476 seconds
Total Section Travel Time (minutes)			7.9 minutes

Between Downtown Glendale¹ and Downtown Peoria²

Distance	miles	Speed (mph)	Time to traverse (seconds)
	4.2	60	252 seconds
Signals		LOS	Signal Delay (seconds per vehicle)
63rd Ave./ Orangewood Ave. (new)		D	16
Total			16 seconds
Total Section Travel Time (seconds)			268 seconds
Total Section Travel Time (minutes)			4.5 minutes

Between Downtown Peoria² and Loop 101

Distance	miles	Speed (mph)	Time to traverse (seconds)
	1.8	45	144 seconds
Signals		LOS	Signal Delay (seconds per vehicle)
83rd Ave.		E-F	33
Peoria Ave.		E-F	33
85th Ave.		B-C	3
91st Ave.		D	16
Total			85 seconds
Total Section Travel Time (seconds)			229 seconds
Total Section Travel Time (minutes)			3.8 minutes
Total Corridor Travel Time (minutes)			16.2 minutes

1. Downtown Glendale was assumed to be at 59th Avenue and Glendale Avenue

2. Downtown Peoria was assumed to be at 83rd Avenue and Grand Avenue

Access Control Along Grand Avenue

Southwest Side

Location	Length of Frontage (feet)		Access Controlled Frontage (feet)		Non-Access Controlled Frontage (feet)		Number of Intersecting Streets ¹		
	Existing	Option 4	Option 4	Option 5	Option 4	Option 5	Existing	Option 4	Option 5
I-17 to 27th Ave	1,650	1,650	1,650	1,650	-	-	-	-	-
27th Ave to 35th Ave	7,410	5,820	5,820	5,820	1,590	1,590	3	2	2
35th Ave to 43rd Ave	7,460	3,760	3,760	3,760	3,700	3,700	-	-	-
43rd Ave to 51st Ave	7,420	7,420	7,420	7,420	-	-	-	-	-
51st Ave to 59th Ave	7,530	7,530	7,530	7,530	-	-	2	-	-
59th Ave to 67th Ave	7,260	7,260	7,260	7,260	-	-	7	2	2
67th Ave to 75th Ave	7,610	7,610	7,610	7,610	-	-	-	-	-
75th Ave to 83rd Ave	7,210	2,720	2,720	2,720	4,490	4,490	-	-	-
83rd Ave to 91st Ave	7,060	-	-	-	7,060	7,060	4	3	3
91st Ave to Loop 101	1,630	-	-	-	1,630	1,630	4	4	4
Total	62,240	43,770	43,770	43,770	18,470	18,470	19	11	11
Percent	100%	70%	70%	70%	30%	30%			

1. Totals do not include major arterial streets

Northeast Side

Location	Length of Frontage (feet)		Access Controlled Frontage (feet)		Non-Access Controlled Frontage (feet)		Number of Intersecting Streets ¹		
	Existing	Option 4	Option 4	Option 5	Option 4	Option 5	Existing	Option 4	Option 5
I-17 to 27th Ave	1,650	1,650	1,650	1,650	-	-	-	-	-
27th Ave to 35th Ave	7,410	2,230	2,230	2,230	7,410	5,180	5	4	4
35th Ave to 43rd Ave	7,460	3,000	3,000	3,890	5,860	4,460	3	3	2
43rd Ave to 51st Ave	7,420	-	-	6,260	7,420	7,420	1	1	1
51st Ave to 59th Ave	7,530	4,660	4,660	6,190	7,530	2,870	9	2	2
59th Ave to 67th Ave	7,260	2,450	2,450	5,650	7,260	4,810	8	2	2
67th Ave to 75th Ave	7,610	4,290	4,290	6,930	3,360	3,320	1	1	1
75th Ave to 83rd Ave	7,210	7,210	7,210	7,210	-	-	1	1	1
83rd Ave to 91st Ave	7,060	7,060	7,060	7,060	-	-	-	-	-
91st Ave to Loop 101	1,630	1,630	1,630	1,630	-	-	-	-	-
Total	62,240	34,180	34,180	48,700	38,840	28,060	28	14	13
Percent	100%	55%	55%	78%	62%	45%			

1. Totals do not include major arterial streets

Total -Both Sides

Location	Length of Frontage (feet)	Access Controlled Frontage (feet)		Non-Access Controlled Frontage (feet)		Number of Intersecting Streets ¹	
		Existing	Option 5	Existing	Option 5	Existing	Option 5
I-17 to 27th Ave	3,300	3,300	3,300	-	-	-	-
27th Ave to 35th Ave	14,820	5,820	8,050	9,000	6,770	8	6
35th Ave to 43rd Ave	14,920	5,360	6,760	9,560	8,160	3	3
43rd Ave to 51st Ave	14,840	7,420	7,420	7,420	7,420	1	1
51st Ave to 59th Ave	15,060	7,530	12,190	7,530	2,870	11	2
59th Ave to 67th Ave	14,520	7,260	9,710	7,260	4,810	15	4
67th Ave to 75th Ave	15,220	11,860	11,900	3,360	3,320	1	1
75th Ave to 83rd Ave	14,420	9,930	9,930	4,490	4,490	4	4
83rd Ave to 91st Ave	14,120	7,060	7,060	7,060	7,060	4	4
91st Ave to Loop 101	3,260	1,630	1,630	1,630	1,630	4	4
Total	124,480	67,170	77,950	57,310	46,530	47	25
Percent	100%	54%	63%	46%	37%		26%

1. Totals do not include major arterial streets

Total Delay - Methodology and Calculations

Non -Train Total delay at the intersections was calculated by

1. Using the intersection level of service for each intersection in the study area from the MAG EMME2 model for the p.m. peak hour period.
2. Assuming a total delay per vehicle value for each level of service (see table)
3. Multiplying average delay per vehicle by number of vehicles entering the intersection from the MAG EMME2 Model for the p.m. peak hour period
- d. Summing the delay at each intersection to get total delay for the study area

LOS		Stopped Delay ¹	Total Delay ²
B-C	4-legged intersection	5	6.5
D	4-legged intersection	25	32.5
D	6-legged intersection	32.5	42.5
E-F	4-legged intersection	60	78
E-F	6-legged intersection	100	130

1. Stopped delay are values taken from the 1994 Highway Capacity Manual, values for four-legged intersections are the low end of the scale, values for six-legged intersections are a median value
LOS E-F for six-legged intersections was taken from existing conditions presented in WP # 3

2. Total delay includes stopped delay and delay from vehicle slowing down at intersections. It is equal to 1.3 times stopped delay.

Additional Train Delay was calculated by

1. Assuming that one train would interrupt travel during the p.m. peak hour
2. The train would interrupt traffic for 240 seconds (the longest time observed)
3. Calculating the number of vehicles approaching the intersection during train interruption for the east-west and north-south approaches assuming even distribution of traffic over the peak hour
Volumes were obtained from the MAG EMME2 model.
4. Multiplying the number of vehicles by 130 seconds of total delay per vehicle
(130 seconds of additional total delay per vehicle was taken from existing conditions presented in WP # 3)

2020 P.M. Peak Hour Additional Delay from the Train

Base Case

Location	Total Vehicles	Affected Vehicles	Additional Delay Per Vehicle	Total Additional Delay (seconds)	Total Additional Delay (hours)
27th/Thomas	5,340	356	130	46,280	13
43rd/Camelback	5,070	338	130	43,940	12
51st/Bethany Home	4,640	309	130	40,213	11
55th/Maryland	220	15	130	1,907	1
59th/Glendale	4,640	309	130	40,213	11
67th/Northern	5,200	347	130	45,067	13
75th/Olive	4,900	327	130	42,467	12
91st Ave/Grand	1,100	73	130	9,533	3
Total	31,110	2,074		269,620	75

Option 4

Location	Total Vehicles	Affected Vehicles	Additional Delay Per Vehicle	Total Additional Delay (seconds)	Total Additional Delay (hours)
27th/Thomas	7,080	472	130	61,360	17
43rd/Camelback	3,020	201	130	26,173	7
51st/Bethany Home	2,720	181	130	23,573	7
55th/Maryland	-	-	130	-	-
59th/Glendale	5,570	371	130	48,273	13
67th/Northern	3,320	221	130	28,773	8
75th/Olive	2,590	173	130	22,447	6
91st Ave/Grand	1,250	83	130	10,833	3
Total	25,550	1,703		221,433	62

Option 5

Location	Total Vehicles	Affected Vehicles	Additional Delay Per Vehicle	Total Additional Delay (seconds)	Total Additional Delay (hours)
27th/Thomas	7,250	483	130	62,833	17
43rd/Camelback	6,760	451	130	58,587	16
51st/Bethany Home	5,990	399	130	51,913	14
55th/Maryland	-	-	130	-	-
59th/Glendale	5,590	373	130	48,447	13
67th/Northern	6,330	422	130	54,860	15
75th/Olive	6,710	447	130	58,153	16
91st Ave/Grand	1,250	83	130	10,833	3
Total	39,880	2,659		345,627	96