Initial Design Concept Report

RED MOUNTAIN FREEWAY (SR 202L)
(I-10/SR51 TI to SR 101L)

ADOT CONTRACT NO. 05-26
PROJECT NO. 202L MA 0 H687101L
FEDERAL AID NO. 202-A(AQN)

Prepared For:

Arizona Department of Transportation

Prepared By:

DMJM HARRIS | AECOM

2777 E. Camelback Road, Suite 200
Phoenix, Arizona 85016

ON THE MOVE
PARTNERS IN PROGRESS

SEPTEMBER 2006

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EXECUTIVE SUMMARY

This Initial Design Concept Report describes the development, evaluation and recommendation to provide additional general-purpose lanes on the Red Mountain Freeway (SR 202L) from Interstate 10 (I-10)(Milepost 0.00) to the Price Freeway (SR 101L)(Milepost 9.80). This project is located in the Arizona Department of Transportation's (ADOT's) Phoenix District within Maricopa County in south-central Arizona.

The Arizona Transportation Board has approved funding in ADOT's Five-Year Transportation Facilities Construction Program (2007-2011) to begin construction of this project. The following projects are listed for SR 202L within the study area:

Begin MP	Location	Type of Work	Funding Source	Funding Amount ($000)	Fiscal Year
0.0	I-10/SR51 TI to SR 101L, EB	Design (GPL)	State	4,800	2008
0.0	I-10/SR51 TI to SR 101L, EB	Construction (GPL)	State	28,500	2009
0.0	I-10/SR51 TI to SR 101L, EB	Construction (GPL)	RARF	31,500	2009
8	Rural Road to SR 101L, WB	Design (GPL)	RARF	800	2008
8	Rural Road to SR 101L, WB	Construction (GPL)	RARF	9,000	2009
8	Rural Road to SR 101L, EB	Design (GPL)	State	1,430	2011
9.8	SR 101L to Gilbert Road	Design (HOV)	State	2,500	2008
9.8	SR 101L to Gilbert Road	Construction (HOV)	State	29,000	2009
9.8	SR 101L to SR 87	Design (FMS)	CMAQ	600	2008
9.8	SR 101L to SR 87	Construction (FMS)	CMAQ	6,000	2009

The Maricopa Association of Governments (MAG), Regional Public Transportation Authority (RPTA) and ADOT have worked together for many years to develop a comprehensive plan for the Regional Freeway System that is included in the Regional Transportation Plan (RTP) that was adopted by the MAG Regional Council in November 2003.

The voters of Maricopa County passed Proposition 400 in November 2004, which authorized the continuation of the existing half-cent sales tax for the next 20 years to be used for implementing the MAG RTP. A portion of the revenues collected from the half-cent sales tax extension will be deposited into the Regional Area Road Fund (RARF) to fund the RTP Freeway Program (RTPFP) projects. This project is included in the RTPFP.

A number of additional projects are currently planned within or adjacent to the study corridor and are included in ADOT's Transportation Facilities Construction Program or the RTP. These projects are shown on the next page.

Route	Freeway Segment	Type of Work	RTPFP Budget ($000)	RTPFP Phase	RTPFP Phase (years)
SR 202L	Rural Road to SR 101L	General-Purpose Lanes	29,000	2	2011-2015
SR 202L	SR 101L to Gilbert Road	General-Purpose Lanes	51,000	2	2011-2015
SR 101L	Princess Drive to SR 202L, Red Mountain	HOV Lanes (Construction)	65,000	1	2006-2010
SR 101L	SR 202L, Red Mountain to Baseline Road	HOV Lanes (Construction)	17,000	1	2006-2010
SR 101L	Shea Boulevard to SR 202L, Red Mountain	General-Purpose Lanes	94,000	2	2011-2015

Traffic demand is causing the SR 202L corridor to become increasingly congested during the morning and evening peak travel periods, and future traffic projections indicate the congestion will worsen. Additional general-purpose lanes would increase the freeway capacity and help alleviate increased levels of traffic congestion in the future.

The purpose of this report is to evaluate the safety and operational characteristics of the existing SR 202L freeway, and to evaluate alternatives to provide additional general-purpose lanes as identified in the RTPFP. The alternatives analysis includes the evaluation of the following improvements:

Eastbound SR 202L

- Add one general-purpose lane from the I-10/SR51 Traffic Interchange (TI) to Scottsdale Road
- Add one or two general-purpose lanes from Scottsdale Road to the SR101L/SR202L TI
- Add additional auxiliary lanes at various locations

Westbound SR 202L

- Add one or two general-purpose lanes from the SR101L/SR202L TI to McClintock Drive
- Add one general-purpose lane from the McClintock Drive to Scottsdale Road
- Add an auxiliary lane between the McClintock Drive entrance ramp and the Scottsdale Road TI exit ramp

The No-Build and two Build alternatives were evaluated for the eastbound and westbound roadways. Alternative 2 is recommended for each roadway and is presented in Appendix D. The Recommended Alternative is based on an evaluation of the geometric design criteria, benefits to traffic operations, environmental considerations, right-of-way acquisition requirements and utility impacts, construction costs, conformance with adopted regional transportation plans, public agency input and public participation.

Coordination for this project has been conducted will be required with the following public agencies: ADOT, MAG, Valley Metro, Valley Metro Rail, Salt River Pima-Maricopa Indian Community (SRPMIC), Federal Highway Administration, Maricopa

County Department of Transportation (MCDOT), Flood Control District of Maricopa County (FCDMC) and the cities of Phoenix, Tempe, and Mesa.

This study also included an evaluation of providing an additional exit ramp connection between the westbound SR 202L mainline and McClintock Drive. The technical evaluation concluded that the new ramp would create additional congestion and introduce safety concerns because insufficient distance is available between the SR101L/SR202L TI ramps and McClintock Drive.

The acquisition of new right-of-way is not anticipated with this project. Temporary Construction Easements (TCE's) will be required for the construction of the Recommended Alternative. The TCE locations and limits will be finalized during final design.

Coordination with concurrent construction projects will be required for this project. Coordination will also be required with several utility companies and the Union Pacific Railroad (UPRR).

Mitigation measures for this project are identified in the following section. The Categorical Exclusion will include all final mitigation and coordination requirements.

Additional reports prepared as part of the study include a Draft AASHTO Controlling Design Criteria Report, Initial Traffic Report, Initial Onsite Drainage Report, Pre-Initial Salt River and Indian Bend Wash Drainage Report, Draft Air Quality Analysis Technical Report, Draft Noise Analysis Technical Report, Draft Hazardous Materials Inventory, Draft Biology Evaluation, Section 404 Permit Jurisdictional Delineation, and Draft Categorical Exclusion.

The total estimated cost for the Recommended Alternative is $184,000,000, which includes $170,500,000 for construction and $13,500,000 for design. The current programmed amount for this project is $105,030,000. The detailed cost estimates are provided in Chapter 5 of this report.

LIST OF MITIGATION MEASURES

Design Responsibilities:

All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction will be seeded using species native to the project vicinity.

During final design, the project will be designed in a manner that will minimize disturbances to the Salt River channel and associated wetland/riparian areas to the extent practicable. The construction limits will be included on the construction plans.

The type of Section 404 permit necessary for this action will be confirmed by the Arizona Department of Transportation (ADOT) and US Army Corps of Engineers (COE) at the completion of Stage II final design plans. If the construction activities cannot avoid impacts to the jurisdictional wetlands within the project area, a Section 404 Individual Permit would be necessary. The Arizona Department of Environmental Quality (ADEQ) would also require a Section 401 water quality certification.

During final design, a habitat mitigation plan will be prepared for the riparian/wetland vegetation lost due to the construction project. The mitigation plan may include a combination of off-site replacement and on-site rehabilitation and will be approved by the US Army Corps of Engineers through the Section 404 permitting program.

The design consultant shall contact ADOT Environmental Planning Group (EPG) during final design to complete the environmental clearance process for geotechnical investigations.

Upon completion of the geotechnical investigations conducted during the Stage II design, the ADOT Project Manager will schedule a meeting with the ADOT EPG Hazardous Materials Team, the project design team, the appropriate Arizona Department of Environmental Quality (ADEQ) representative for the 52nd Street Motorola Superfund Site, and the appropriate ADEQ representative for the South Indian Bend Wash Water Quality Assurance Revolving Fund (WQARF) site to obtain their recommendations for the design and construction elements of the project in the vicinity of these areas.

ADOT will conduct asbestos containing materials (ACM) and lead-based paint (LBP) testing on bridge structures during final design. If these substances are detected, a containment/remediation plan will be prepared prior to construction.

During Stage IV of the final design, the ADOT Project Manager will contact the ADOT EPG hazardous materials coordinator (602.712.7768) to determine the need for an additional site assessment.

The final designer will secure an Aquifer Protection Permit prior to geotechnical investigations in the Salt River and Indian Bend Wash. The final design will include

provisions to prevent surface water and earth from entering the groundwater in the vicinity of the 52nd Street Motorola Superfund Site.

Coordination with the City of Tempe floodplain administrator, as well as the Flood Control District of Maricopa County, will be conducted for approvals and permits during final design.

The ADOT Project Manager and ADOT EPG environmental planners will coordinate during final design to review and verify the noise analysis results and abatement considerations.

ADOT Roadside Development Section will determine who will prepare the Stormwater Pollution Prevention Plan.

During final design, impacts to protected native plants will be evaluated. If protected native plants will be impacted, the ADOT Roadside Development Section will notify the Arizona Department of Agriculture at least 60 days prior to the start of construction so that the Arizona Department of Agriculture can determine the disposition of these plants.

During final design, the Arizona Department of Transportation will develop measures to avoid impacting cliff swallows that are nesting on bridges in the project area. These measures may include the removal of cliff swallow nests during the non-breeding season preceding the construction project and employing deterrents to prevent cliff swallows from rebuilding nests before construction begins.

Phoenix Construction District Responsibilities:

The ADOT Phoenix Construction District, in coordination with the ADOT Project Manager and Environmental Planning Group, will direct those constructing the project to minimize disturbance to the Salt River channel and associated wetland/riparian vegetation as indicated in the construction documents.

The ADOT Phoenix Construction District will direct the construction contractor to perform the construction activities in accordance with the habitat mitigation plan prepared by ADOT EPG and approved by the U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers.

The ADOT Phoenix Construction District will place restrictions on the construction contractor that specify construction in the Salt River channel shall not begin until September 15th and that any necessary vegetation clearing shall be completed by February 1st of the following calendar year.

The ADOT Phoenix District Construction Office will submit the Arizona Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Arizona Department of Environmental Quality.

This project is located within a designated municipal separate storm sewer system. Therefore the ADOT Phoenix District Construction Office will submit the Notice of Intent and the Notice of Termination to the City of Phoenix and City of Tempe.

Contractor Responsibilities:

In accordance with Maricopa County Rule 310, Fugitive Dust Ordinance, before beginning construction, an approved *Application for Earth Moving Permit, Demolition, and Dust Control Plan* shall be obtained from the Maricopa County Environmental Services Department. The permit describes measures to control and regulate air pollutant emissions during construction.

The contractor shall limit construction activities in the Salt River (including access, stockpiling, staging, and vehicle travel) to locations designated in the construction documents.

Construction in the Salt River channel shall not begin until September 15th and any necessary vegetation clearing shall be completed by February 1st of the following calendar year.

The contractor shall submit the Arizona Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Arizona Department of Environmental Quality.

This project is located within a designated municipal separate storm sewer system. Therefore the contractor shall submit the Notice of Intent and the Notice of Termination to the City of Phoenix and City of Tempe.

To prevent the introduction of invasive species seeds, all construction equipment shall be washed at the contractor's storage facility prior to entering the construction site.

To prevent invasive species seeds from leaving the site, the contractor shall inspect all construction equipment and remove all attached plant/vegetation debris prior to leaving the construction site.

All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction shall be seeded using species native to the project vicinity.

Material removed/excavated from within the 52nd Street Motorola Superfund and South Indian Bend Wash WQARF sites shall be stockpiled and tested for hazardous materials. If hazardous materials are present in the stockpiled material, it shall be treated as such and transported to an appropriate hazardous materials treatment facility.

A qualified hazardous materials assessor shall be on site during the geotechnical investigations and construction excavations within the 52nd Street Motorola Superfund

and South Indian Bend Wash WQARF sites. The assessor shall sample the excavated material and direct the stockpiling and containment of the excavated material.

Provisions will be implemented to prevent surface water and earth from entering the groundwater in the vicinity of the 52nd Street Motorola Superfund Site through excavations done for geotechnical investigations or construction.

The contractor shall follow the provisions of the Aquifer Protection Permit during construction activities in the Salt River.

The contractor shall comply with all terms and conditions of the Section 404 Permit; this permit will be prepared during final design.

1.0 INTRODUCTION

1.1 FOREWORD

This Initial Design Concept Report describes the development, evaluation and recommendation to provide additional general-purpose lanes on the Red Mountain Freeway (SR 202L) from Interstate 10 (I-10) (Milepost 0.00) to the Price Freeway (SR 101L) (Milepost 9.80). This project is located in the Arizona Department of Transportation's (ADOT's) Phoenix Construction District within Maricopa County in south-central Arizona. Project location and vicinity maps are provided with Figures 1 and 2, respectively.

The purpose of this report is to evaluate the safety and operational characteristics of the existing SR 202L freeway, and to evaluate alternatives to provide additional general-purpose lanes as identified in the Regional Transportation Plan Freeway Program (RTPFP). The alternatives analysis includes the evaluation of the following improvements:

Eastbound SR 202L

- Add one general-purpose lane from the I-10/SR51 TI to Scottsdale Road
- Add one or two general-purpose lanes from Scottsdale Road to the SR101L/SR202L TI
- Add additional auxiliary lanes at various locations

Westbound SR 202L

- Add one or two general-purpose lanes from the SR101L/SR202L TI to McClintock Drive
- Add one general-purpose lane from McClintock Drive to Scottsdale Road.
- Add an auxiliary lane between the McClintock Drive entrance ramp and the Scottsdale Road TI exit ramp

A Categorical Exclusion document and related technical reports are being developed in concert with this design concept study.

1.2 NEED FOR THE PROJECT

The Red Mountain Freeway (SR 202L) is a major element of the Maricopa Association of Governments (MAG) adopted Regional Transportation Plan Freeway Program (RTPFP). This segment of SR 202L accommodates traffic from Interstate 10 (I-10), State Route 51 (SR 51), the Hohokam Freeway (SR 143), the Pima and Price Freeways (SR 101L) and Sky Harbor Boulevard. The project is located adjacent to Phoenix Sky Harbor International Airport, Arizona State University, and Tempe Town Lake.

Maricopa County has been one of the fastest growing regions in the United States. Population projections indicate the population of Maricopa County will double between 2000 to 2030. Growing traffic demand has caused the SR 202L corridor to become increasingly congested during the morning and evening peak travel periods, and traffic

volume projections indicate the congestion will worsen in the future. Additional general-purpose lanes would increase the freeway capacity and help alleviate increased levels of traffic congestion in the future.

The MAG, RPTA and ADOT have worked together for many years to develop a comprehensive plan for the Regional Freeway System which is included in the RTP that was adopted by the MAG Regional Council in November 2003.

The voters of Maricopa County passed Proposition 400 in November 2004, which authorized the continuation of the existing half-cent sales tax for the next 20 years to be used for implementing the MAG RTP. A portion of the revenues collected from the half-cent sales tax extension will be deposited into the Regional Area Road Fund (RARF) to fund the RTPFP. This project is included in the RTPFP.

1.3 CHARACTERISTICS OF THE CORRIDOR

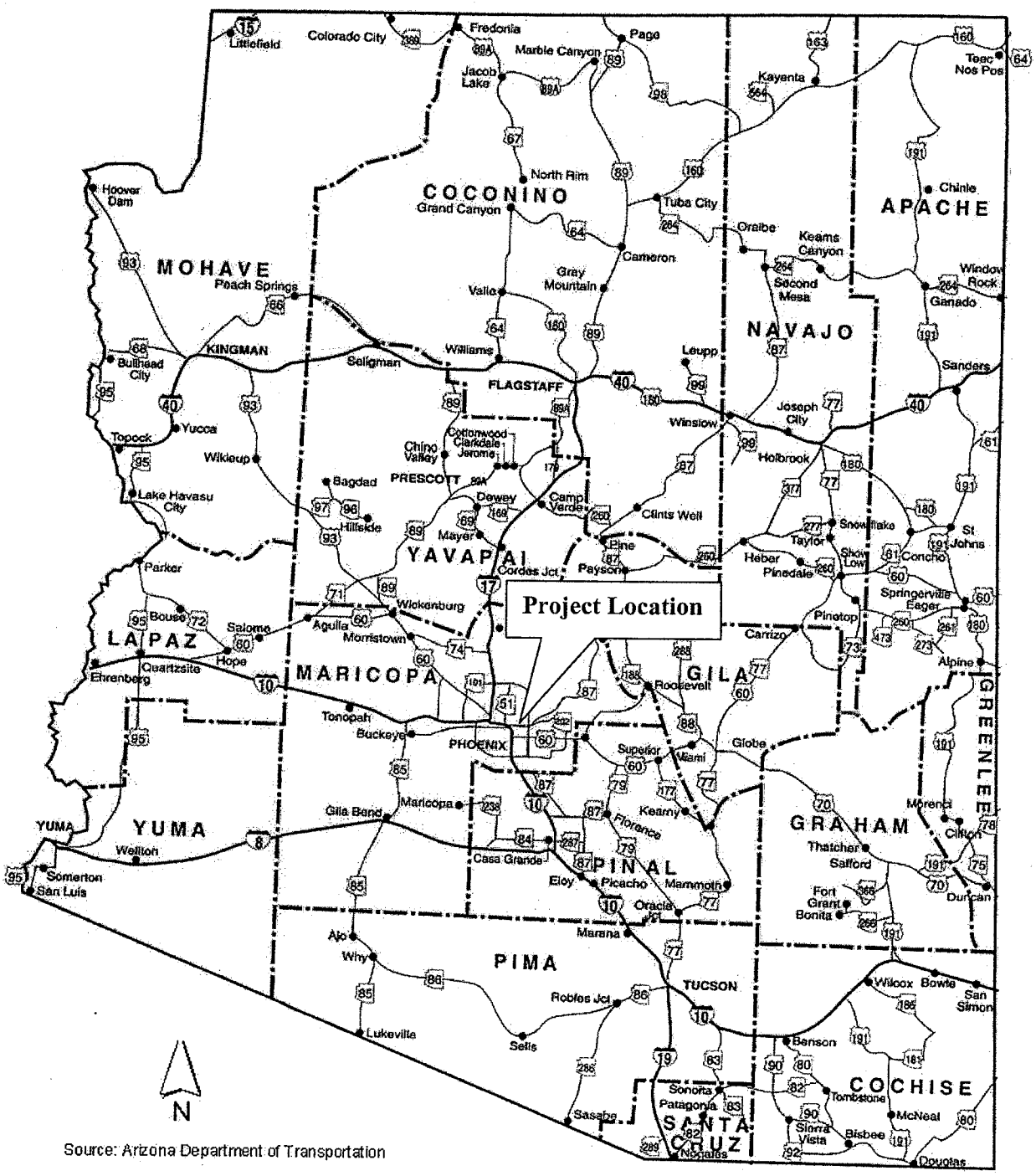
This segment of SR 202L (Red Mountain Freeway) provides a vital transportation artery in central and eastern Maricopa County that links Interstate 10, SR 51, SR 101L, SR 143 and US 60. It is a major freeway corridor that provides direct access between the communities in the east valley, Sky Harbor International Airport, and the Phoenix central business district.

1.3.1 Roadway Characteristics

SR 202L is classified as a controlled-access Urban Principal Freeway/Expressway with a posted speed limit of 55 mph between I-10 (Milepost 0.0) and 48th Street (Milepost 3.45). The posted speed limit is 65 mph between 48th Street and the SR101L/SR202L TI (Milepost 9.80).

The eastbound roadway section includes three 12' width general-purpose lanes and one 12' HOV lane from 24th Street to 32nd Street, transitioning to three 11' general-purpose lanes and one 11' HOV lane between 32nd Street and SR 143, and then transitioning back to three 12' general-purpose lanes and one 12' HOV lane between SR 143 and Priest Drive. Four 12' general-purpose lanes and one 12' HOV lane are provided between Priest Drive and the SR101L/SR202L TI.

The eastbound median shoulder is typically 10' wide throughout the corridor, with the exception of a 2' shoulder between 32nd and SR 143. The outside shoulder is consistently 10' wide throughout the study area. A 32" median concrete barrier separates the eastbound and westbound roadways. No glare screen is provided within the study area.



Source: Arizona Department of Transportation

Figure 1 – Project Location Map

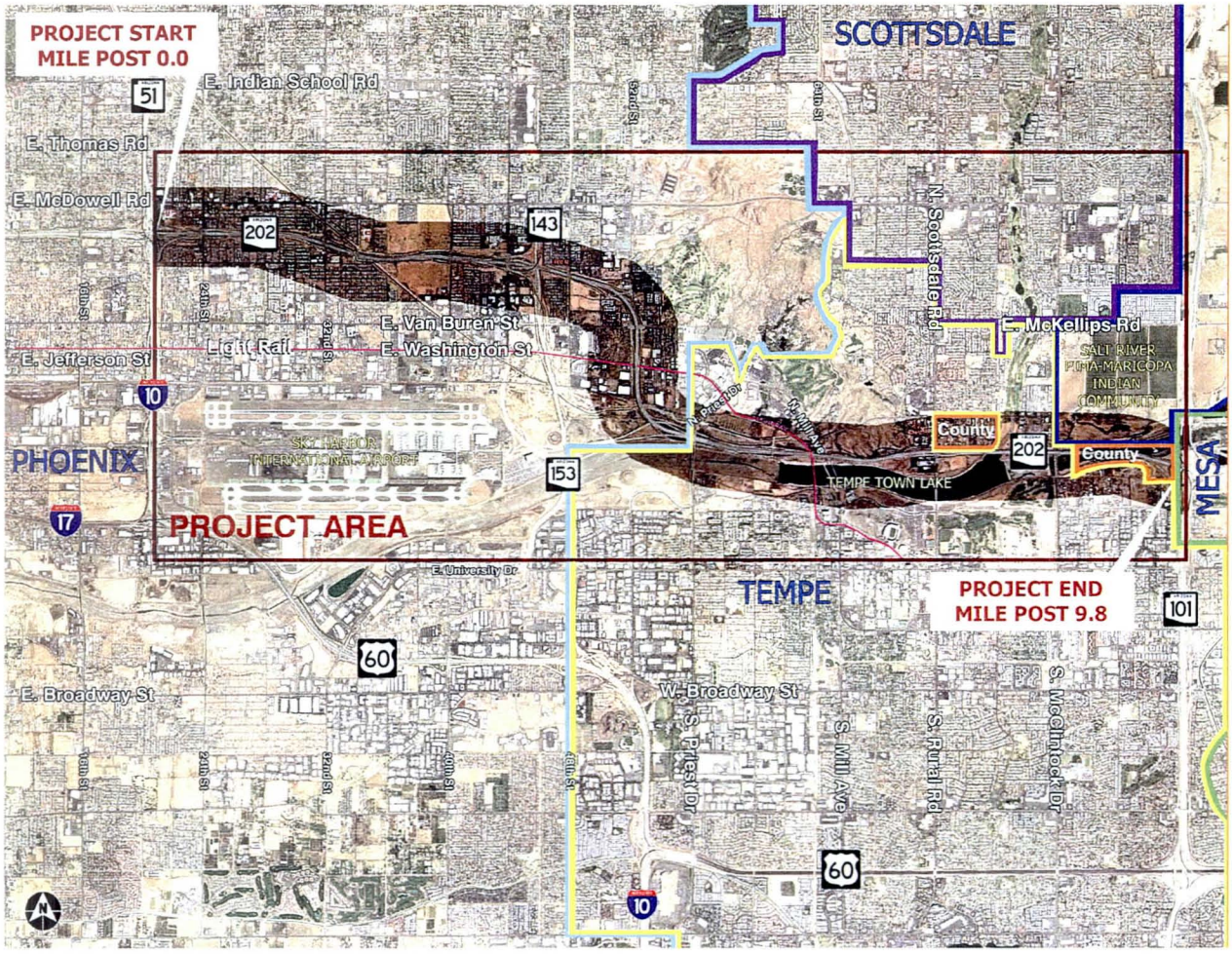


Figure 2 – Vicinity Map

In the westbound direction of travel, three 12' general-purpose lanes are provided approaching the SR101L/SR202L TI from the east. The outside lane is dropped just west of the Ramp W-S/W-N exit with an AASHTO lane drop, allowing two general-purpose lanes to continue through the interchange. An HOV lane is developed within the interchange that continues to the west. Four 12' general-purpose lanes and one 12' HOV lane depart the SR101L/SR202L TI and continue to the west to the Sky Harbor Boulevard exit ramp. The median and outside shoulders are 10' wide.

The SR101L/SR202L TI Ramp N-W (2 lanes) and Ramp S-W (1 lane) merge to provide a two lane entrance into the westbound SR 202L mainline. There is a high degree of congestion on these directional ramps because of their current configuration. The existing SR 202L lane configurations are shown on Figure 4 on page 41.

SR 202L is elevated between 24th Street and Washington Street, transitioning to a partially depressed freeway between Priest Drive to Mill Avenue, and then back to an elevated roadway from Mill Avenue to the SR 101L/SR 202L TI. The freeway is generally bordered with noise walls, earthen berms, or a combination of berms and walls along residential developments.

SR 202L intersects with Interstate 10 (I-10), State Route 51 (SR 51), the Hohokam Expressway (SR 143) (2 locations) and the Price Freeway (SR 101L). Additional freeway lanes are provided on the SR 202L mainline to improve maneuverability for traffic approaching and departing these interchanges. The east SR 143 connection also provides direct access to Sky Harbor Boulevard, which is the east entrance into Phoenix Sky Harbor International Airport.

Service interchanges provide full freeway access at 24th Street, 32nd Street, 40th Street, 44th Street, 48th Street, Priest Drive, Center Parkway, and Scottsdale Road. One-way frontage roads are provided along SR 202L between 40th and 48th Streets, and between Priest Drive and Center Parkway. Half diamond interchanges are provided at 52nd Street (ramps to/from the west), Van Buren Street (ramps to/from the east), and McClintock Drive (ramps to/from the west). Grade separations and freeway overpasses provide local street connectivity at 48th Street, 52nd Street, Washington Street, Mill Avenue, Miller Road and College Avenue.

24th Street is a ~~five~~ lane arterial street. At the 24th Street TI, the street section consists of two lanes in the southbound direction of travel, three lanes in the northbound direction of travel, one left-turn lane for the southbound to eastbound traffic movement, and one left-turn lane for the northbound to westbound traffic movement. A right-turn lane is provided for the northbound to eastbound traffic movement.

32nd Street is a six lane arterial street to the north of SR 202L, and a five lane arterial street south of SR 202L. At the 32nd Street TI, the street section consists of two lanes in the southbound direction of travel, three lanes in the northbound direction of travel, two left-turn lanes for the southbound to eastbound traffic movement, and two left-turn lanes

for the northbound to westbound traffic movement. Right-turn lanes are provided for the northbound to eastbound and southbound to westbound traffic movements.

40th Street is a four lane arterial street. At the 40th Street TI, the street section consists of two lanes in the northbound and southbound directions, one left-turn lane for the southbound to eastbound traffic movement, and one left-turn lane for the northbound to westbound traffic movement. A right-turn lane is provided for the southbound to westbound traffic movement.

48th Street is a six lane arterial street. At the 48th Street TI, the street section consists of three lanes in the northbound and southbound directions, two left-turn lanes for the southbound to eastbound traffic movement, and two left-turn lanes for the northbound to westbound traffic movement. Right-turn lanes are provided for the southbound to westbound and northbound to eastbound traffic movements.

52nd Street is a one-way three lane arterial street at the crossing of SR 202L, with freeway access provided at the Van Buren Street TI.

Van Buren Street is a four lane arterial street. At the Van Buren Street TI, the street section consists of two lanes in the westbound and eastbound directions, one left-turn lane for the westbound to southbound traffic movement, and one left-turn lane for the eastbound to northbound traffic movement. A right-turn lane is provided for the eastbound to southbound traffic movement.

Washington Street is a six lane arterial street, with three lanes in the westbound and eastbound directions of travel.

Priest Drive is a six lane arterial street. At the Priest Drive TI, the street section consists of three lanes in the northbound and southbound directions, two left-turn lanes for the northbound to westbound traffic movement, and two left-turn lanes for the southbound to eastbound traffic movement. Right-turn lanes are provided for the southbound to westbound and northbound to eastbound traffic movements.

Center Parkway is a six lane arterial street that terminates at the traffic interchange. At the Center Parkway TI, the street section consists of one northbound lane, and two left-turn lanes for the southbound to eastbound traffic movement. A right-turn lane is provided for the southbound to westbound traffic movement.

Scottsdale Road is a six lane arterial street. At the Scottsdale Road TI, the street section consists of three lanes in the northbound and southbound directions, two left-turn lanes for the northbound to westbound traffic movement, and two left-turn lanes for the southbound to eastbound traffic movement. Right-turn lanes are provided for the southbound to westbound and northbound to eastbound traffic movements.

McClintock Drive is a six lane arterial street. At the McClintock Drive TI, the street section consists of three lanes in the southbound and two lanes in the northbound

directions, one left-turn lane for the northbound to westbound traffic movement, and a right-turn lane for the southbound to westbound traffic movement.

Miller Road and College Avenue are two lane collector streets, with one lane in each direction of travel at the SR 202L crossings.

The Union Pacific Railroad (UPRR) crosses beneath SR 202L south of Washington Street, and again west of Mill Avenue. The Grand Canal also passes beneath SR 202L east of 32nd Street, and again south of Washington Street.

The Central Phoenix-East Valley Light Rail Transit (LRT) "METRO" line will pass beneath SR 202L at Washington Street and west of Mill Avenue. The METRO maintenance facility is located west of SR 202L and north of the Sky Harbor Boulevard connector. Access to the maintenance facility is provided with a spur connection between Washington Street and the Grand Canal that is located within ADOT's right-of-way to the west of the SR 202L mainline. The METRO maintenance facility and mainline segments are currently under construction with the system scheduled to be operational by December 2008.

Two existing pedestrian overpasses are located between Mill Avenue and College Avenue that could provide access across the SR 202L between Papago Park and Tempe Town Lake. The bridge openings are currently fenced awaiting improvements from the local agencies. The freeway also crosses Indian Bend Wash and the Salt River.

1.3.2 Transit Facilities and Routes

There are no existing park and ride lots currently in operation within the study area. A park and ride lot is planned along Red Mountain Freeway near 48th Street.

Valley Metro plans to initiate the Red Mountain Express and the Red Mountain Freeway Connector Bus Rapid Transit routes utilizing the HOV lanes on SR202L in July 2008 and 2018 respectively.

Valley Metro currently operates Express Route 532 that originates in east Mesa and provides service to the Phoenix central business district. This bus route utilizes the HOV lanes on the SR 202L mainline between I-10 and Scottsdale Road. Four inbound (AM) and four outbound (PM) routes are provided during the morning and evening peak periods. There is a possibility that this route may be adjusted to service additional destinations further to the east by continuing on the HOV lanes.

The Central Phoenix-East Valley Light Rail Transit (LRT) "METRO" line will pass beneath SR 202L at Washington Street and west of Mill Avenue. LRT stations are currently planned at the intersections of 44th Street and SR 153, Priest Drive and Washington Street, and Mill Avenue and 3rd Street. The METRO maintenance facility is planned west of SR202L, south of the Grand Canal, and east of SR 143. Access to the

maintenance facility is provided with a spur connection between Washington Street and the Grand Canal that is located within ADOT's right-of-way to the west of the SR 202L mainline. The METRO maintenance facility and mainline segments are currently under construction with the system scheduled to be operational by December 2008.

Valley Metro Rail intends to evaluate a future LRT line that would cross the SR 202L at McClintock Drive with a future study project.

1.3.3 Land Use

Land ownership in the project area includes State Trust lands administered by the Arizona State Land Department (ASLD), Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), municipal, and private. The SR 202L borders portions of the Salt River Pima-Maricopa Indian Community (SRPMIC), which is located north of the freeway between McClintock Drive and SR 101L. The existing freeway right-of-way is owned by ADOT except where the freeway traverses BLM lands through an easement. No changes to the current land use and ownership of the project area are anticipated with this project.

Adjacent land uses include residential, commercial, industrial, transportation, vacant, and public uses such as schools and parks. Between the I-10/SR 51 TI and 52nd Street, residential development is primarily single family homes and multi-story apartment buildings. Between 52nd Street and SR 101L, a few family homes and several apartment complexes are clustered near Center Parkway and Scottsdale Road. A new multi-story condominium project is underway south of SR 202L and east of Scottsdale Road.

Commercial development is generally clustered along the major arterial streets and traffic interchanges. Several medium-rise hotel and office buildings are located in the vicinity of 44th Street. Warehouse and shipping/distribution facilities are located between 52nd Street and Priest Drive, and a block of mixed industrial properties occur north of SR 202L between Scottsdale Road and McClintock Drive.

The Arizona State Land Department owns vacant parcels between 32nd and 40th streets. Vacant land is also located adjacent to the freeway between McClintock Drive and SR 101L, and on the SRPMIC lands located near the SR 202L/SR 101L TI.

The Excelencia Elementary School is located north of the I-10/SR 51 TI. The Gateway Elementary School is located north of SR 202L at 35th Street, and the Balsz Elementary School is located north of SR 202L at 44th Street.

1.3.4 Existing and Planned Recreational Facilities

The Carraro Cactus Garden (a City of Phoenix park that includes the Tovrea Castle) is located west of SR 202L and south of Washington Street. This park is undergoing renovation and will not be open to public until 2008.

The Moeur, Papago, and Tempe Town Lake/Rio Salado Parks are operated by the City of Tempe. The Tempe Town Lake Marina, a component of the Tempe Town Lake/Rio Salado Park, is located south of the freeway near Scottsdale/Rural Road.

The Tempe Town Lake/Rio Salado Park includes parking lots, pathways, pathway lighting and landscaping that are located within and adjacent to the SR202L right-of-way. The City of Tempe has also installed aesthetic features that are mounted on the freeway retaining walls. Many of these improvements were placed within the freeway right-of-way with an ADOT Encroachment Permit. City of Tempe improvements that are within the freeway right-of-way would be relocated by the City of Tempe.

There is a publicly accessible riparian habitat restoration project located in the Indian Bend Wash channel that includes multi-use trails. Similar projects sponsored by the U.S. Army Corps of Engineers are planned for the Salt River both upstream and downstream of the Tempe Town Lake. The City of Tempe maintains a nature preserve adjacent to Mouer Park known as the Lopiano Bosque.

The Grand Canal serves as a segment of the MAG Bikeway System and provides transportation and recreation opportunities for non-motorized travelers. The Grand Canal crosses the study area near 32nd Street and again near Priest Drive.

1.3.5 Utilities

The major existing public utilities that are located within this segment of the SR 202L corridor are presented in Table 1. This inventory of utilities was compiled from quarter-section maps, existing facility plans and as-built drawings that were provided by the local agencies and utility companies.

Table 1 – Existing Utility Crossings

Cross Street/Intersection	Existing Utility Description
SR51 TI, east half	18" and 8" sanitary sewer
SR51 TI to 24th Street	18" sanitary sewer; 4" and 8" steel gas lines; 10" and 21" sanitary sewers; 16" steel water line
26th Street to 32nd Street	8" sanitary sewer; 10" sanitary sewer; 16" RCP water line; 21" sanitary sewer; 27" RCP irrigation pipeline; 8" CIP water line; 6" steel and 4" gas lines
Grand Canal	Grand Canal crossing
36th Street to 44th Street	69kV overhead power lines; 15" sanitary sewer in 36" steel sleeve; 15" sanitary sewer; 4" steel gas line; 8" sanitary sewer; 54" RCP water line; 16" DIP water line; fiber optic lines; 8" sanitary sewer
SR143 TI	6" CIP water line; 30" RCP sanitary sewer with 48" RCP sleeve

Table 1 – Existing Utility Crossings (continued)

Cross Street/Intersection	Existing Utility Description
48th Street to 52nd Street	8" CIP and 12" CIP water lines; 8" steel and 4" gas lines; 3-6" water lines; 15" sanitary sewer; 12" and 16" DIP water lines
Van Buren Street	Fiber optic lines; 8" and 16" water lines; 8" sanitary sewer
Washington Street	69kV overhead power lines; 4" CIP, 8" DIP, 8" CIP water lines; 4" sewer force main; 8" steel and 2" PE gas lines
Union Pacific Railroad	Railroad underpass; fiber optic lines along UPRR right-of-way
North of Sky Harbor Boulevard to south of Priest Drive	69kV overhead power lines; fiber optic lines; 24" VCP sanitary sewer in steel casing; 69kV overhead power lines
Union Pacific Railroad Overpass	Underground telephone; fiber optic telephone
North Lake View Road to Mill Avenue Viaduct	Water and sewer lines; (2 circuits) 69kV overhead power lines; 6" steel nitrogen pipeline; water line; 8" steel gas line
Rural Road/Scottsdale Road	36" sanitary sewer line; 2-8" and 1-30" water lines; 4" high pressure steel gas line
Miller Road to McClintock Drive	12" DIP water line; 3 circuits of 230kV overhead power lines with 69kV underbuilt
McClintock Drive	SRP 69kV overhead power lines; APS 230kV overhead power lines; APS 69kV/SRP 12kV power lines; 36" CCP water line; 36" RCP, 21" VCP, 18" VCP sanitary sewers; 12" steel gas line
McClintock Drive to SR101L/SR202L TI	APS and SRP overhead 230kV power lines along the north side of the freeway

1.3.6 Drainage

1.3.6.1 Off-site Drainage Systems

The existing topography of the project area is relatively flat desert land. The drainage pattern slopes gradually from east to west and predominantly to the south towards the Salt River. The SR 202L was designed to intercept, convey and discharge the 100 year off-site drainage flows to the historic outfalls without adversely impacting the adjacent property. The storm water intercepted by the freeway on-site drainage systems is conveyed to the off-site drainage systems.

The eastern end of the study area is located within the Salt River and Indian Bend Wash 100-year floodplains. Measures to mitigate flooding impacts to the freeway included channelization of these waterways, and constructing the freeway above the 100-year flood stage. The Salt River and Indian Bend Wash crossings are discussed further in Section 1.3.6.3.

The information for the existing off-site and on-site drainage systems was gathered from drainage reports and as-built plans. Seven drainage reports were obtained from the ADOT Drainage Section and are listed as follows:

Project Number	Description
RAM-600-5-303	Off-site collection/on-site outfall (I-10 to 40th Street)
RAM-600-3-513	Off-site and on-site collection (40th Street to 48th Street)
RAM-600-5-509	Off-site and on-site collection (48th Street to Priest Drive)
RAM-600-5-308	Off-site and on-site collection (Priest Drive to Indian Bend Wash)
RAM-600-5-301D	Off-site and on-site collection (Indian Bend Wash to SR 101L)
600-5-517	Hydraulic and scour analysis (Indian Bend Wash Crossing)
Not Available	Hydraulic and scour analysis (Salt River Crossing)

The off-site drainage systems include channels, culverts, detention basins, retention basins, and storm drains that ultimately outfall to the Salt River. The following is a list of off-site systems that are categorized by their outfall.

I-10 Inner Loop Storm Drain Tunnel

The I-10 Inner Loop Storm Drain East Tunnel is a 21' diameter concrete lined tunnel that runs north-south along I-10 between the I-10/SR51 TI and the Salt River. The tunnel is the outfall for numerous drainage basins within the City of Phoenix. The SR 202L East Papago Storm Drain (EPSD) drainage system discharges into the tunnel at the Moreland Avenue drop structure.

East Papago Storm Drain

The EPSD is located along the north side of SR 202L between the Moreland Avenue drop structure and the SR143 TI. The EPSD is a closed conduit system that ranges in size from a two cell 10' x 9' RCBC at the drop structure to a 54" RCP at 36th Street. A series of off-site drainage channels extend this drainage system from 36th Street to the SR143 TI.

An existing 60" storm drain collects and conveys storm water on 24th Street to the south to the SR 202L. This storm drain discharges into the EPSD.

The North State Lands Detention Basin is located north of SR 202L and east of 36th Street. This basin was constructed as a joint facility for ADOT and the Arizona State Land Department (ASLD). The basin intercepts all flows entering the ASLD property between 36th and 40th Streets, runoff from 36th Street, and discharges from the EPSD further to the east. Storm water is routed through the basin and drains into the EPSD to the west.

The South State Lands Detention Basin is located on the ASLD property south of SR 202L and east of 36th Street. This basin intercepts off-site drainage along the north side of the Grand Canal. Runoff collected by the basin is conveyed to the EPSD.

The North and South Grand Canal Detention Basins are located north and south of SR 202L respectively at the west Grand Canal crossing. These basins collect, store and discharge off-site drainage to the EPSD.

32nd Street Storm Drain

This 60" diameter storm drain is located within 32nd Street and collects storm water from the north before crossing SR 202L and continuing to the south.

Grand Canal

The Grand Canal crosses SR 202L east of 32nd Street, and again south of Washington Street (both crossings are in a FEMA Zone A Floodplain). This canal serves as part of the Salt River Project (SRP) irrigation system.

40th Street Storm Drain

This 84" diameter storm drain is located within 40th Street and collects storm water from the north before crossing SR 202L and continuing to the south.

Relocated Old Crosscut Canal

The Old Crosscut Canal originally served as a flood control channel and was relocated with the construction of the SR202L/SR143 TI. The Relocated Old Crosscut Canal (ROCC) is concrete lined and originates at McDowell Road east of SR143. The ROCC continues to the south along the east side of SR 143 to collect and convey storm water to the Salt River.

The East Papago Detention Basin is located within a triangular area bounded by 52nd Street, Ramp A and Roosevelt Street. This basin receives storm water from the City of Phoenix 52nd Street storm drain. Storm water is routed through this basin and discharges into the ROCC.

The Hohokam Retention Basin is located adjacent to Ramp E-N at the SR202L/SR143 TI. This basin collects storm water runoff from a depressed segment of SR 143. Runoff collected in this basin is drained by a small lift station that discharges into the ROCC.

East Papago Storm Drain Interceptor

The East Papago Storm Drain Interceptor (EPSDI) begins at a diversion structure located east of 52nd Street and just south of Roosevelt Street. This storm drain continues to the south along the east side of SR 202L, until crossing SR 202L just north of the UPRR and discharging into the Salt River. The EPSDI ranges in diameter from a 60" to 80" RCP, transitioning to a two cell 8' x 5' box culvert when it crosses under the Grand Canal.. The pavement drainage from approximately Station 162+00 and Station 167+00 to the UPRR, drains into the EPSDI.

The 52nd Street Detention Basin is located in an area bounded by 52nd Street, Ramp B and SR 202L. This basin collects runoff from the northeast and discharges into the EPSDI.

Priest Drive Storm Drain

This 96" diameter storm drain is located within Priest Drive and collects storm water from the north before crossing SR 202L and continuing to the south to discharge into the Salt River. This storm drain is an element of the Salt River Project Papago Park Master Plan.

The Priest Drive detention basin is located east of Priest Drive and south of the Union Pacific Railroad (UPRR). The basin collects storm water from the off-site area south of the UPRR and north of SR 202L between Priest Drive and Center Parkway. The on-site storm water captured by the basin includes part of the Priest Drive Bridge, Ramp C, and a section of the mainline. The majority of the basin is located outside of ADOT right-of-way within an easement with SRP. The basin routes storm water to the Priest Drive 96" storm drain.

Storm Drain at SR202L Station 148+50

Pavement drainage from approximately Station 148+00 to Station 167+50 is discharged into a 36" storm drain that outfalls directly to the Salt River.

Storm Drain at SR 202L Station 167+65

This 102" diameter storm drain crosses SR 202L in a north-south direction approximately 600' west of Center Parkway. This storm drain is an element of the Salt River Project Papago Park Master Plan. The pavement drainage from the eastbound mainline between Station 190+25 and Station 194+25 is intercepted by special deck inlets and conveyed to the west through the bridge abutment to this storm drain.

Center Parkway Retention Basin

This retention basin is located north of SR 202L and east of Center Parkway. The storm water runoff between Center Parkway and the UPRR is intercepted by the freeway embankment and diverted to the Center Parkway retention basin..

The storm water runoff from the westbound Mill Avenue viaduct from Station 189+30 to Station 194+25 is intercepted by special bridge deck inlets, and is conveyed to the west with a pipe conduit system that passes through the west bridge abutment and discharges to northwest at the toe of the embankment slope. The runoff is then conveyed to the Center Parkway retention basin.

Storm Drain Outlet Channel at SR 202L Station 191+00

This 66" diameter storm drain is located on the east side of the UPRR. The storm drain conveys the storm water collected with an off-site channel on the north side of SR 202L to another channel located south of SR 202L. The south channel discharges into another 66" diameter pipe before discharging to the Salt River.

West and East Pedestrian Overpasses

The west and east pedestrian overpasses are located at Station 210+00 and 224+00, respectively. These pedestrian crossings convey drainage collected along the north side of SR 202L to the Salt River.

Pavement drainage collected between Station 194+25 and 231+00 is collected and conveyed to the north to a natural channel located along the north side of SR 202L. The runoff is then conveyed to the pedestrian overpasses that provide conveyance for the flows to the Salt River.

College Avenue Overpass and Storm Drain

A dual 48" diameter storm drain is located in College Avenue, and is the outfall for the College Avenue/Gilbert Drive storm drain systems to the north. This storm drain conveys flows to the Salt River.

Pavement drainage for this portion SR 202L, and the majority of the Scottsdale Road TI Ramps A and B will discharged into this storm drain system. On-site and off-site runoff in excess of the capacity of the storm drain is conveyed through the overpass to the Salt River.

Indian Bend Wash Pump Drain

The Indian Bend Wash Pump Drain is a channel located north of SR 202L between Mill Avenue and College Avenue. The off-site drainage from the north is intercepted by this system until the capacity of the drain is exceeded. Excess runoff then discharges directly to the Salt River through the two pedestrian overpasses and the east span of the Mill Avenue viaduct.

Scottsdale Road Storm Drain

This 36" diameter storm drain is located with Scottsdale Road. This storm drain continues to the south and discharges into the Salt River.

The pavement drainage collected from the SR 202L mainline, the Scottsdale Road TI ramps, and Scottsdale Road is collected and conveyed to this storm drain.

Box Culvert at SR 202L Station 258+50

The double 8'x6' box culvert is located between Scottsdale Road and Indian Bend Wash. The culvert conveys runoff across SR 202L to an existing channel south of the freeway, which discharges into the Salt River.

Indian Bend Wash

Indian Bend Wash is a FEMA mapped floodplain that crosses SR 202L between Scottsdale Road and McClintock Drive, where it outfalls into the Salt River. The Indian Bend Wash bridges are approximately 1008' long.

Salt River

Within the limits of this project, the Salt River is adjacent to SR 202L from east of Priest Drive to SR 101L. The Salt River is a FEMA mapped floodplain that serves as the receiving waters for all of the off-site and on-site drainage associated with this project. the east and westbound Salt River bridges are approximately 5,289.50' and 5,097.50' long respectively.

1.3.6.2 On-Site Drainage Systems

The on-site drainage system is defined here as the pavement drainage system, which is designed to maintain storm water encroachments on the roadway within the design criteria. This system drains the storm water from the roadway to the appropriate off-site drainage facilities.

The existing on-site drainage infrastructure includes a 30" cast-in-place concrete pipe (CIPCP) storm drain that is currently located under portions of the eastbound and westbound roadway shoulders from east of 24th Street to 40th Street.

The Indian Bend Wash and Salt River Bridges are currently drained with a combination of two types of drains. The first type is a 6" diameter scupper (hole through deck) placed in the bridge deck. The second type is a 22" by 3" slot opening in the bridge barrier. These drains outfall directly through the bridge deck and barrier into the area below. The remaining bridges/overpasses include catch basins installed in the roadway approaches that are located outside of the bridge limits.

1.3.6.3 Salt River and Indian Bend Wash

Salt River

The contributing drainage area upstream of the SR 202L bridge is approximately 1,000 square miles and includes the White, Black and Verde Rivers. Dams constructed within this watershed include the Theodore Roosevelt, Horse Mesa, Mormon Flat, Stewart

Mountain, Horseshoe and Bartlett Dams. The design discharge for the Salt River is primarily controlled by releases at the Theodore Roosevelt dam.

Tempe Town Lake extends from approximately McClintock Drive to just downstream of Mill Avenue. The lake is developed with inflatable dams that are used to detain water within the river banks. During large river flow events, the dams are deflated and the water flows unobstructed down the Salt River.

The U.S. Army Corps of Engineers (Corps) completed the *Gila River and Tributaries, Central Arizona Water Control* Study in 1982. The primary objective of this study was to develop an existing condition discharge to frequency correlation at selected points in the Gila River and its tributaries. The recorded stream flows for these watercourses were converted to a sequence of "standardized" existing condition discharges to develop an existing condition discharge to frequency relationship for the river.

A second Corps study was completed for the modified Theodore Roosevelt Dam in 1996 that quantified the impact of the recent Theodore Roosevelt Dam modifications on the original discharge to frequency relationships at selected points within the Gila River Basin. These two Corps studies provide the best estimating method for the hydrologic conditions in the watercourse.

The design discharges that were used for the existing Salt River channelization and freeway bridges were obtained from the Corps study with the "pre-Roosevelt modification" conditions (1982 study).

Table 2 presents the results of the Corps hydrologic analyses for the Salt River at the Mill Avenue Bridge, which is approximately two miles downstream of the Salt River Bridge. These discharges were used to define the peak discharge for various frequency flood events within the study area.

Table 2 – Salt River Discharges at Mill Avenue Bridge

Return Period (years)	Discharge (cfs)
5	40,000
10	93,000
20	135,000
50	160,000
100	215,000
200	275,000
500	330,000

The Salt River is channelized throughout the study area. Cement stabilized alluvium (CSA) bank protection has been constructed for both river banks to contain the 100-year flood event within the river channel.

Table 3 provides the existing 100-year water surface elevations from the hydraulic model recently developed for this study to include current topographic conditions within the river. The results of the new hydraulic model were compared with the current adopted hydraulic model prepared by Simons, Li & Associates (SLA) in 1994. The SLA hydraulic model was developed to document the river hydraulic characteristics based upon the "as-built" river bank protection and river crossings. The SLA and AZTEC hydraulic model produced similar results.

The water surface and velocity components of the table were derived from the AZTEC hydraulic model, while the top of bank elevations were obtained from the *Final Hydraulic & Scour Analysis Report* prepared by Simons, Li & Associates (SLA) in 1994.

Table 3 – Existing Salt River Hydraulic Conditions

Cross Section ID	100-year Flow Rate (cfs)	Existing WSEL (1) (ft)	Existing Velocity (ft/s)	Top of Bank Elevation (1) (ft)	Existing Bank Freeboard (ft)
120.50	215,000	1165.17	15.45	1173.72	8.55
122.00	215,000	1165.84	14.30	1172.22	6.38
122.65	215,000	1166.05	14.50	1171.32	5.27
123.55	215,000	1168.8	12.63	1172.12	3.32
228.00	215,000	1170.26	11.38	1174.32	4.06
229.00	215,000	1170.70	11.88	1174.92	4.22
230.00	215,000	1171.23	14.07	1174.72	3.49
231.00	215,000	1172.20	13.98	1174.52	2.32
232.00	215,000	1172.59	13.86	1175.72	3.13
233.00	215,000	1173.15	14.56	1175.92	2.77
234.00	215,000	1175.15	13.32	1178.92	3.77
235.00	215,000	1176.05	12.15	1179.82	3.77
236.00	215,000	1177.48	10.54	1180.92	3.44
237.00	215,000	1179.28	9.78	1182.92	3.64
238.00	215,000	1180.09	8.18	1183.42	3.33
239.00	215,000	1180.08	8.56	1182.52	2.44
240.00	220,000	1180.80	7.75	1184.92	4.12
240.10	220,000	1180.83	7.24	--	--
240.20	220,000	1180.85	7.18	--	--
240.30	220,000	1180.96	6.90	--	--
240.40	220,000	1180.97	6.84	--	--
240.50	220,000	1180.99	6.70	--	--
240.60	220,000	1180.98	6.79	--	--
241.10	220,000	1180.99	6.87	1184.52	3.53
241.20	220,000	1180.97	6.83	--	--

Notes: (1) The water surface and bank protection elevations are NAVD 88 datum, and are derived from the current hydraulic model prepared by AZTEC Engineering (2006)

The Corps completed a Flood Insurance Study (FIS) for this portion of the Salt River in 1984. The FIS delineates 28 miles of floodplain in the Salt River from the confluence with the Gila River to Country Club Drive. The Federal Emergency Management Agency (FEMA) adopted the Salt River FIS and the mapping was published as the regulatory floodplain and floodway. There are two FEMA Flood Insurance Rate Maps

(FIRM) within the project area, panel 2160 Map No. 04013C2160F and panel 2170 Map No. 04013C22170G.

The Salt River FIS used the peak flood discharges developed in the Corp's Central Arizona Water Control Study as shown in Table 2 as the existing conditions. The FIS estimated a 100-year frequency peak discharge of 215,000 cfs through the project reach, and 220,000 cfs upstream of the Pima Freeway (SR 101L) bridge crossing. The peak discharge of 250,000 cfs for this project was designated as the "Superflood" in this FIS report.

Indian Bend Wash

Indian Bend Wash is channelized upstream and through out the limits of this study and discharges into the Salt River through the Indian Bend Wash (IBW) Drop Structure. The IBW Drop Structure is a series of drops that dissipate the flow energy and is comprised of 8' to 10' thick roller compacted concrete. Tempe Town Lake downstream of the northern edge of the structure and water from the lake extends above a large portion of this structure. Some of the existing piers for the Indian Bend Wash Bridge penetrate the drop structure.

Simons Li & Associates (SLA) completed the Indian Bend Wash Flood Insurance Study for this watercourse in 1997. The FIS included the Indian Bend Wash drop structure at the downstream section of the watercourse as it flows into the Tempe Town Lake. The FIS report delineated the 100-year floodway and floodplain that was accepted by FEMA as the regulated floodplain. The report used 20,000 cfs as the 100-year flow and documented the Standard Project Flood (SPF) as 39,000 cfs. The 10-year flow was not presented in this report, but was defined in the original study completed by the Corps at 4,000 cfs.

1.3.7 Right-Of-Way

The existing ADOT right-of-way width varies along the SR 202L corridor throughout the study area. The total right-of-way width varies from approximately 225' to 1040'.

After construction of the original freeway improvements, a strip of right-of-way along Mill Avenue was abandoned to the City of Tempe by ADOT Board Resolution.

The City of Tempe (COT) has facilities located below the Mill Avenue Viaduct and between Mill Avenue and College within the ADOT right-of-way by lease agreement. The COT also has existing landscaping, pathways, pedestrian lighting, aesthetic features attached to ADOT's retaining walls, and other amenities that have been installed between Mill Avenue and College Avenue within the ADOT right-of-way by permit or agreement.

The right-of-way at Indian Bend Wash was acquired by ADOT from the BLM under a grant agreement. BLM issued a grant to ADOT with a stipulation that required ADOT to

assign a flowage easement (channelization) to FCDMC. A license was issued to FCDMC for the channelization.

1.3.8 Structures

The existing bridge structures within this segment of the SR 202L corridor were built between the years of 1987 and 1999. The ADOT Bridge Inspection Reports indicate that all existing structures provide sufficient vertical clearance with the exception of the 44th and 48th Street overpasses. Several discrepancies were noted between the as-built documents and the bridge inspection records. Field verification of the vertical clearances at these structures will be required as part of the final design.

The METRO crossings of SR 202L are currently being constructed at Washington Street and west of Mill Avenue. Field verification of the vertical clearances at these structures will also be required with the final design.

A summary of the existing bridges within the study area is provided in Table 4.

Table 4 – Existing Bridge Summary

Structure Number	Milepost (SR 202L)	Structure Name	Superstructure And Foundation Type(s)	Minimum Vertical Clearance / Total Bridge Length
2116	147.27 (I-10)	WB 10/SB 51 – EB 202 Ramp	Cast-in-place post-tensioned concrete box; Full-height abutments on drilled shafts; Piers on drilled shafts	16.80' / 304.50'
2021	0.70	24th Street TI Overpass	Cast-in-place post-tensioned concrete box; Full-height abutments on dual row of battered and single row of straight steel piles	17.43' / 251.50'
2022	1.75	32nd Street TI Overpass	Cast-in-place post-tensioned concrete box; Full-height abutment on single row of battered and single row of straight steel piles	17.11' / 194.29'
2023	2.01	Grand Canal Bridge	Cast-in-place post-tensioned concrete box; Partial-height abutments on dual row of straight steel piles	20.5' over maintenance road at Sta 1067+20 / 142.52'
2024	2.45	40th Street TI Overpass	Cast-in-place post-tensioned concrete box; Partial-height abutments on dual row of drilled shafts	17.84' / 158.00'
2140	2.90	44th Street TI Overpass	Cast-in-place post-tensioned concrete box; Full-height abutments on spread footings; Piers on spread footings	15.85' / 295.02'
2159	3.25	Ramp E-N (over SR 202L)	Cast-in-place post-tensioned concrete box; Partial-height abutments on drilled shafts; Piers on spread footings	16.91'/681.00'

Table 4 – Existing Bridge Summary (continued)

Structure Number	Milepost (SR 202L)	Structure Name	Superstructure And Foundation Type(s)	Minimum Vertical Clearance / Total Bridge Length
2160	3.25	East Papago TI Underpass EB	Cast-in-place post-tensioned concrete box; Partial-height abutments on spread footings; Piers on spread footings	17.32' / 324.20'
2198	3.45	48th Street Overpass EB	Cast-in-place post-tensioned concrete box; Partial-height abutments on drilled shafts; Piers on spread footings	17.28'(1) / 181.23'
2208	3.89	Ramp B Overpass EB	Cast-in-place post-tensioned concrete box; Stub abutments on a single row of battered and a single of row of straight steel piles; Piers on spread footings	16.66' / 153.72'
2210	4.04	52nd Street Overpass EB	Cast-in-place post-tensioned concrete box; Partial-height abutments on a single row of battered and a single row of straight steel piles; Piers on spread footings	18.50' / 306.84'
2212	4.20	Van Buren Street Overpass EB	Cast-in-place post-tensioned concrete box; Partial-height abutments on a single row of battered and a single row of straight steel piles; Piers on spread footings	16.56' / 203.00'
2214	4.52	Washington Street Overpass EB	Cast-in-place post-tensioned concrete box; Partial-height abutments on a single row of battered and a single row of straight steel piles; Piers on spread footings	16.98' / 216.02'
2217	4.83	SPRR/Grand Canal Bridge EB	Precast prestressed concrete AASHTO Type VI Standard and Modified Girders; Partial-height abutments on a dual row of battered and a single row of straight steel piles; Piers on spread footings	24.47' / 417.83'
2219	5.02	Sky Harbor Boulevard WB Overpass (202L EB)	Cast-in-place post-tensioned concrete box; Partial-height abutments on a single row of battered and a single row of straight steel piles; Piers on spread footings	16.72' / 271.14'
2405	5.70	Priest Drive TI Underpass	Precast prestressed concrete AASHTO Type VI Modified Girders; Stub abutments on drilled shafts cast integrally with retaining wall; Pier on spread footing	20.42' / 270.68'

Table 4 – Existing Bridge Summary (continued)

Structure Number	Milepost (SR 202L)	Structure Name	Superstructure And Foundation Type(s)	Minimum Vertical Clearance / Total Bridge Length
2227	6.04	Center Parkway TI Underpass	Cast-in-place post-tensioned concrete box; Full-height Abutment 1 and partial-height Abutment 2 founded on dual row of drilled shafts; Pier on drilled shafts	18.70' / 281.00'
2258	6.34	Mill Avenue Viaduct (EB & WB)	Cast-in-place post-tensioned concrete box; Partial-height abutments on dual row of drilled shafts (note: terraced wall at Abutment 2); Pier on drilled shafts	18.07' over Mill Avenue; 24.25' over railroad / 1,029.23'
2259	7.13	W Pedestrian Overpass EB/WB	Cast-in-place post-tensioned concrete box; Stub abutments on drilled shafts cast integrally with retaining wall	12.2' (note: clearance = 10.1 for WB structure) / 74.00'
2260	7.41	E Pedestrian Overpass EB/WB	Cast-in-place post-tensioned concrete box; Stub abutments on drilled shafts cast integrally with retaining wall	12.2' / 74.00'
2261	7.55	College Avenue Overpass	Cast-in-place post-tensioned concrete box; Partial height abutments on dual row of drilled shafts	15.57' / 125.80'
2263	7.71	Scottsdale Road TI Overpass	Cast-in-place post-tensioned concrete box; Full-height abutments on dual row of drilled shafts	16.53' / 200.50'
2265	8.06	Indian Bend Wash Bridge	Precast prestressed concrete AASHTO Type VI Standard Girders; Stub abutments on drilled shafts; Piers on drilled shafts	15.3' (maintenance road adjacent to Indian Bend Wash Structure @ Sta 266+98, SR202L EB) / 1,008.00'
2268	8.17	Salt River Bridge EB	Precast prestressed concrete AASHTO Type VI Standard and Super Girders; Stub abutments on drilled shafts; Piers on drilled shafts	16.58' over McClintock; 15.58' over McClintock Ramp; 29.1' over maintenance road (Salt River bank @ Sta 299+06, 202L EB) / 5,289.50' (EB), 5,097.50' (WB)
2269	8.17	Salt River Bridge WB	Precast prestressed concrete AASHTO Type VI Standard and Super Girders; Stub abutments on drilled shafts; Piers on drilled shafts	
2358	51.00	Ramp N-W	Cast-in-place post-tensioned concrete box; Full-height abutment on drilled shafts; Piers on spread footings	16.94' for SR202L WB, 20.50' for SR202L EB / 3096.22'
2343	50.98 (SR 101L)	Ramp 101 S to Ramp 202 E	Precast prestressed concrete AASHTO Type VI Standard and Girders (Spans 1-5) and Cast-in-place post-tensioned concrete box (Spans 6 -14)	17.67' / 2290.12'

Table 4 – Existing Bridge Summary (continued)

Structure Number	Milepost (SR 202L)	Structure Name	Superstructure And Foundation Type(s)	Minimum Vertical Clearance / Total Bridge Length
2379	51.24 (SR 101L)	Ramp W-S Over 202L	Cast-in-place post-tensioned concrete box; Full-height Abutment 1 on dual row of drilled shafts, Stub Abutment 2 on single row of drilled shafts; Piers on drilled shafts	16.73' for 202L WB; 17.90' for 202L EB / 245.00'
2381	51.37 (SR 101L)	101L NB Over SR 202L	Cast-in-place post-tensioned concrete box; Stub abutments on drilled shafts; Pier on spread footings	21.48' / 281.71'
2382	51.37 (SR 101L)	101L SB Over 202L	Cast-in-place post-tensioned concrete box; Stub abutments on drilled shafts; Piers on spread footings	
2409	51.37 (SR 101L)	Ramp E-N Over 202L	Cast-in-place post-tensioned concrete box; Stub abutments on drilled shafts; Pier on spread footing	16.63' / 301.00'

All vertical clearances shown have been obtained with ADOT Bridge Maintenance records or as-built plans.
(1) ADOT Bridge Maintenance notes that the WB vertical clearance is 15.83'. Additional survey is recommended at this structure to verify the vertical clearance noted for the EB structure (17.28').

1.3.9 Signing and Lighting

Guide Signs

The existing freeway guide signs are supported with cantilever sign supports or tubular sign bridges. The majority of the existing sign bridges were not designed to accommodate future pavement widening based on a review of the as-built plans. Table 5 depicts the existing sign bridges that would be required to be modified to support the additional general-purpose and auxiliary lanes associated with this project.

Table 5 – Existing Sign Structures Requiring Modifications

Direction of Travel	SR 202L Station	Sign Structure Type
Eastbound	1005+20	DMS
Eastbound	1019+00	Cantilever
Eastbound	1025+00	Cantilever
Eastbound	1038+50	Cantilever
Eastbound	1048+75	Sign Bridge
Eastbound	1078+50	Sign Bridge
Eastbound	1091+60	Cantilever
Eastbound	1102+00	Sign Bridge
Eastbound	1119+20	Sign Bridge
Eastbound	29+90	Cantilever

Table 5 – Existing Sign Structures Requiring Modifications (continued)

Direction of Travel	SR 202L Station	Sign Structure Type
Eastbound	44+00	Cantilever
Eastbound	52+50	DMS
Eastbound	84+00	Cantilever
Eastbound	101+50	Cantilever
Eastbound	117+30	Cantilever
Eastbound	241+00	Cantilever
Eastbound	253+00	Cantilever
Eastbound	276+65	Sign Bridge
Eastbound	285+00	DMS
Eastbound	300+30	Sign Bridge
Eastbound	315+30	Cantilever
Eastbound	335+00	Sign Bridge
Westbound	262+00	Cantilever
Westbound	271+40	Cantilever
Westbound	300+00	DMS
Westbound	309+75	Cantilever

Freeway Lighting

The existing SR 202L freeway lighting consists of high mast lighting at the system interchanges, and a mixture of median mounted high mast poles and offset mounted poles. The pole heights vary in the vicinity of the service interchange ramps.

The SR 202L mainline and ramp lighting systems are energized with 240/480 volt Type IV load centers. Table 6 presents the locations of the existing load centers, the limits of the lighting fixtures associated with each load center, and the existing SR 202L mainline conduit crossing locations.

Table 6 – Existing SR 202L Load Center Locations

Load Center Locations	Western Limit	Eastern Limit
SW Corner of 24th Street TI	SR 202L Station 400+00	SR 202L Station 1021+00
NW Corner of 32nd Street TI	SR 202L Station 1021+00	SR 202L Station 1083+00
NE Corner of 40th Street TI	SR 202L Station 1083+00	SR 202L Station 38+00
4613 E. Beatrice	SR 202L Station 38+00	SR 202L Station 62+00
NE Corner of Washington St TI	SR 202L Station 62+00	SR 202L Station 120+00
NE Corner of Priest Drive TI	SR 202L Station 120+00	SR 202L Station 288+00
NW Corner of McClintock Dr TI	SR 202L Station 288+00	SR 202L Station 340+00

1.3.10 Freeway Management System

The existing Freeway Management System (FMS) consists of ramp meters at various entrance ramps, Dynamic Message Signs (DMS), CCTV cameras, detector loops as shown in Table 7.

The FMS communication system includes three 3" conduits with fiber optic cables located along the shoulders of the eastbound and westbound roadways. The conduit system is concrete encased where located along the existing roadways, and is typically attached to the bridge structures at the overpasses.

Table 7 – Existing FMS System Elements

Direction of Travel	SR 202L Station	FMS Element
Eastbound	1005+20	DMS
Eastbound	1010+08	System Loops
Eastbound	1010+08	Ramp Meter
Eastbound	1028+74	System Loops
Eastbound	1047+00	System Loops
Eastbound	1065+50	System Loops
Eastbound	1065+50	Ramp Meter
Eastbound	1084+80	System Loops
Eastbound	1104+00	System Loops
Eastbound	1125+00	System Loops
Eastbound	19+50	System Loops
Eastbound	33+50	System Loops
Eastbound	52+50	DMS
Eastbound	54+00	System Loops
Eastbound	72+00	System Loops
Eastbound	88+00	System Loops
Eastbound	88+00	Ramp Meter
Eastbound	105+00	System Loops
Eastbound	115+50	CCTV
Eastbound	122+55	System Loops
Eastbound	132+90	System Loops
Eastbound	132+90	Ramp Meter
Eastbound	157+50	System Loops
Eastbound	159+00	Ramp Meter
Eastbound	182+80	System Loops
Eastbound	182+80	Ramp Meter
Eastbound	200+00	CCTV
Eastbound	201+00	System Loops
Eastbound	214+00	System Loops
Eastbound	236+50	System Loops
Eastbound	255+50	System Loops

Table 7 – Existing FMS System Elements (continued)

Direction of Travel	SR 202L Station	FMS Element
Eastbound	255+50	Ramp Meter
Eastbound	265+00	CCTV
Eastbound	282+00	System Loops
Eastbound	285+00	DMS
Eastbound	300+50	System Loops
Eastbound	320+00	System Loops
Westbound	249+70	System Loops
Westbound	249+70	CCTV
Westbound	265+00	System Loops
Westbound	287+00	System Loops
Westbound	287+00	Ramp Meter
Westbound	286+00	CCTV
Westbound	300+00	DMS
Westbound	306+00	System Loops
Westbound	325+00	System Loops
Westbound	325+50	CCTV

1.3.11 Geotechnical Conditions

Bridge Foundations

The geotechnical conditions for this segment of SR 202L were determined based on a review of the as-built plans and available geotechnical investigation reports.

The general site geology consists of Precambrian age basement granite with an overlying stratum of Tertiary age sedimentary rock; termed the Camels Head Formation (Reynolds, 2002). Both of these units were tilted and severely faulted in Tertiary times during the formation of the Basin and Range, with basin infilling of the eroded surficial Camels Head Formation to form the similar, though much softer, Tempe Formation (Tempe Beds). Late Tertiary to Quaternary age erosion and infilling of low lying areas resulted in a finer to coarse grained unconsolidated unit of basin fill. The sand, gravel and cobble deposit (locally referred to as SGC) was formed by the ancestral widespread meandering of and infilling of Paleochannels that were cut through the basin fill and were in-filled with sand, gravel and cobble materials that originated upstream (east) of the project limits. Though much of the SGC layer is exposed within the near proximity to the Salt River, a large portion of this deposit is overlain by a more recent floodplain Quaternary deposit of silt, sand, and clay with minor gravels. SGC is known to extend to depths of 100' or more. Most of the SGC is non-plastic and un-cemented, though it does contain isolated lenses or layers (generally at depth) with higher percentages of low to medium plastic fines. The upper contact (5' to 10') of this stratum is also locally weakly to moderately cemented with calcium carbonate.

The majority of near surface materials consist of alluvial soils which vary from fine to coarse depending upon the proximity to the sand, gravel and cobble laden Salt River stream bed. Relatively shallow to exposed bedrock is also present within the middle portions of the project. Relatively firm, finer grained silty to clayey sands, and sandy clays to silt are present to depths which vary from about 15' to 22' in depth between I-10 and 38th Street. These soils are typically weakly cemented with calcium carbonate and vary from non-plastic to medium plasticity. SGC with minor sand layers underlies the surficial finer grained soils. SGC was not encountered with the previous test borings that were advanced along the project alignment between 40th Street and the UPRR/Grand Canal overpass structure. Much of this area is underlain by older, firm to hard basin fill clayey sands to clayey gravel and shallow to exposed metarhyolite and granite bedrock which abuts to the east with the red sandstone/siltstone/conglomerate (Tempe Formation) which predominates at Pagago Buttes. Granite bedrock (likely the Tovrea Granite) was encountered at depths ranging from about 48 feet at the 48th Street Overpass (rock was not encountered in borings performed at the Ramp B Overpass) to about 1' (Van Buren Street OP) and dropping to about 35 feet at the Sky Harbor Westbound OP. The depth to rock increases in the vicinity of Priest Drive where rock was not encountered within the structural borings. To the east, the alignment approaches the south flank of the exposed Tempe Formation, with rock being encountered at depths of about 12' to 79' in borings advanced at Mill Avenue, College Avenue, and the eastbound and westbound pedestrian overpass structures. The bedrock is overlain by up to 30' of finer grained silty sands, sandy silt and clayey sand which overlies SGC, extending down to bedrock. The SGC layer was not encountered in borings advanced for the College Avenue OP, with shallow rock encountered at depths of 12' to 29', near the base of the exposed buttes.

The remaining portion of the SR 202L alignment that includes the Scottsdale Road TI OP, the Indian Bend Wash Bridge and the Salt River Bridge are all underlain by finer grained alluvium of varying depths, man-made fills in many areas, SGC to significant depths (generally more than 100') and old basin fill alluvium. From just west of Indian Bend Wash east to the SR101L/SR202L TI, SR 202L passes through previous construction debris and municipal solid waste landfills. Past gravel mining operations, which were significant along this reach of the Salt River, created open pits which were later often used as disposal sites. Significant geotechnical and environmental studies were performed to investigate the extent and possible hazards associated with the landfills. However, these previous man-made areas were previously mitigated with the original freeway construction projects.

Groundwater was encountered between 40th and 52nd Streets, from the SPRR/Grand Canal Bridge to Mill Avenue, and from Indian Bend Wash to the SR101L/SR202L TI. At the time of the original investigations, a perched groundwater layer was encountered at a depth of 65' with one test boring. Other borings did not indicate groundwater conditions. Between 44th Street and SR 143, the depth of groundwater varied from 34' to 40' below ground surface. Ground water was encountered at depths of 10' to 20' at the 52nd Street overpass. While rock was not identified at the Van Buren Street and Washington Street overpasses, water may have been present within the bedrock that

was not identified within core holes advanced with water. Groundwater was encountered at depths of 12' to 30' between these SPRR/Grand Canal bridge to Mill Avenue. The depth to water varied considerably within the test borings between Indian Bend Wash and the SR101L/SR202L TI, with recorded groundwater depths ranging from 40' to 119'. The depths to water within the vicinity of the Salt River are known to vary widely depending on rainfall and flows within the channel.

Pavement Structural Sections

The existing pavement structural sections were obtained from the as-built plans and available geotechnical investigation reports.

Portland cement concrete pavements (PCCP) with thickness ranging from 10" to 13.5" were provided over 4" to 5" of either asphaltic concrete base (ACB), Class 2 Aggregate Base (AB), or Lean Concrete Base (LCB). AB was typically used for at-grade and elevated freeway conditions, while ACB or LCB was used within depressed freeway areas. The existing pavement structural sections that were constructed with the previous freeway projects are provided in Table 8.

Table 8 – Existing Pavement Structural Sections

Project Segment & Number	Roadway	PCCP (in)	AB Class 2 (in)	ACB Mix (in)	Total Thickness (in)
I-10/SR51 TI to 24th Street RAM-600-5-506	Mainline, Median, and Outside Shoulder	10	5*	-	15
	Ramps	10	4	-	14
24th Street to 40th Street RAM-600-5-501 RAM-600-5-502	Mainline, Median and Outside Shoulder	13.5	4.5	-	18
	24th & 40th Street Ramps 32nd Street Ramps	10 9	3	4	13
40th Street to 48th Street RAM-600-3-512	Mainline, Median, and Outside Shoulder	13	4	-	17
	Ramps	10	5	-	15
48th Street to Priest Drive RAM-600-5-509	Mainline, Median, and Outside Shoulders	12	4	-	16
	Ramps	10	4	-	14
Priest Drive to Indian Bend Wash RAM-600-5-511	Mainline, Median, and Outside Shoulder	12 to 12.5**	4	-	16
Salt River Bridge RAM-600-5-517					
Salt River Bridge to Red Mtn TI RAM-600-1-518	Mainline, Median and Outside Shoulder	13.5	4	-	17.5
	Ramps	11	4	-	15

* Lean concrete base used in lieu of AB
** As-built plans did not include pavement sections in this area (assumed pavement section to be verified during final design)

1.3.12 Previous Projects

The ADOT Milepost Strip Map shows the project listed in the Table below:

Table 9 – Previous Projects

Project Number and/or TRACS Number	Begin Milepost	As-Built Date	Description
RAM-600-5-502 H 085502C	1.6	1987	East Papago Freeway Jct. I-10-Grand Canal
RBM-600-5-505 H086401C	1.6	1987	East Papago Freeway Grand Canal Bridge
RAM-600-3-510 H204401C	2.0	1992	Hohokam-East Papago TI-Phase I
RAM-600-5-504 H096301C	0.6	1992	East Papago Freeway 24th St TI
RAM-600-3-512 H204402C	2.0	1993	Hohokam-East Papago TI-Phase II
RAM-600-5-506 H085904C	0	1993	East Papago/Squaw Peak Interchange
RAM-600-5-501 H085501C	147	1993	East Papago (Jct. 1-10-40th St.) GD/Pave/Str
RAM-600-5-511 H086101C	5.5	1993	East Papago (Priest Dr.-McClintock Dr. G/D)
RAM-600-5-513 H086102C	5.5	1993	Reconstruct/Upgrade
RAM-600-5-510 H086003C	0.7	1994	Landscaping and Irrigation
RAM-600-3-518 H204404C	3.2	1994	Hohokam, Red Mountain TI Landscaping
RAM-600-5-509 H086001C	3.5	1994	East Papago (48th St.-Priest Dr.)
RAM-600-5-516 H086103C	6.0	1994	Priest to Jct. 101L Landscaping
RAM-600-5-511A H086101C	6.0	1995	East Papago (Priest Dr.-McClintock Dr. G/D)
RAM-600-5-517 H086104C	7.4	1996	East Papago (Indian Bend Wash – McClintock Dr.)
RAM-600-5-508 H215101C	8.2	1997	East Papago (McClintock Dr.-SR 101L)
RAM 202-B-501 H562001C	8.2	2000	Red Mountain Freeway 202L-Salt River Bridge EB & WB-Median Gap Closure
S-202-A-503 H574801C	0.6	2001	Red Mountain Freeway (202L) 24th St. to 32nd St.
RAM-888-A-500 H665001C	4.4	Not Available	Red Mountain Quiet Pavement Phase VI
RAM-600-5-512 H085504C	147	Not Available	East Papago (Jct. I-10-40th St. Lands)
M-600-5-525 H451601C	1.6	Not Available	32nd St.-44th St. Restriping
RAM-600-5-525 H451601C	1.6	Not Available	32nd St.-44th St. Landscape
I-600-5-508 H215101C	8.0	Not Available	East Papago McClintock Dr.-SR 101L
RAM-600-8-528 H485801C	9.7	Not Available	Red Mountain Freeway (SR 202L)-LP 101-Country Club Dr.-Landscape

2.0 TRAFFIC AND CRASH DATA

2.1 CRASH ANALYSIS

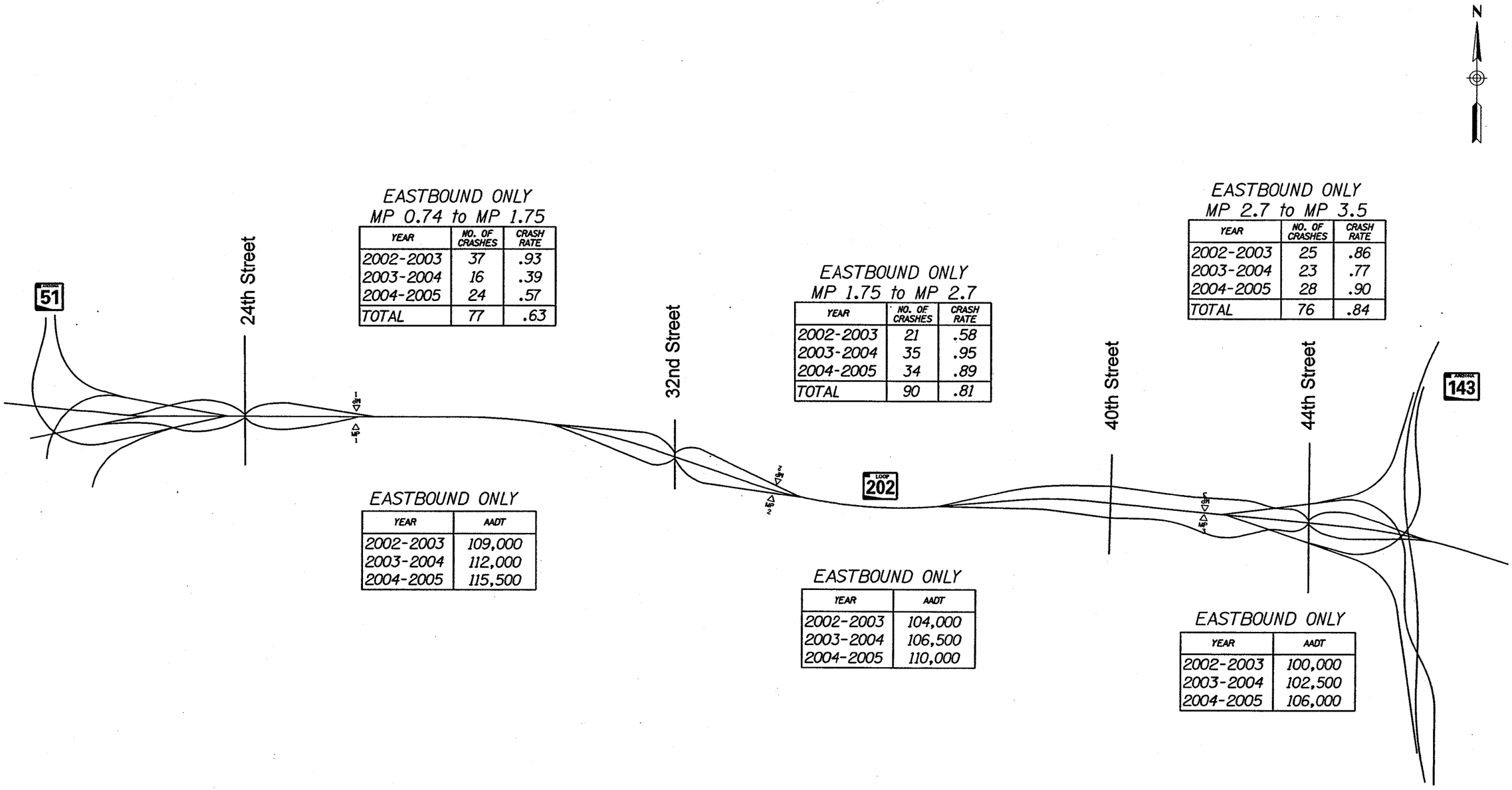
The ADOT Traffic Studies Section provided crash data for the segment of the SR 202L corridor between the I-10/SR51 TI and the SR101L/SR202L TI. Between April 2002 to March 2005, there were a total of 1,657 reported crashes within the study area. Figure 3 and Table 10 illustrate the yearly crash summary by freeway segment during this time period. The following is a summary of some key characteristics of the crash data:

- Of the 1,657 crashes reported, 1,118 resulted in property damage only (67%), 534 resulted in injuries (32%), and 5 resulted in a fatality (0.3%).
- 76 percent of the crashes involved another motor vehicle while 14 percent involved a fixed object. These two types of crashes accounted for 90 percent of the crashes.
- Of the 1,263 crashes with another motor vehicle, 79 percent (997 crashes) were rear-end crashes, and 19 percent (234 crashes) were sideswipe crashes.
- 74 percent of the crashes occurred during daylight hours, 5 percent occurred at dusk or dawn, and the remaining 21 percent occurred during hours of darkness.

Table 10 – Mainline Crash Summary

Freeway Segment	No. of Crashes (April 2002 – March 2005)	Crash Rate (2002 – 2005) (Crash/Million Vehicle Miles)
Eastbound 24th Street to 32nd Street	77	0.63
Eastbound 32nd Street to 40th Street	90	0.81
Eastbound 40th Street to SR143	76	0.84
Eastbound SR143 to 52nd Street	119	1.42
Eastbound Van Buren Street to Priest Drive	159	1.48
Eastbound Priest Drive to Scottsdale Road	386	1.68
Eastbound Scottsdale Road to McClintock Drive	263	2.41
Eastbound McClintock Drive to SR 101L	186	1.20
Westbound Scottsdale Road to McClintock Drive	112	1.02
Westbound McClintock Drive to SR 101L	157	1.01

According to the *Regional Freeway Bottleneck Study* (Maricopa Association of Governments, 2006), the average crash rate on the Regional Freeway System was 0.78 accidents per million vehicle miles in 2000. This study also documented the 75th percentile as 1.41 crashes per million vehicle miles. Six of the ten calculated segment rates are less than the 75th percentile, while two additional segment rates are within 5% of the 75th percentile. Therefore, eight of the ten segments are less than or slightly higher (within 5%) than the 75th percentile.



EASTBOUND ONLY
MP 0.74 to MP 1.75

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	37	.93
2003-2004	16	.39
2004-2005	24	.57
TOTAL	77	.63

EASTBOUND ONLY

YEAR	AADT
2002-2003	109,000
2003-2004	112,000
2004-2005	115,500

EASTBOUND ONLY
MP 1.75 to MP 2.7

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	21	.58
2003-2004	35	.95
2004-2005	34	.89
TOTAL	90	.81

EASTBOUND ONLY

YEAR	AADT
2002-2003	104,000
2003-2004	106,500
2004-2005	110,000

EASTBOUND ONLY
MP 2.7 to MP 3.5

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	25	.86
2003-2004	23	.77
2004-2005	28	.90
TOTAL	76	.84

EASTBOUND ONLY

YEAR	AADT
2002-2003	100,000
2003-2004	102,500
2004-2005	106,000

NOTE:

1. Crash data included records from April 1st to March 31st of each year.
2. Crash Rate is per million vehicle miles.

NOT TO SCALE - SCHEMATIC ONLY

FIGURE 3
SHEET 1 OF 3
YEARLY CRASH SUMMARY

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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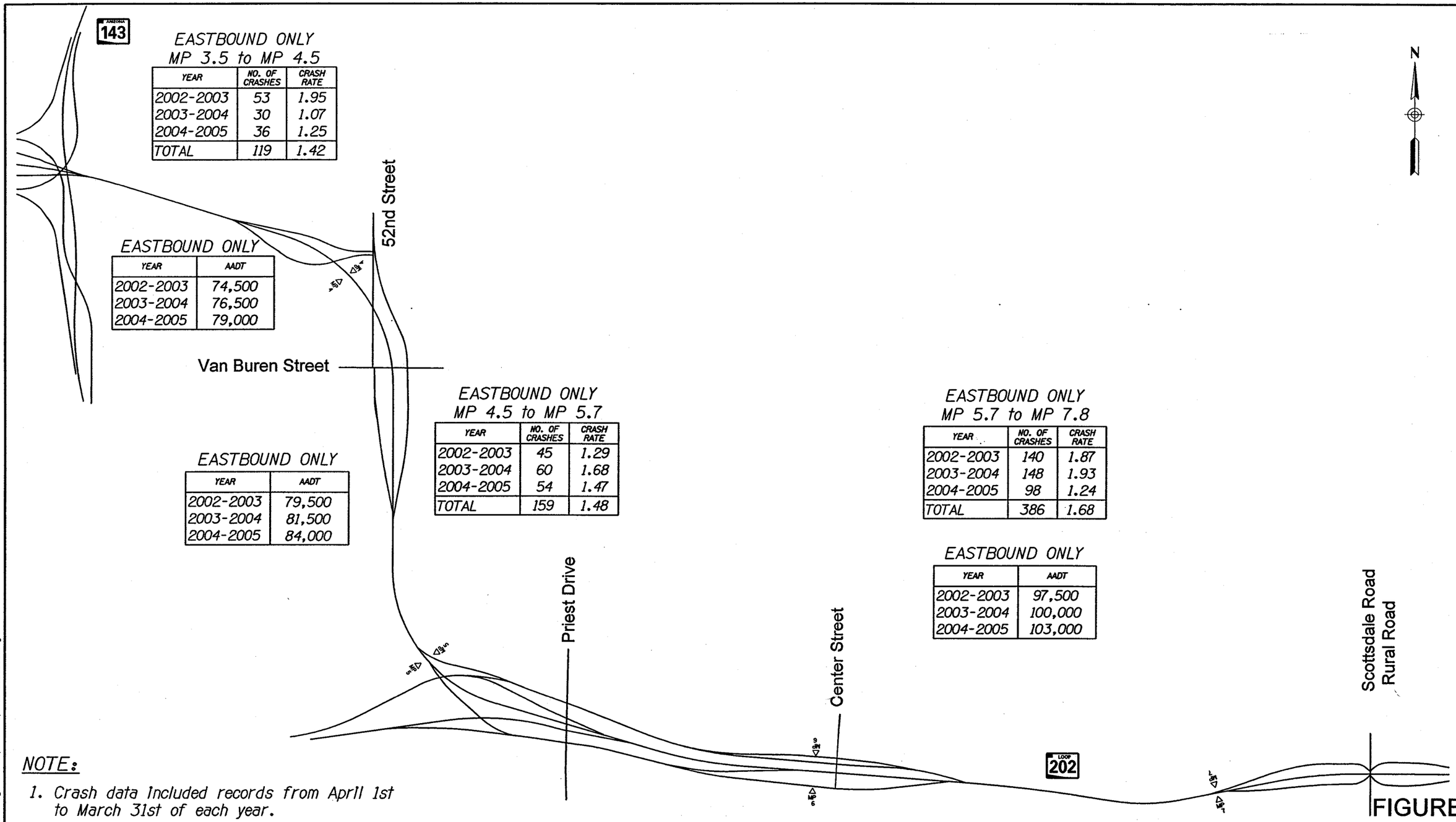

EASTBOUND ONLY
MP 3.5 to MP 4.5

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	53	1.95
2003-2004	30	1.07
2004-2005	36	1.25
TOTAL	119	1.42

EASTBOUND ONLY

YEAR	AADT
2002-2003	74,500
2003-2004	76,500
2004-2005	79,000

EASTBOUND ONLY

YEAR	AADT
2002-2003	79,500
2003-2004	81,500
2004-2005	84,000

EASTBOUND ONLY
MP 4.5 to MP 5.7

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	45	1.29
2003-2004	60	1.68
2004-2005	54	1.47
TOTAL	159	1.48

EASTBOUND ONLY
MP 5.7 to MP 7.8

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	140	1.87
2003-2004	148	1.93
2004-2005	98	1.24
TOTAL	386	1.68

EASTBOUND ONLY

YEAR	AADT
2002-2003	97,500
2003-2004	100,000
2004-2005	103,000

NOTE:

1. Crash data included records from April 1st to March 31st of each year.
2. Crash Rate is per million vehicle miles.

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

FIGURE 3
SHEET 2 OF 3
YEARLY CRASH SUMMARY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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EASTBOUND
MP 7.8 to MP 8.8

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	100	2.81
2003-2004	94	2.58
2004-2005	69	1.84
TOTAL	263	2.41

WESTBOUND
MP 7.8 to MP 8.8

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	33	.93
2003-2004	32	.88
2004-2005	47	1.25
TOTAL	112	1.02

EASTBOUND
MP 8.8 to MP 10.5

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	77	1.53
2003-2004	64	1.24
2004-2005	45	.84
TOTAL	186	1.20

WESTBOUND
MP 8.8 to MP 10.5

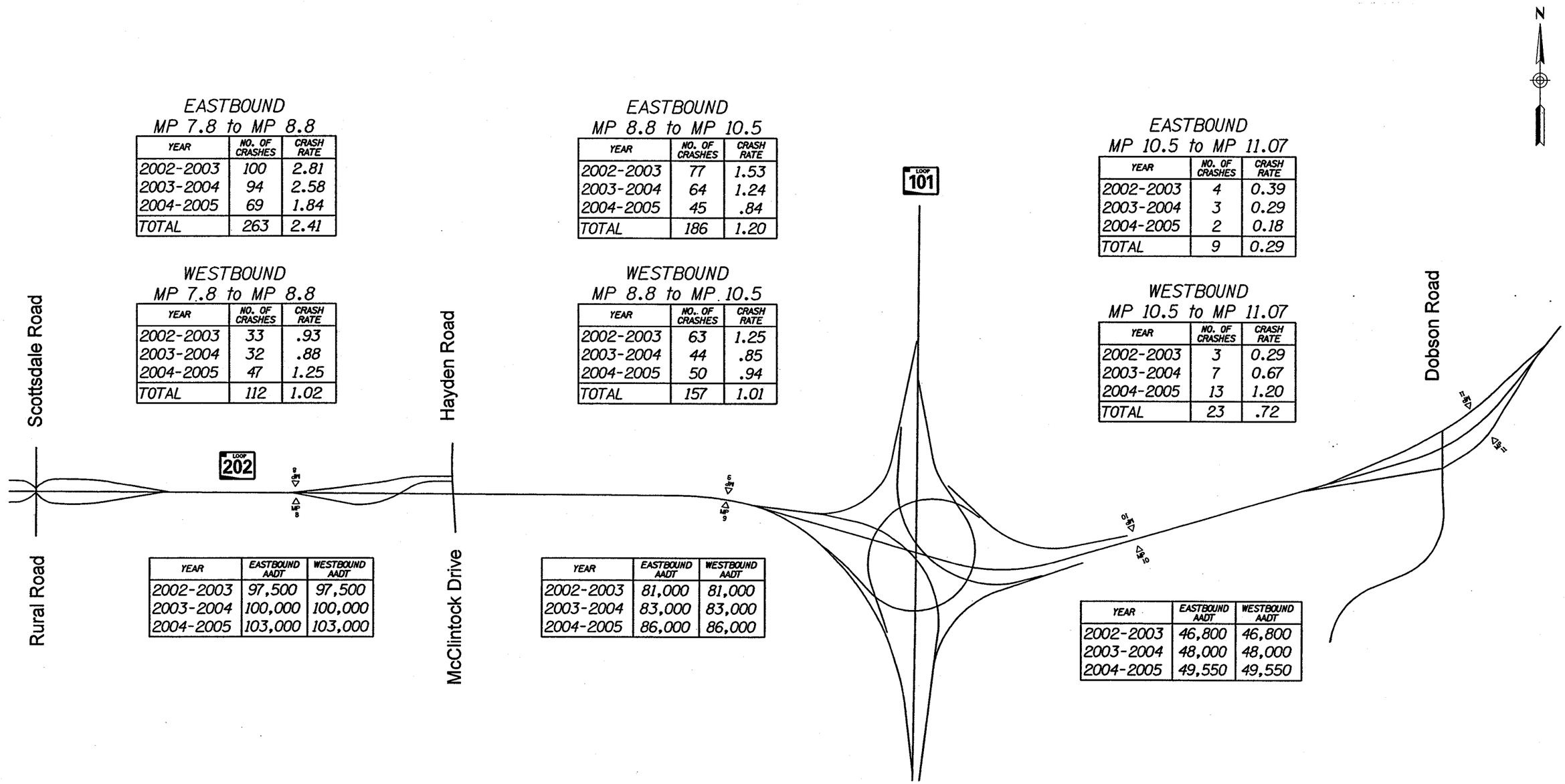
YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	63	1.25
2003-2004	44	.85
2004-2005	50	.94
TOTAL	157	1.01

EASTBOUND
MP 10.5 to MP 11.07

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	4	0.39
2003-2004	3	0.29
2004-2005	2	0.18
TOTAL	9	0.29

WESTBOUND
MP 10.5 to MP 11.07

YEAR	NO. OF CRASHES	CRASH RATE
2002-2003	3	0.29
2003-2004	7	0.67
2004-2005	13	1.20
TOTAL	23	.72



YEAR	EASTBOUND AADT	WESTBOUND AADT
2002-2003	97,500	97,500
2003-2004	100,000	100,000
2004-2005	103,000	103,000

YEAR	EASTBOUND AADT	WESTBOUND AADT
2002-2003	81,000	81,000
2003-2004	83,000	83,000
2004-2005	86,000	86,000

YEAR	EASTBOUND AADT	WESTBOUND AADT
2002-2003	46,800	46,800
2003-2004	48,000	48,000
2004-2005	49,550	49,550

NOTE:

1. Crash data included records from April 1st to March 31st of each year.
2. Crash Rate is per million vehicle miles.

NOT TO SCALE - SCHEMATIC ONLY

SR 202L
I-10/SR 51 to SR 101L

FIGURE 3
SHEET 3 OF 3
YEARLY CRASH SUMMARY

ON THE MOVE
PARTNERS IN PROGRESS

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This evaluation indicates that a substantial number of crashes within this segment of the SR 202L corridor occur during the A.M. and P.M. peak periods with a high percentage of rear-end crashes. These types of crashes are commonly associated with congested traffic conditions. Providing additional freeway capacity that would reduce the level of congestion and provide a more balanced level-of-service throughout the corridor may reduce these crash rates.

2.2 EXISTING TRAFFIC CONDITIONS

Historical traffic count data was obtained from ADOT Transportation Planning Division (TPD) for years 2002, 2003, and 2004. In addition, SR 202L mainline traffic counts were conducted at several locations within the study area in March 2006. The existing daily (ADT) and peak hour volumes are shown on Figure 4.

The existing SR202L mainline daily traffic volume varies within the study area from approximately 230,000 vehicles per day (vpd) at the west end (24th Street to 32nd Street) to approximately 172,000 vpd at the east end (McClintock Drive to SR101L/SR202L TI). The Scottsdale Road ramps have the highest traffic volumes (10,000 – 15,000 vpd).

The traffic factors listed in the ADOT Arizona State Highway System Log indicate the portion of the Average Annual Daily Traffic (AADT) occurring within the peak hour is approximately 9%, the directional distribution is approximately 50% in the peak direction of travel, and approximately 9% of the daily traffic is classified as commercial vehicles (trucks). These factors are based on 365 days of data collected in 1998 and do not reflect the weekday commuting nature of the SR 202L corridor.

An operational analysis was conducted for the existing conditions, and is summarized in Section 2.4.2 and on Figures 5 and 6.

2.3 FUTURE TRAFFIC CONDITIONS

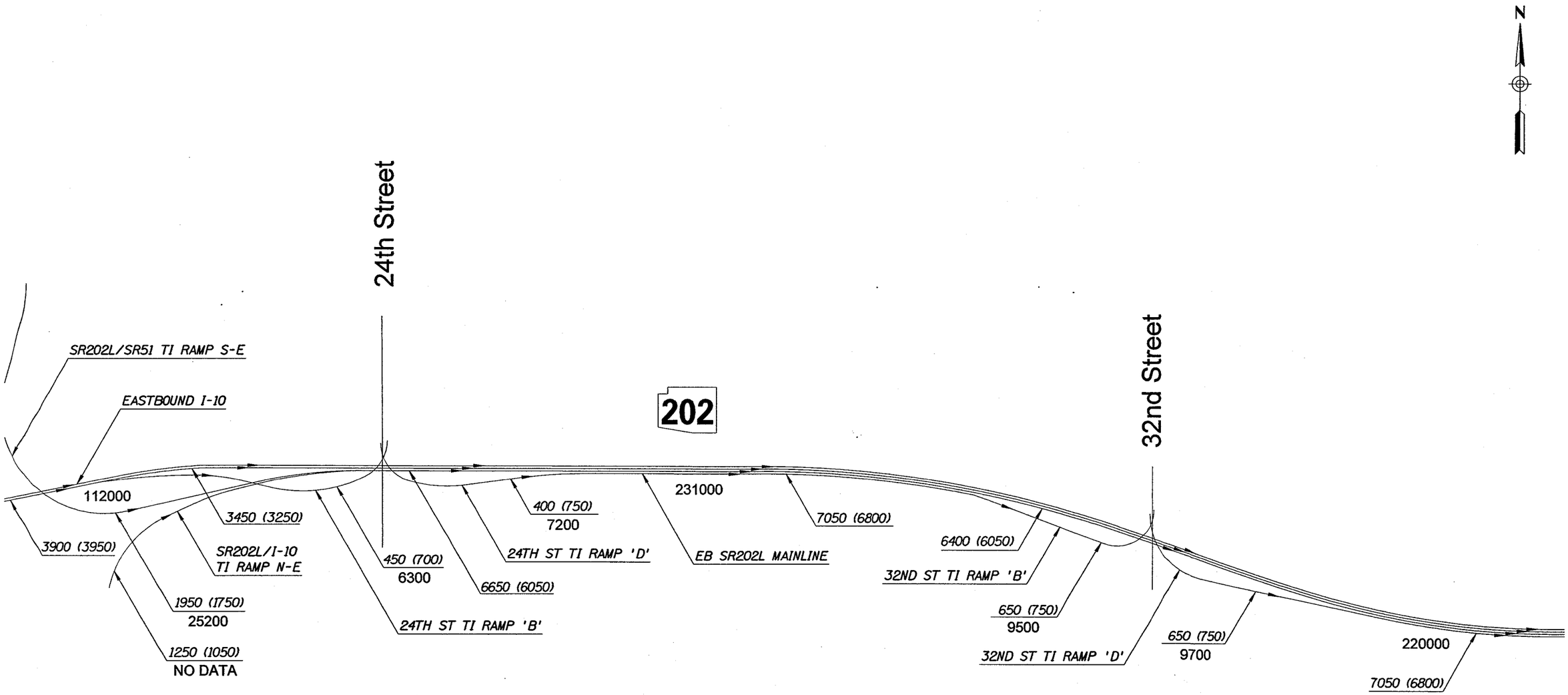
2.3.1 Description of Alternatives

This design concept study evaluated three alternatives including the No-Build, Build Alternative 1, and Build Alternative 2 scenarios. The No-Build Alternative would not include any improvements to this segment of the SR 202L corridor.

Alternative 1 would provide additional freeway capacity by constructing the following improvements:

- Eastbound SR 202L
  - Add one general-purpose lane from the I-10/SR51 TI to the SR101L/SR202L TI
  - Add an auxiliary lane between the 44th Street entrance ramp and the 52nd Street exit ramp, and between the Van Buren Street entrance ramp and Priest Drive exit ramp

(Text continued on page 56)



LEGEND: RAMPS, $\frac{1950\ (1750)}{25200}$: $\frac{\text{AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)}}{\text{AVERAGE ANNUAL DAILY TRAFFIC VOLUMES}}$

MAINLINE, 7050 (6800): AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)

MAINLINE, 231000: AVERAGE ANNUAL DAILY TRAFFIC VOLUMES, EASTBOUND AND WESTBOUND TOGETHER, HOV VOLUMES INCLUDED

NOTES: 1. THE HOV LANES ARE NOT SHOWN IN THE FIGURES.
2. THE DATA SHOWN REFLECTS 2004 COUNTS FROM ADOT AND 2006 COUNTS TAKEN BY DMJM HARRIS.

FIGURE 4
SHEET 1 OF 5
EXISTING TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

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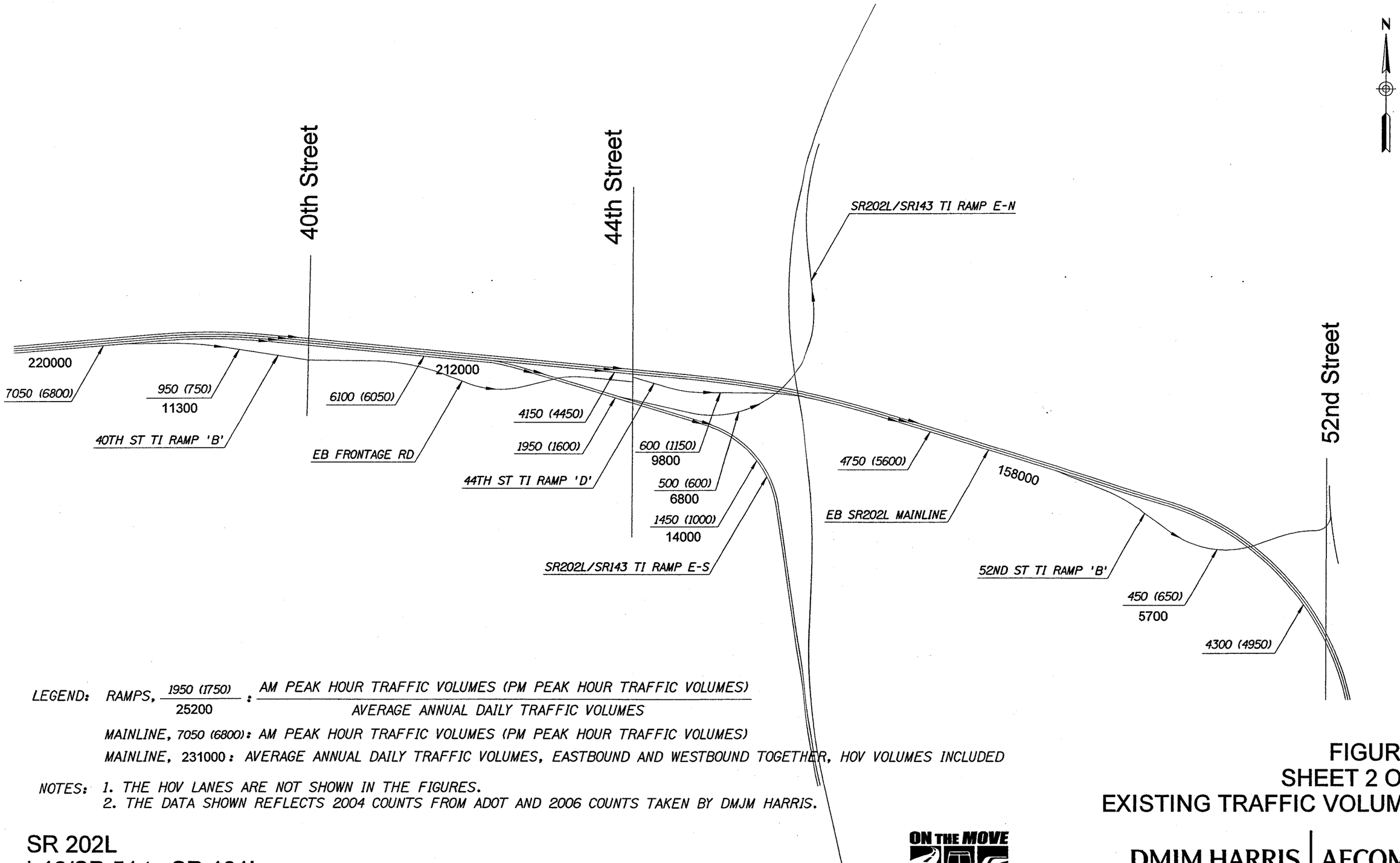

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SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

FIGURE 4
SHEET 2 OF 5
EXISTING TRAFFIC VOLUMES

DMJM HARRIS | AECOM

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LEGEND: RAMPS, 1950 (1750) / 25200 : AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES) / AVERAGE ANNUAL DAILY TRAFFIC VOLUMES

MAINLINE, 7050 (6800): AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)

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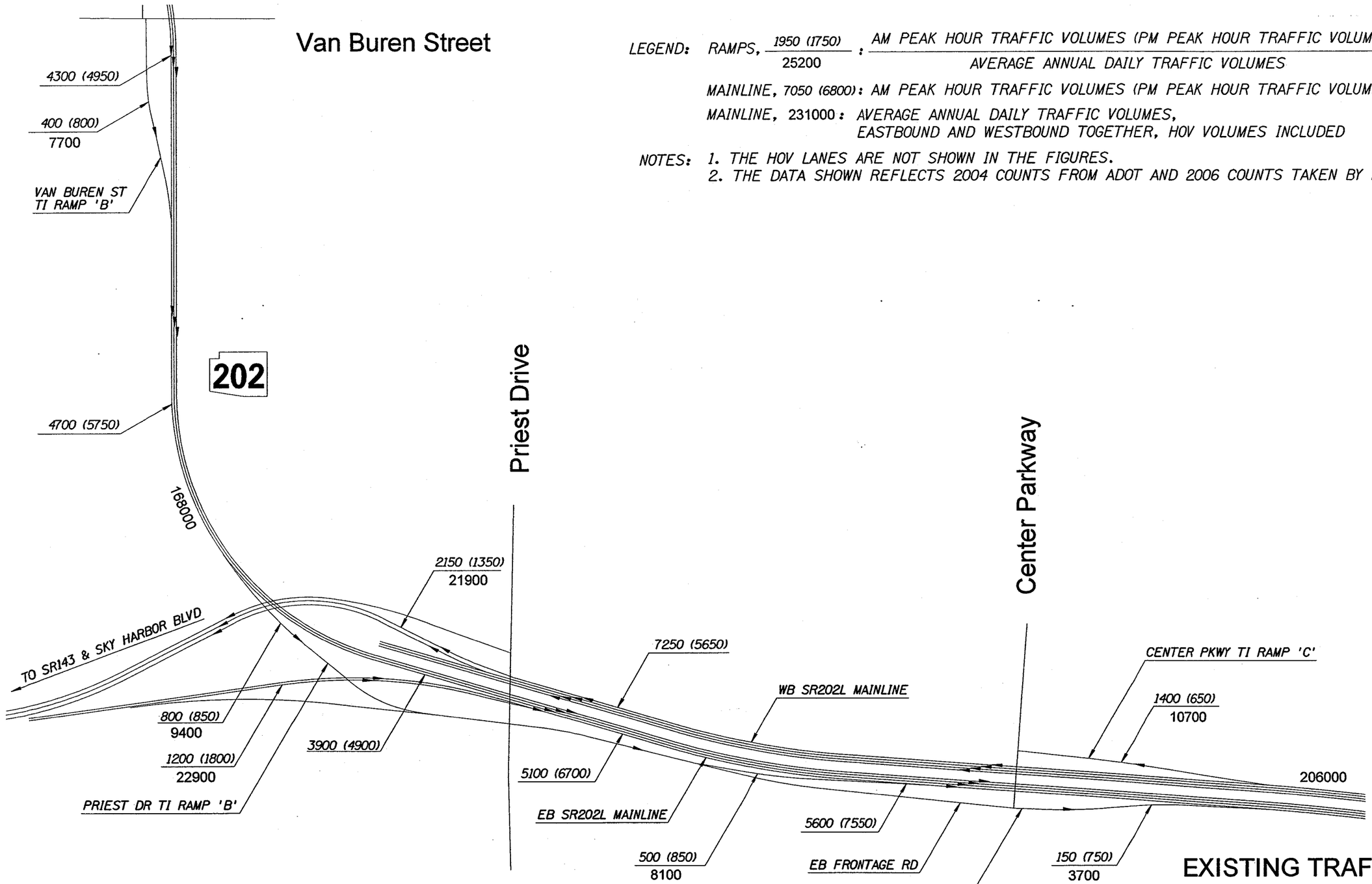

FIGURE 4
SHEET 3 OF 5
EXISTING TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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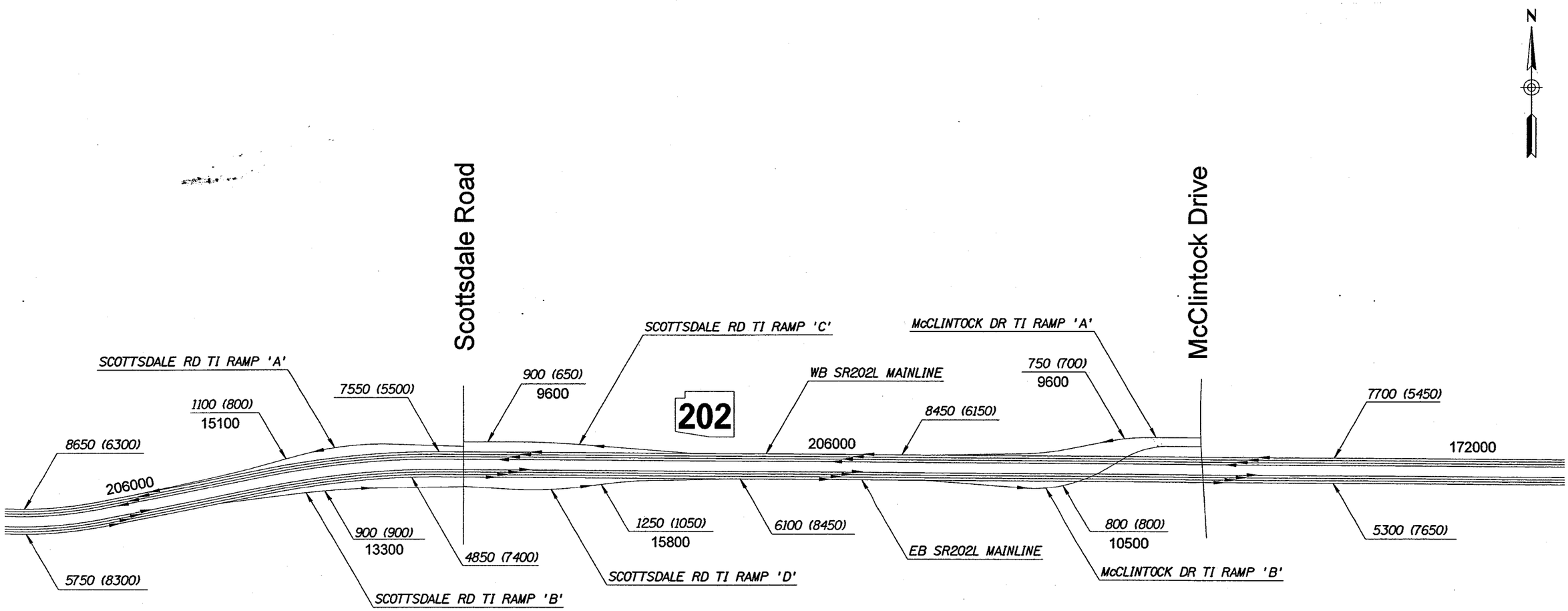

LEGEND: RAMPS, $\frac{1950\ (1750)}{25200}$: $\frac{\text{AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)}}{\text{AVERAGE ANNUAL DAILY TRAFFIC VOLUMES}}$

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FIGURE 4
SHEET 4 OF 5
EXISTING TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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LEGEND: RAMPS, 1950 (1750) / 25200 : AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES) / AVERAGE ANNUAL DAILY TRAFFIC VOLUMES

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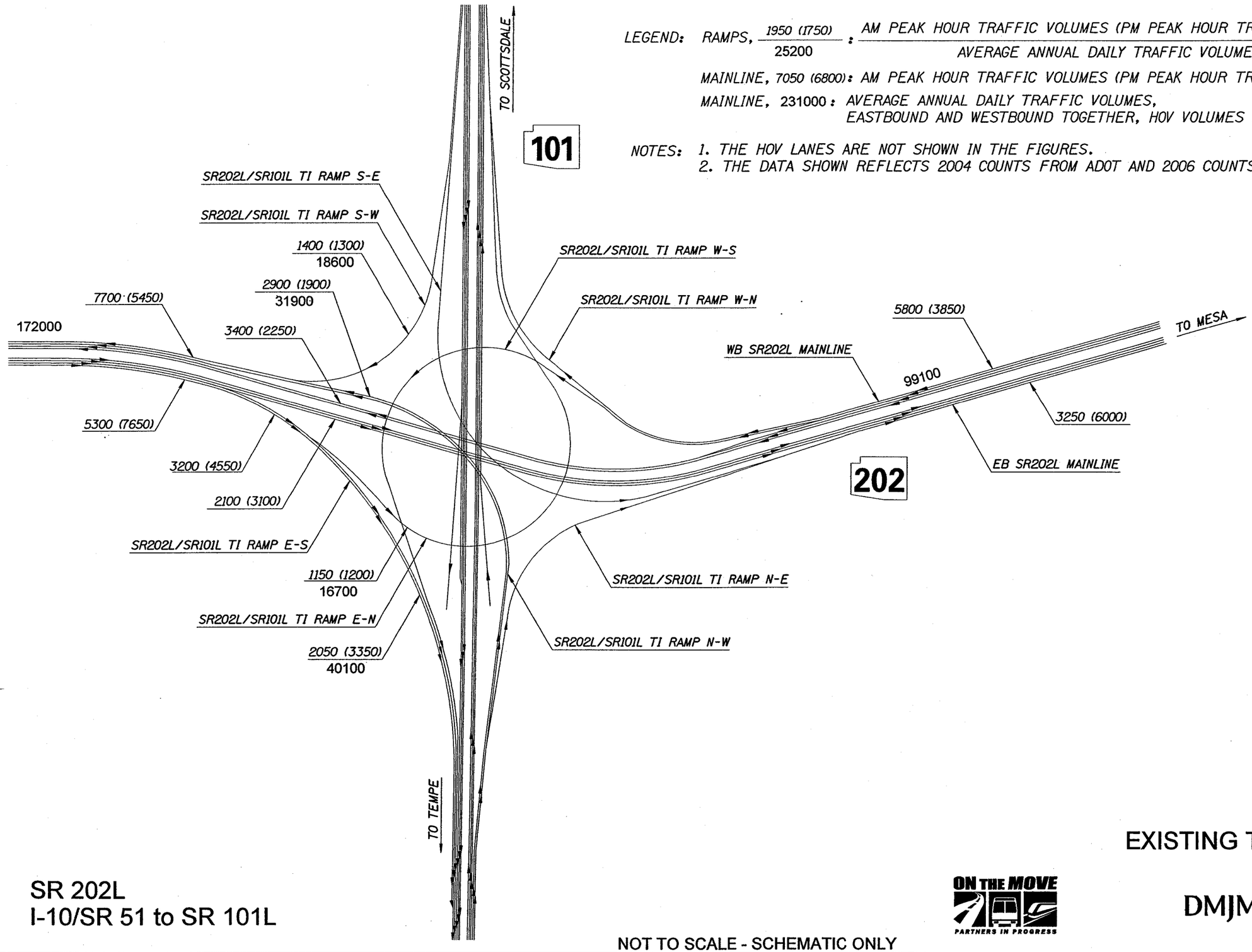

FIGURE 4
SHEET 5 OF 5
EXISTING TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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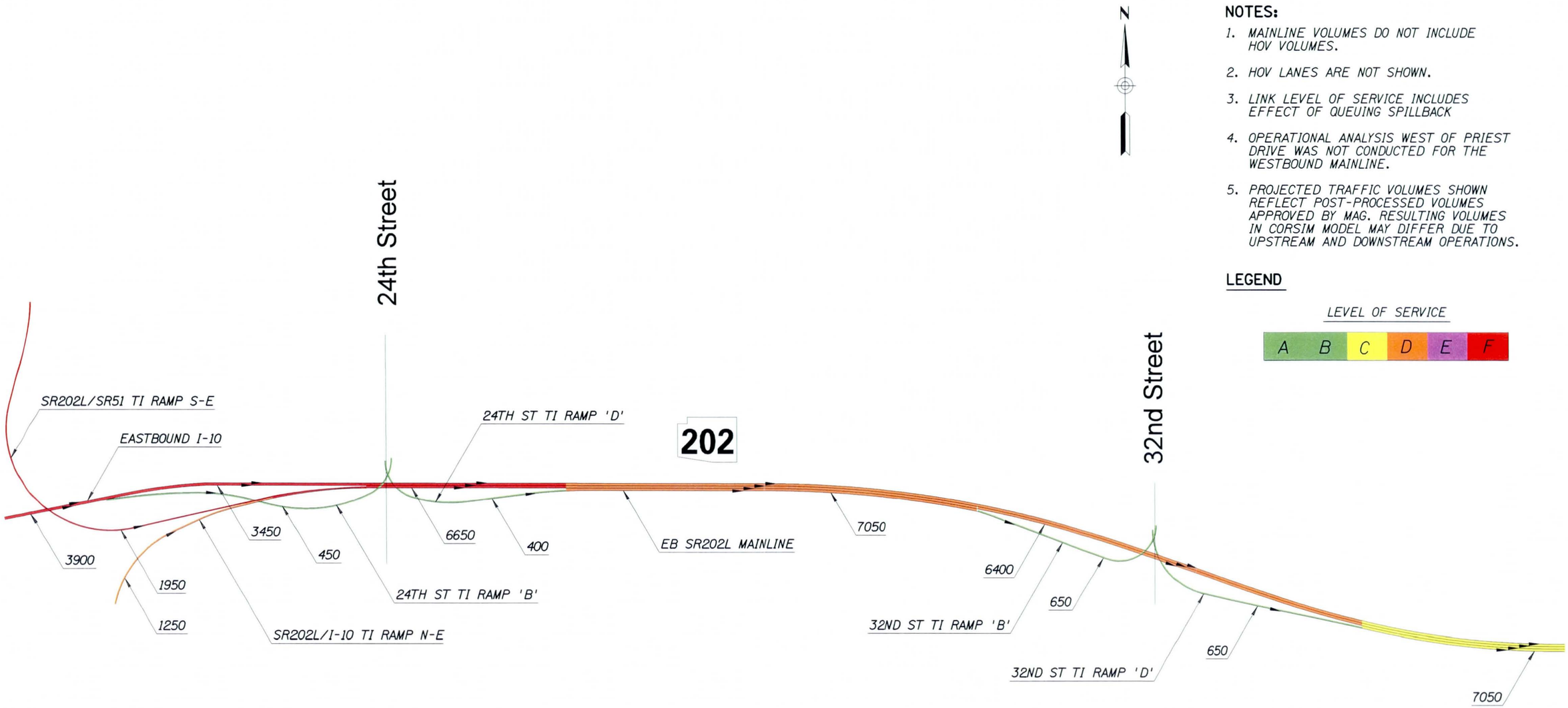

NOTES:

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2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK
4. OPERATIONAL ANALYSIS WEST OF PRIEST DRIVE WAS NOT CONDUCTED FOR THE WESTBOUND MAINLINE.
5. PROJECTED TRAFFIC VOLUMES SHOWN REFLECT POST-PROCESSED VOLUMES APPROVED BY MAG. RESULTING VOLUMES IN CORSIM MODEL MAY DIFFER DUE TO UPSTREAM AND DOWNSTREAM OPERATIONS.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 5

SHEET 1 OF 5
EXISTING AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 5

SHEET 2 OF 5
EXISTING AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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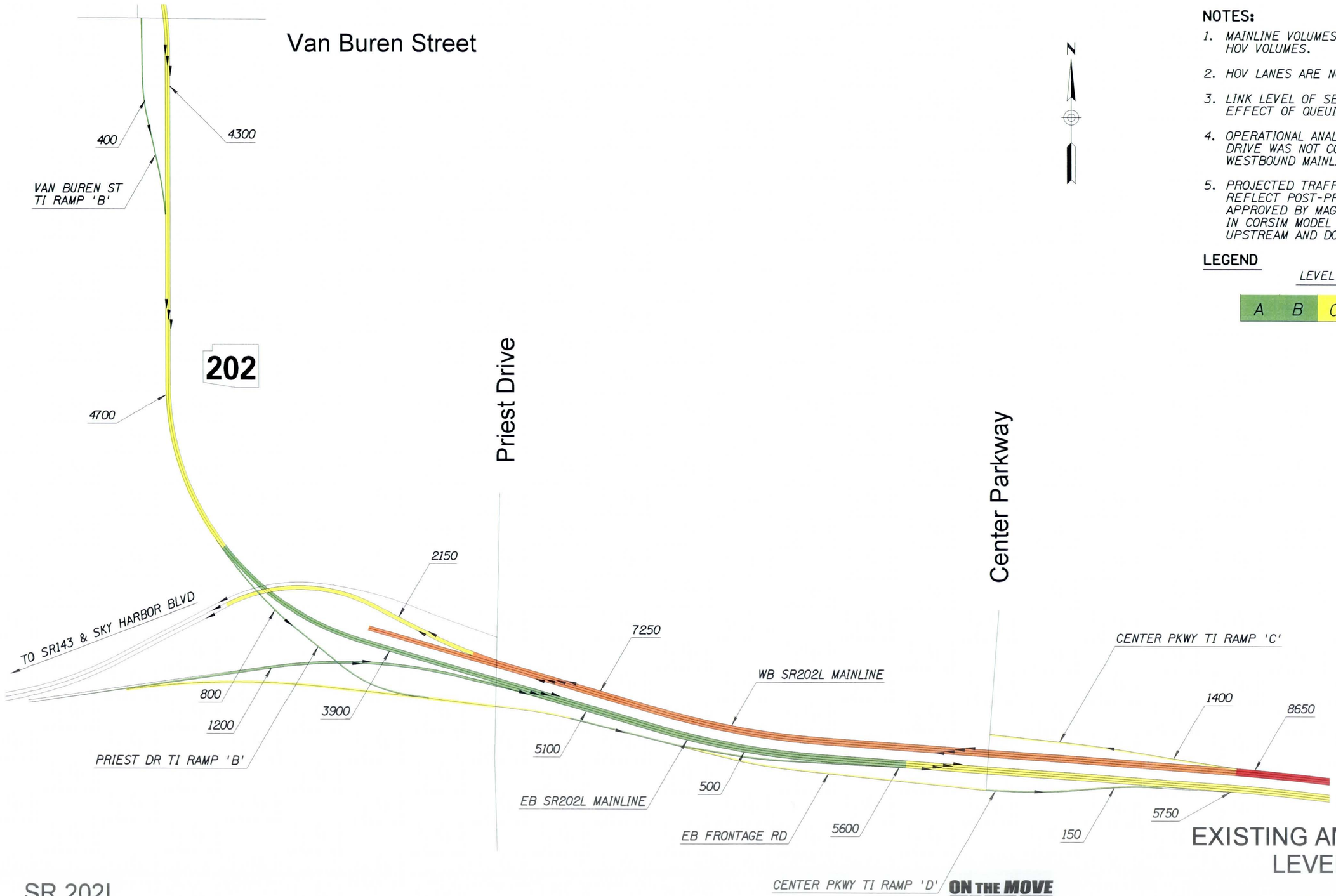

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 5

SHEET 3 OF 5
EXISTING AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

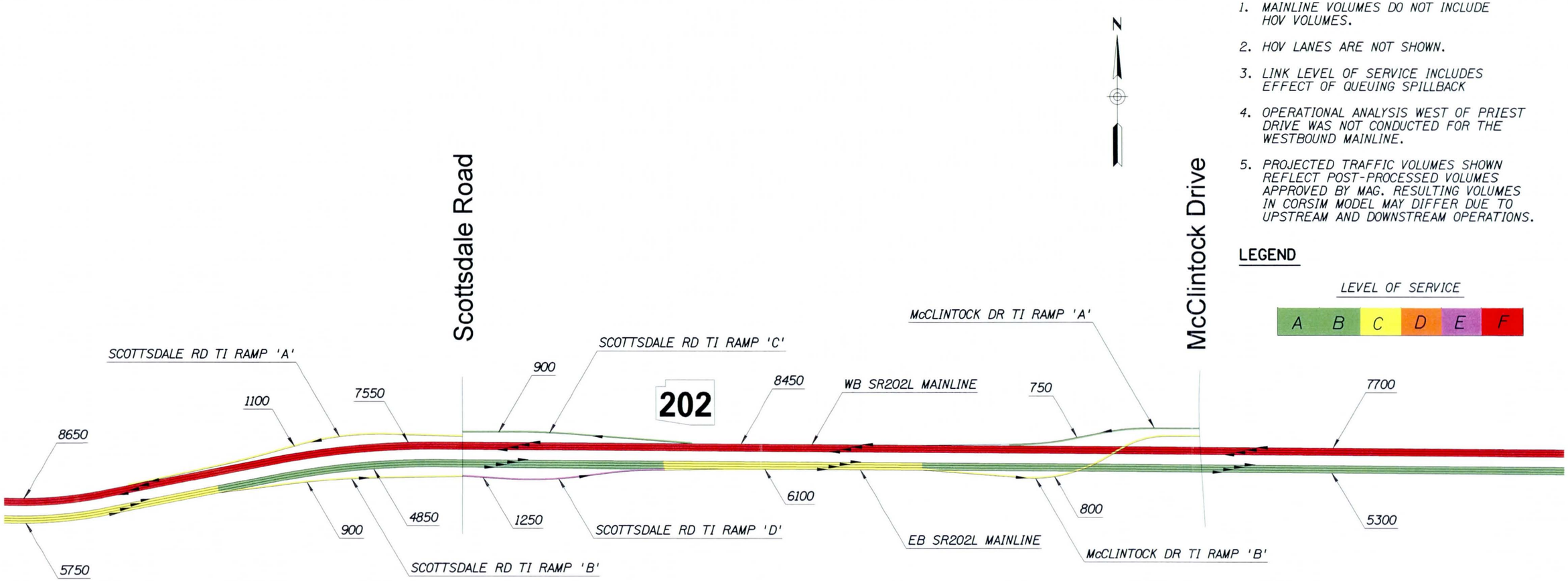

FIGURE 5

SHEET 4 OF 5
EXISTING AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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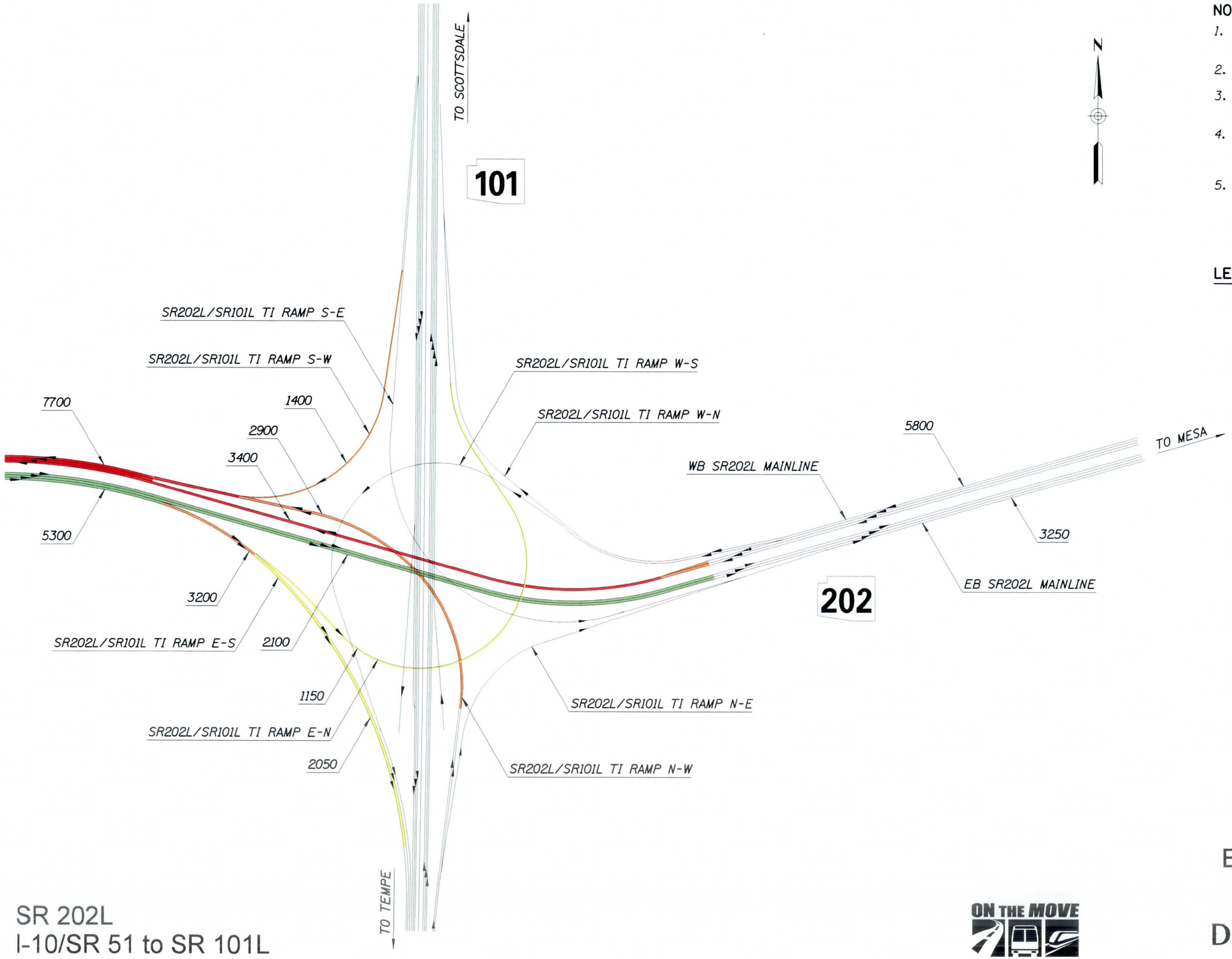

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

FIGURE 5

SHEET 5 OF 5
EXISTING AM PEAK HOUR
LEVEL OF SERVICE

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 6

SHEET 1 OF 5
EXISTING PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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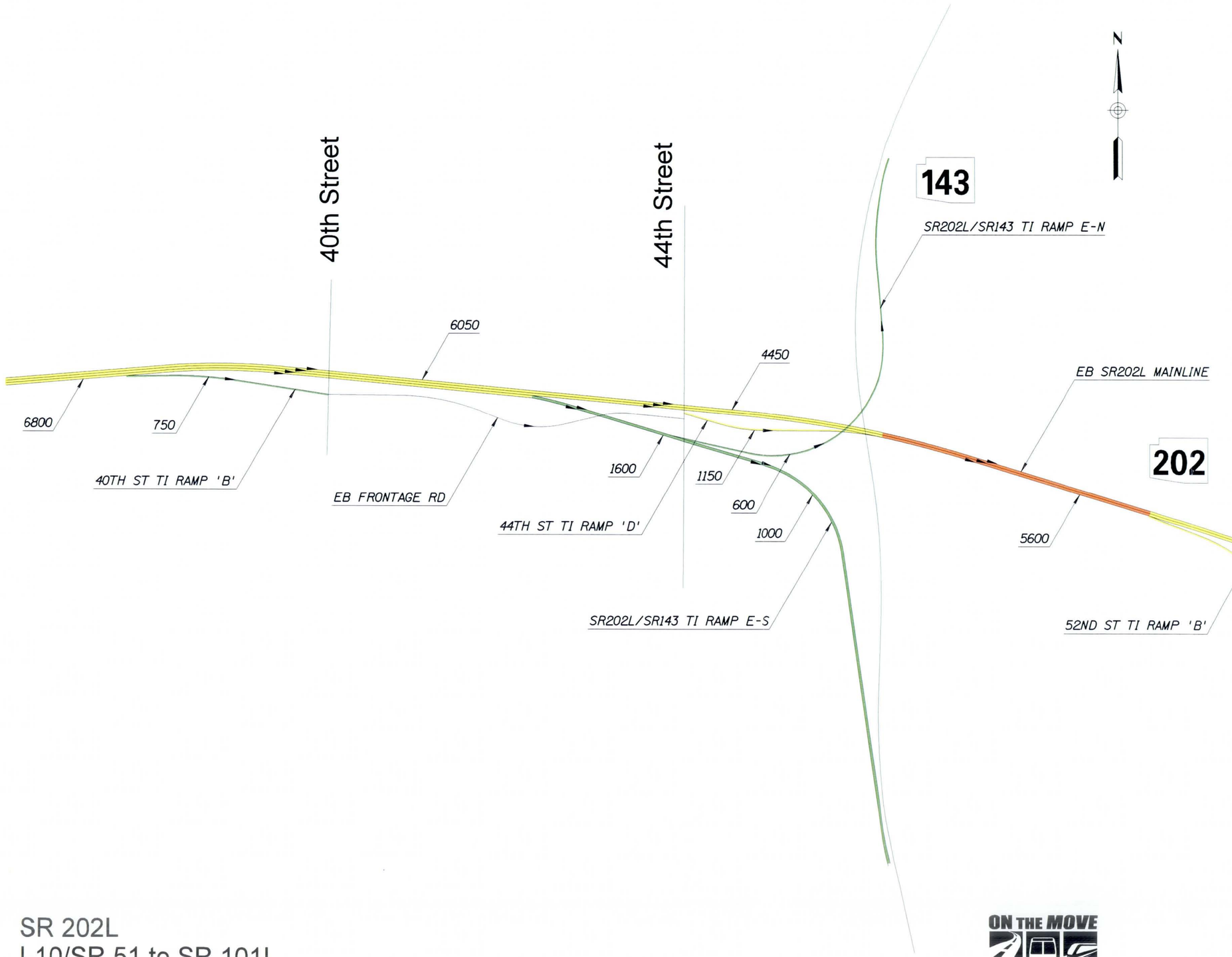

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 6

SHEET 2 OF 5
EXISTING PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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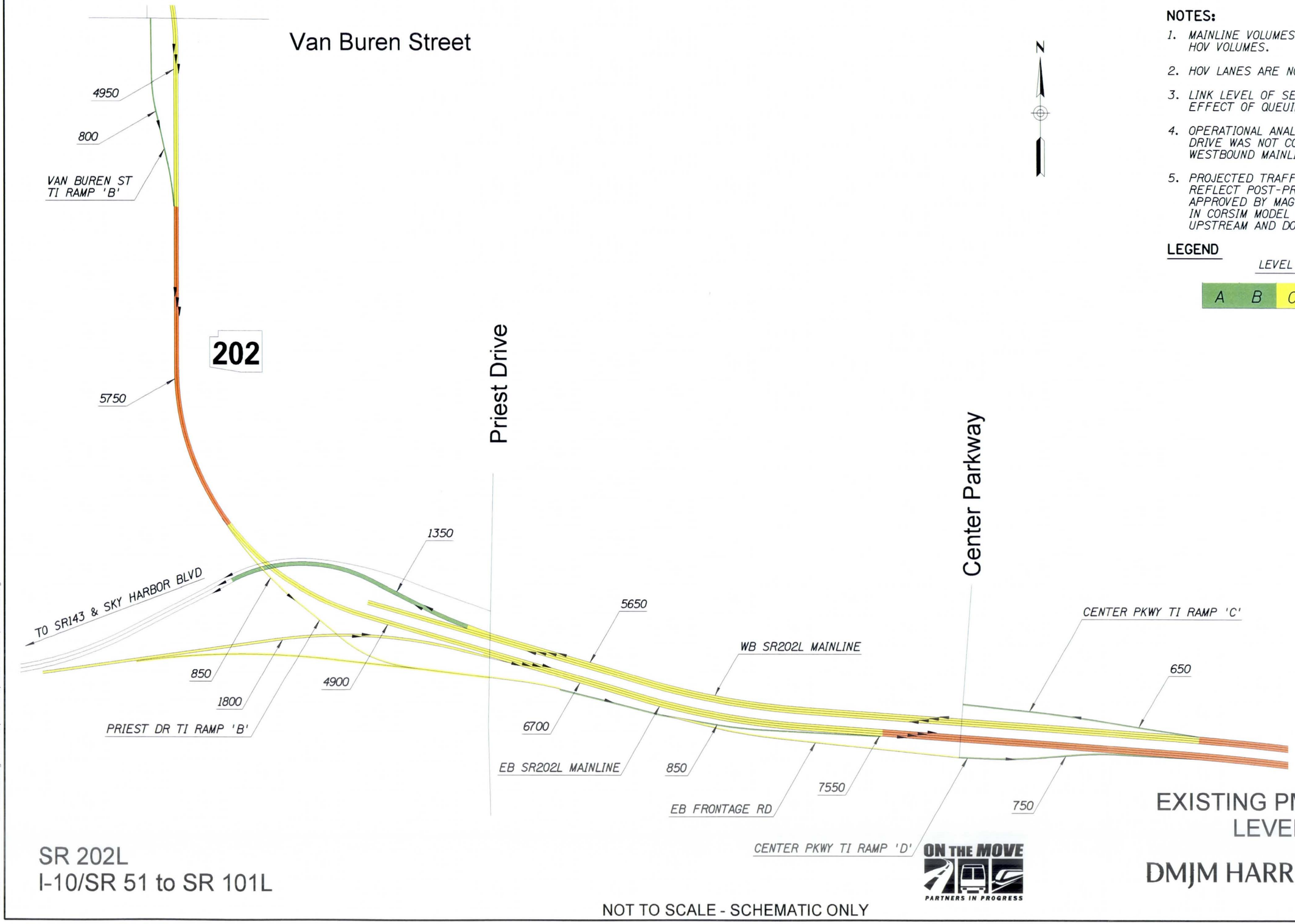

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 6

SHEET 3 OF 5
EXISTING PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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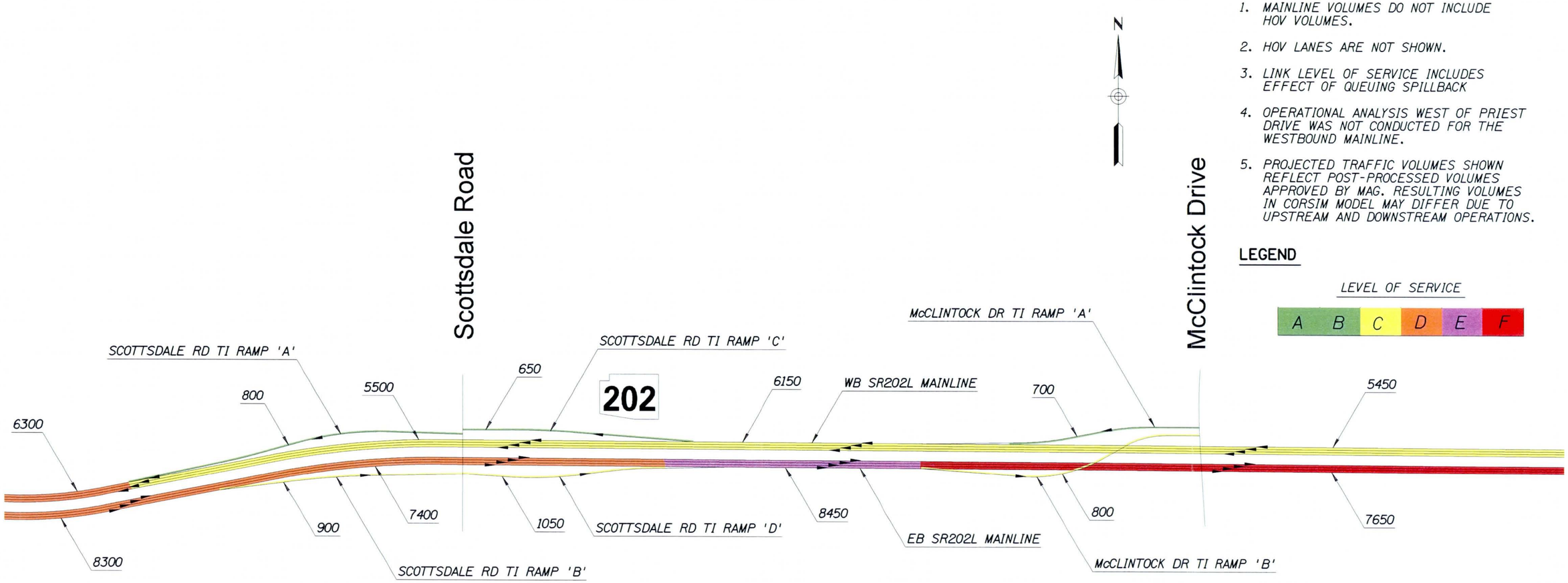

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 6

SHEET 4 OF 5
EXISTING PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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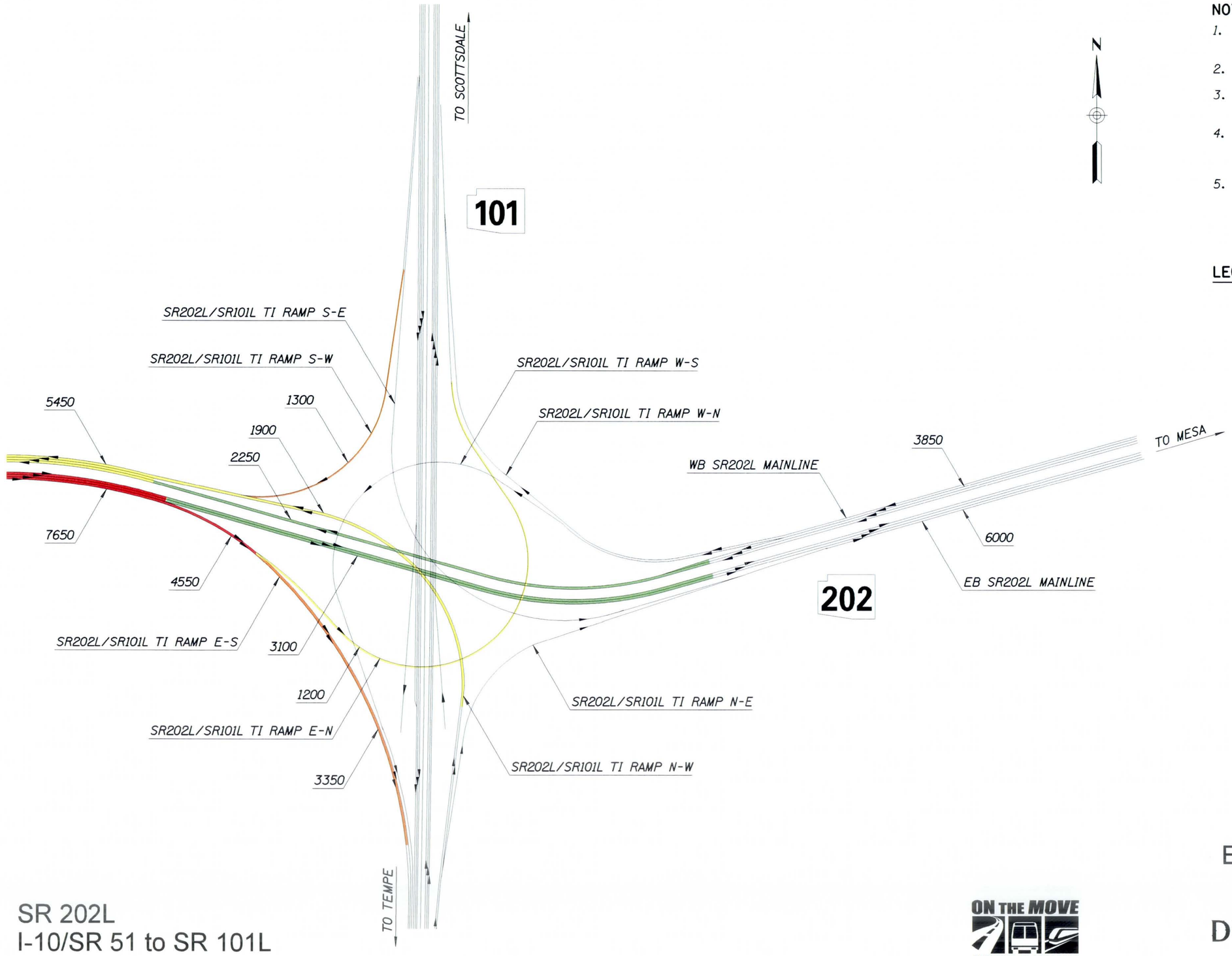

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

FIGURE 6

SHEET 5 OF 5
EXISTING PM PEAK HOUR
LEVEL OF SERVICE

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- Westbound SR 202L

  - Add one general-purpose lane from the SR101L/SR202L TI to Scottsdale Road
  - Add an auxiliary lane between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp

Alternative 1 would result in five eastbound lanes approaching and five westbound lanes departing the SR101L/SR202L TI. The fifth eastbound lane would be added to the mainline with the Sky Harbor Boulevard entrance ramp near Priest Drive, and carried to the east to the system interchange. The fifth westbound lane departing the SR101L/SR202L TI would be dropped at the Scottsdale Road TI with an AASHTO lane drop configuration to transition into the existing freeway lanes west of Scottsdale Road.

Alternative 2 would include the following improvements:

- Eastbound SR 202L

  - Add one general-purpose lane from the I-10/SR51 Traffic Interchange (TI) to Scottsdale Road
  - Add two general-purpose lanes from Scottsdale Road to the SR101L/SR202L TI (to develop six general-purpose lanes approaching the system interchange)
  - Add auxiliary lanes between the 44th Street entrance ramp and the 52nd Street exit ramp, between the Van Buren Street entrance ramp and Priest Drive exit ramp, and between the Center Parkway entrance ramp and the Scottsdale Road exit ramp

- Westbound SR 202L

  - Add one general-purpose lane from the SR101L/SR202L TI to Scottsdale Road (to develop three general-purpose and one HOV lane through the system interchange)
  - Add one general-purpose lane from SR101L/SR202L to McClintock Drive
  - Add an auxiliary lane between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp

Alternative 2 would result in six eastbound general-purpose lanes approaching and six westbound general-purpose lanes departing the SR101L/SR202L TI. The sixth eastbound general-purpose lane would be added to the mainline at the Scottsdale Road TI entrance ramp and continue to the east to the system interchange. The sixth westbound lane would be dropped with a merge taper located east of the McClintock Road entrance ramp gore. The fifth westbound general-purpose lane would be dropped at the Scottsdale Road TI with an AASHTO lane drop configuration to transition into the existing freeway lanes west of Scottsdale Road.

2.3.2 Traffic Volume Projections

The Maricopa Association of Governments (MAG) provided traffic volume projections for Design Year 2030. MAG maintains a regional traffic forecasting model to develop future traffic volume projections based on projected socio-economic, population, employment, origin-destination, and other regionally based data. The output from the model includes daily, peak period, and peak hour traffic volumes for general-purpose and HOV lanes for the regional freeway system.

MAG network simulation output was provided by MAG for the No-Build and Build Alternatives. For the purposes of this study, the Build Alternative roadway network coded in the MAG model corresponded to the Alternative 2 scenario. The 2030 traffic volume projections that were received from MAG were post-processed in accordance with the procedures recommended by MAG. Once the post-processing was completed, the final 2030 traffic volume projections were reviewed and approved by MAG staff.

The 2030 traffic volume projections for the No-Build Alternative are shown in Figure 7 and the 2030 traffic volume projections for the Build alternatives are shown in Figure 8.

2.4 OPERATIONAL ANALYSIS

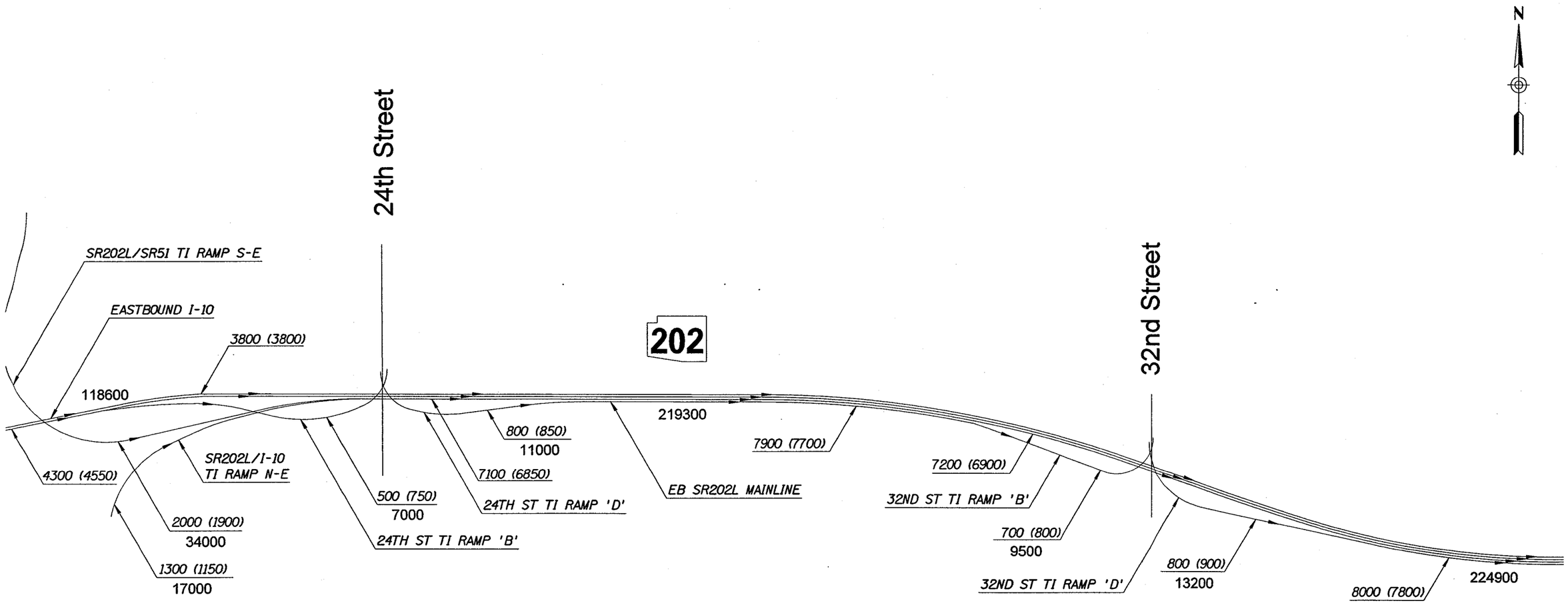
Traffic operational analyses were conducted for the Existing Condition, No-Build, Alternative 1, and Alternative 2 scenarios. The following sections describe the analysis methodology and evaluation results.

2.4.1 Analysis Methodology

An operational analysis was performed for all segments of the mainline, ramp junctions, and weave sections for the existing conditions, No-Build and Build alternatives. The CORSIM computer program was used to provide a simulation of the entire freeway system within the study area. CORSIM is a microscopic traffic simulation program that uses roadway geometry and traffic volume inputs to simulate operations of an entire freeway network. CORSIM has the ability to provide various measures of effectiveness for each link within the system. The vehicle density and speed outputs from CORSIM were used as the measure of effectiveness to relate to a level-of-service as established by the Highway Capacity Manual (HCM).

The concept of level-of-service (LOS) uses qualitative measures that characterize operational conditions within a stream of traffic. The descriptions of individual levels-of-service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. Six levels of service are defined for each type of facility for which the analytical procedures are available. They are given letter designations from 'A' to 'F', with LOS 'A' representing the best operational conditions and LOS 'F' representing an over-capacity condition with a high degree of congestion. Each level of service represents a range of operating conditions.

(Text continued on page 68)



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MAINLINE, 7050 (6800): AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)

MAINLINE, 231000 : AVERAGE ANNUAL DAILY TRAFFIC VOLUMES, EASTBOUND AND WESTBOUND TOGETHER, HOV VOLUMES NOT INCLUDED

NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

FIGURE 7
SHEET 1 OF 5
2030 NO BUILD TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

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NOT TO SCALE - SCHEMATIC ONLY

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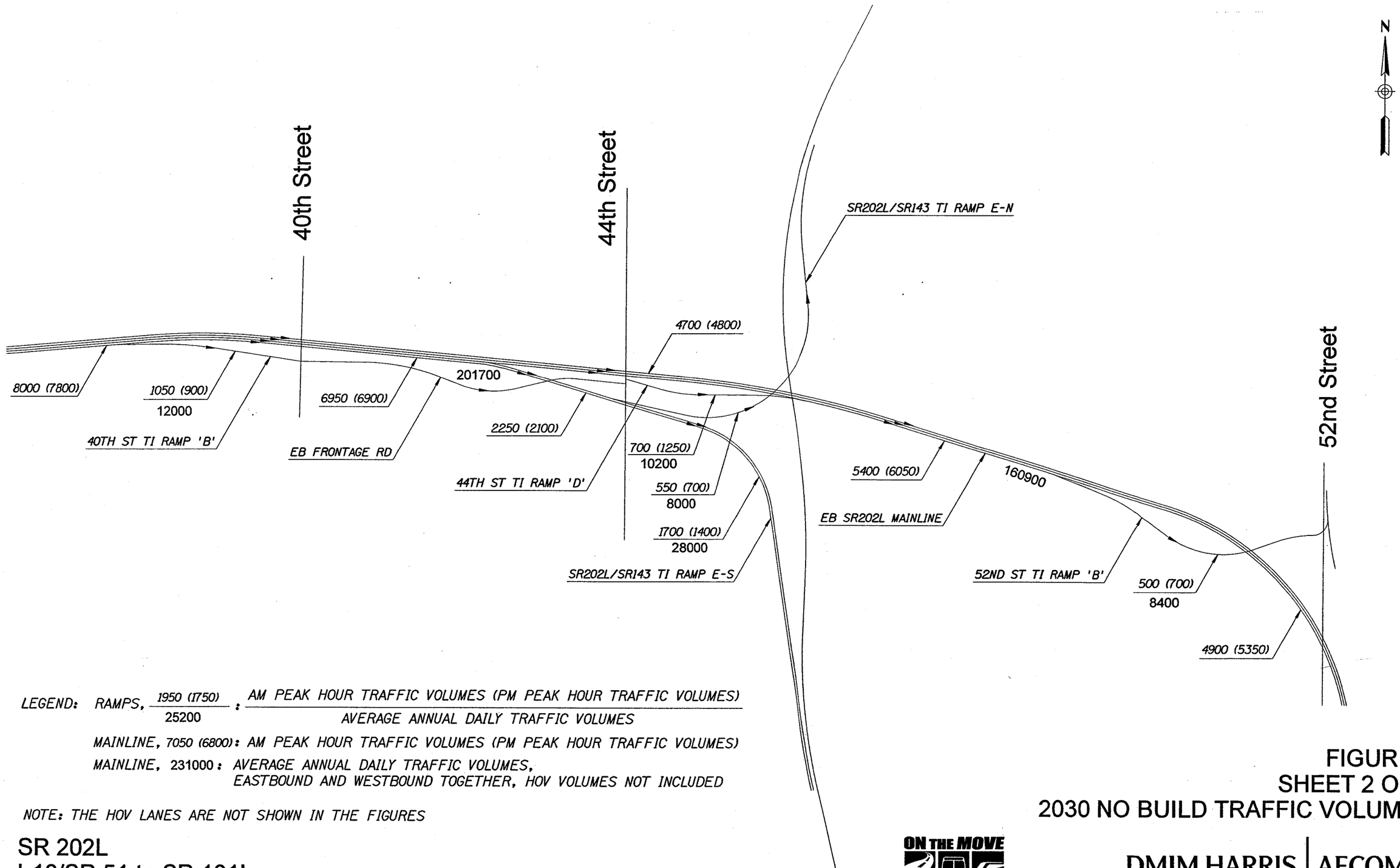

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

FIGURE 7
SHEET 2 OF 5
2030 NO BUILD TRAFFIC VOLUMES

ON THE MOVE
PARTNERS IN PROGRESS

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LEGEND: RAMPS, 1950 (1750) / 25200 : AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES) / AVERAGE ANNUAL DAILY TRAFFIC VOLUMES

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

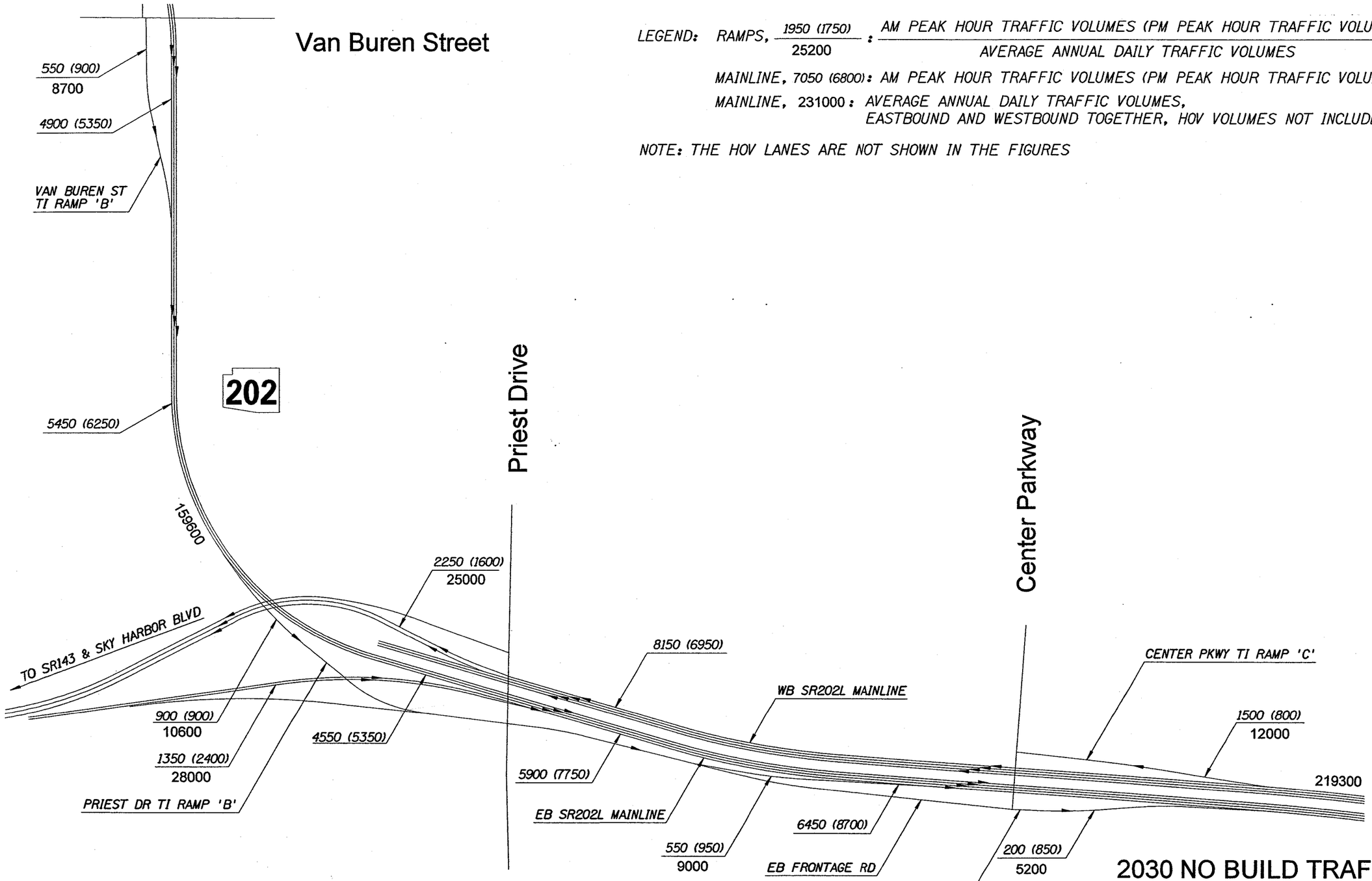

FIGURE 7
SHEET 3 OF 5
2030 NO BUILD TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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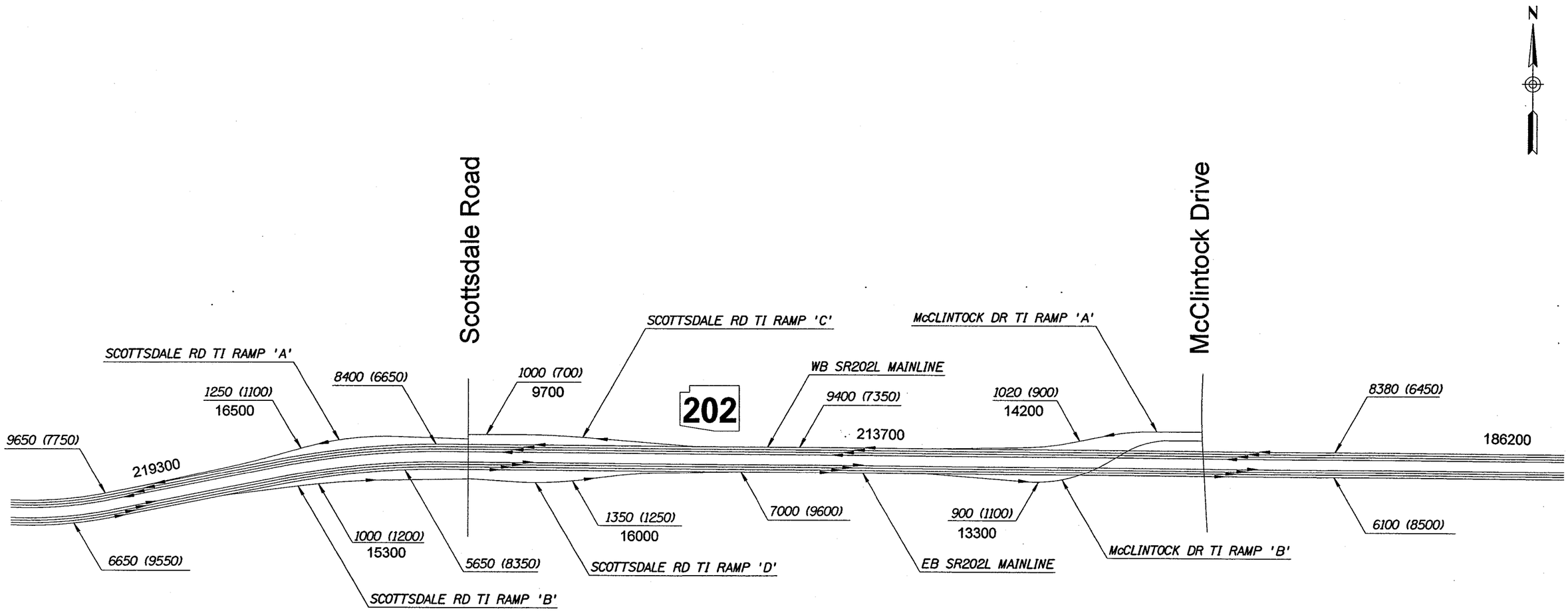

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

FIGURE 7
SHEET 4 OF 5
2030 NO BUILD TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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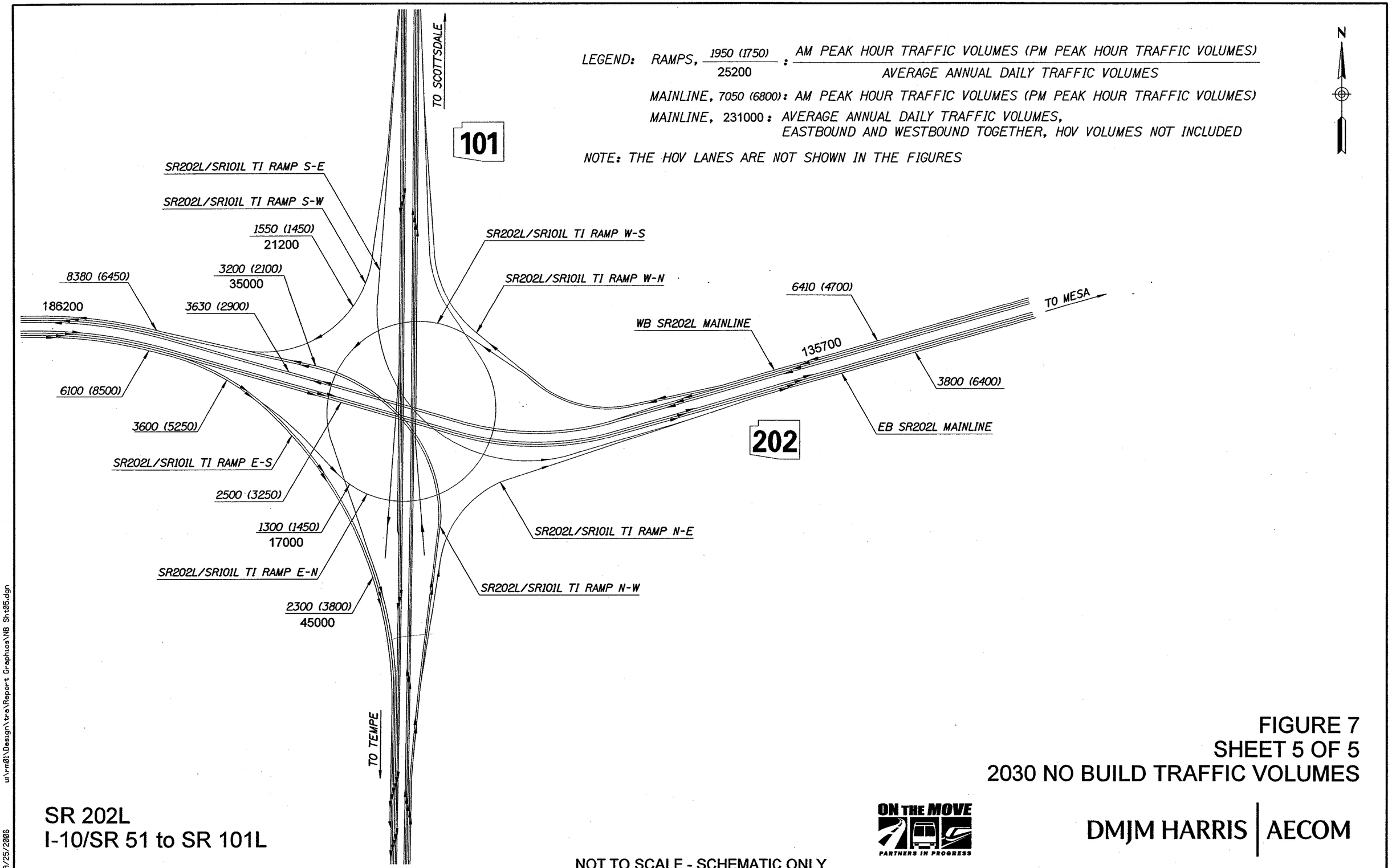

FIGURE 7
SHEET 5 OF 5
2030 NO BUILD TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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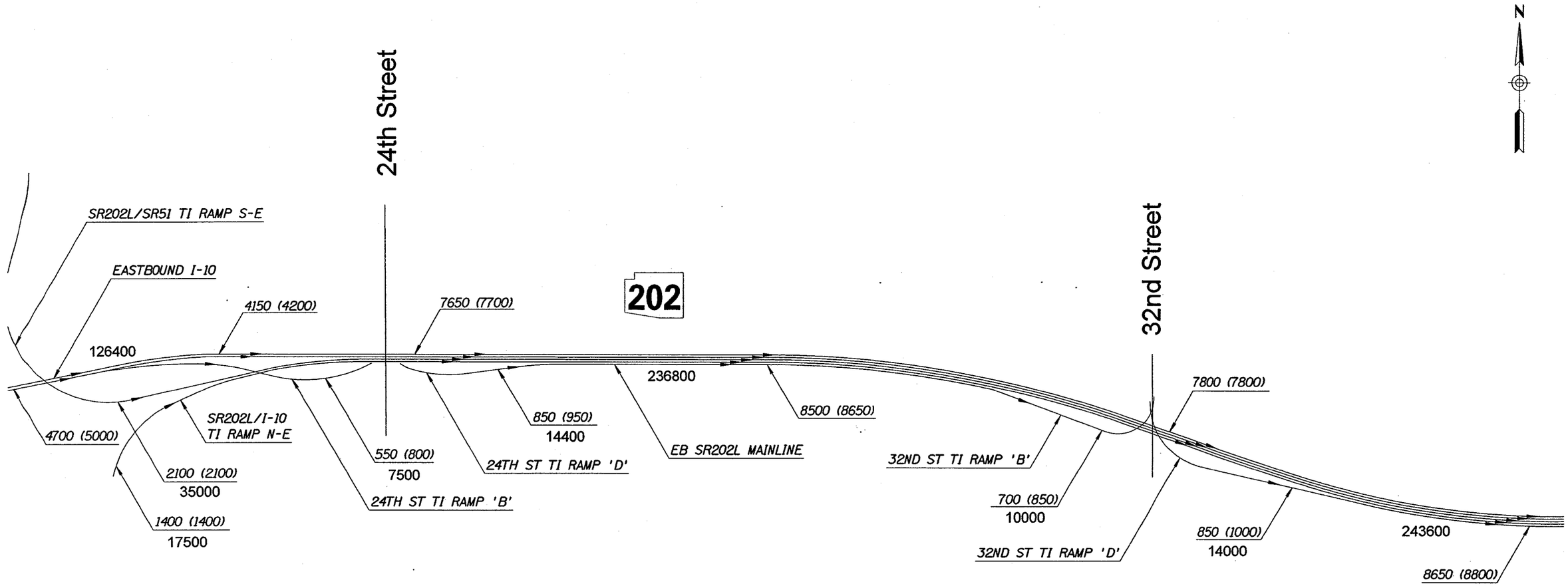

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

FIGURE 8
SHEET 1 OF 5
2030 ALTERNATIVE 1 & ALTERNATIVE 2
TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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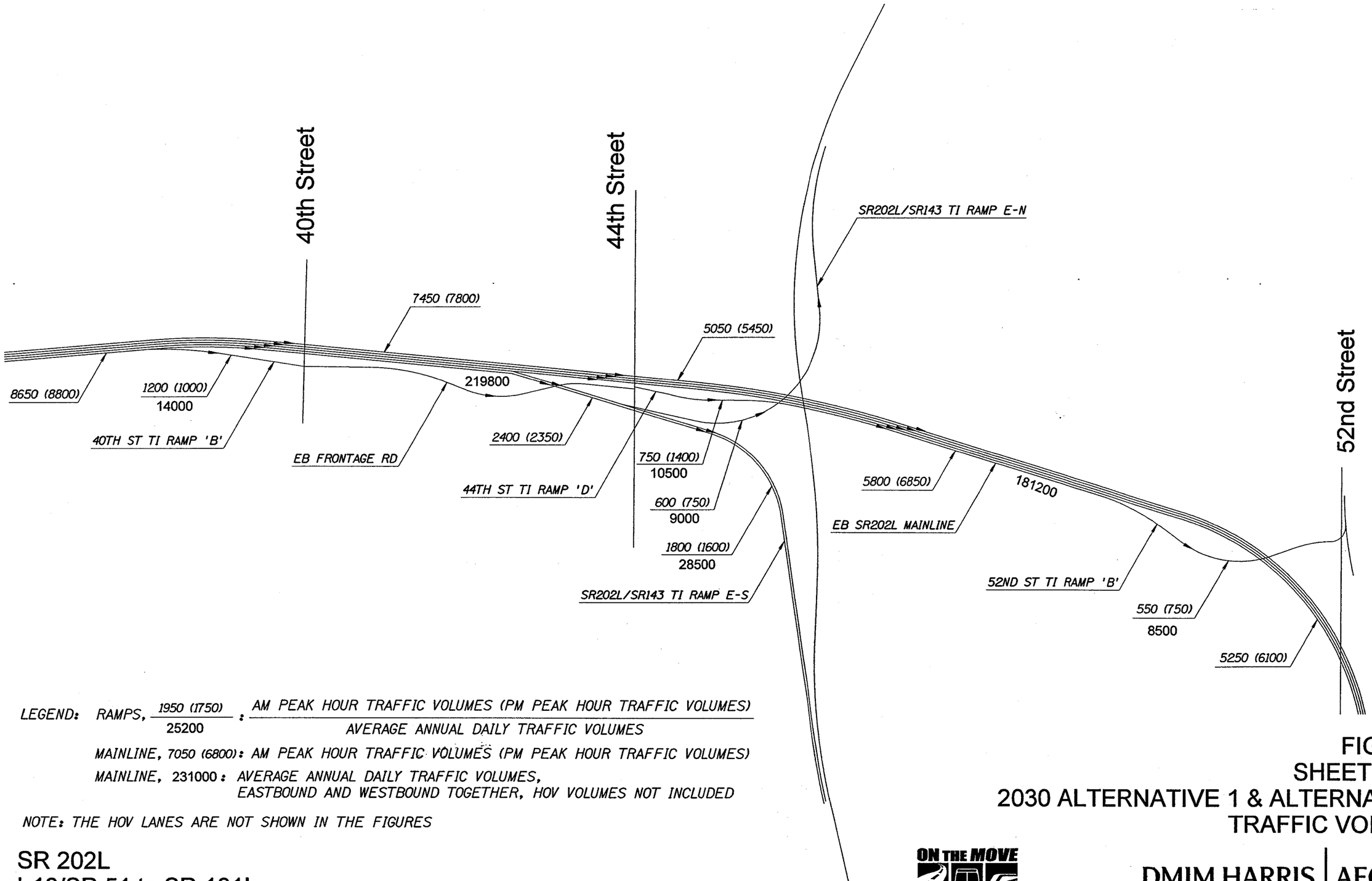

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

FIGURE 8
SHEET 2 OF 5
2030 ALTERNATIVE 1 & ALTERNATIVE 2 TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

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NOT TO SCALE - SCHEMATIC ONLY

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FIGURE 8
SHEET 3 OF 5
2030 ALTERNATIVE 1 & ALTERNATIVE 2 TRAFFIC VOLUMES

LEGEND: RAMPS, 1950 (1750) / 25200 : AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES) / AVERAGE ANNUAL DAILY TRAFFIC VOLUMES

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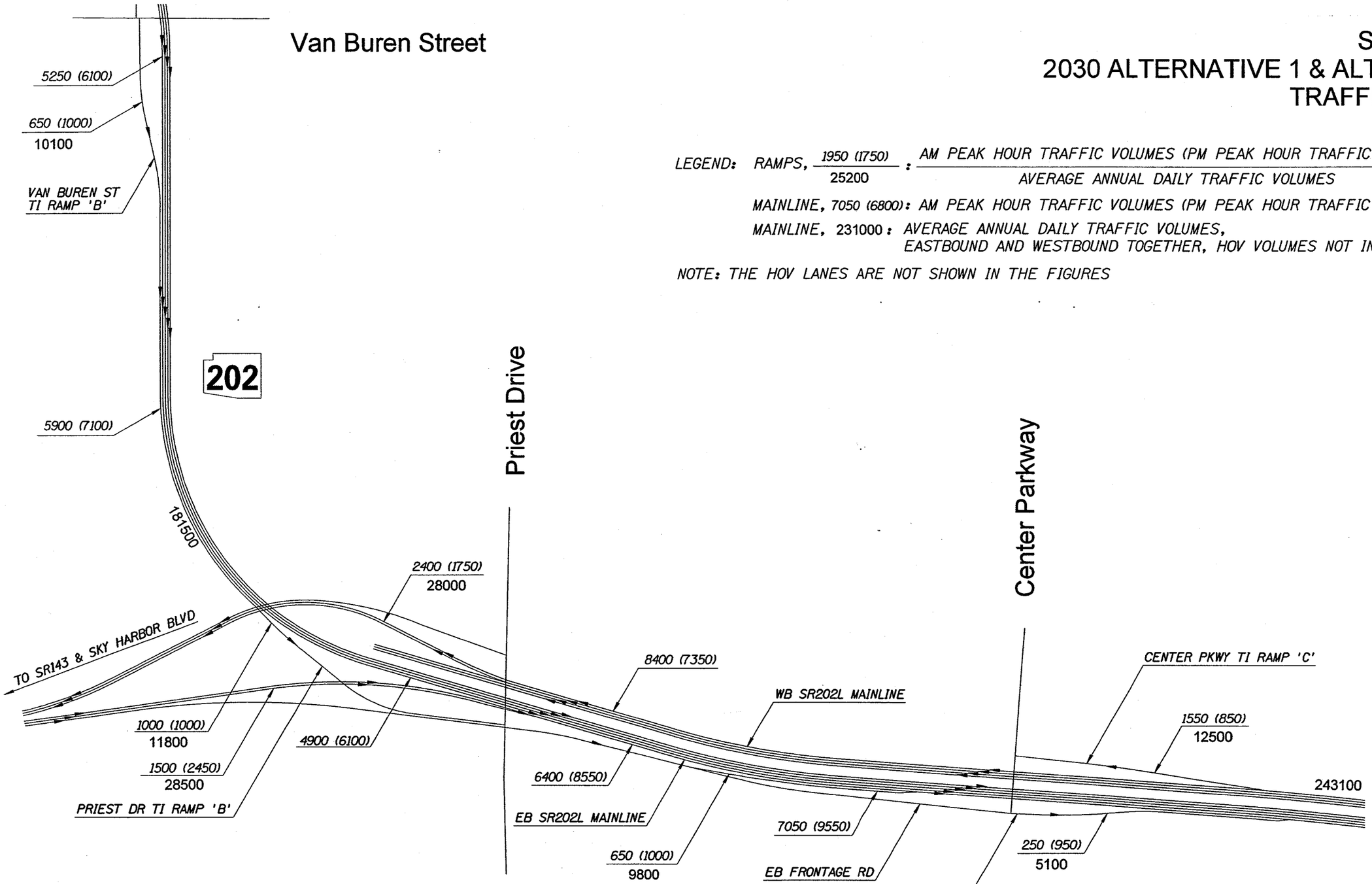
NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES



SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE PARTNERS IN PROGRESS

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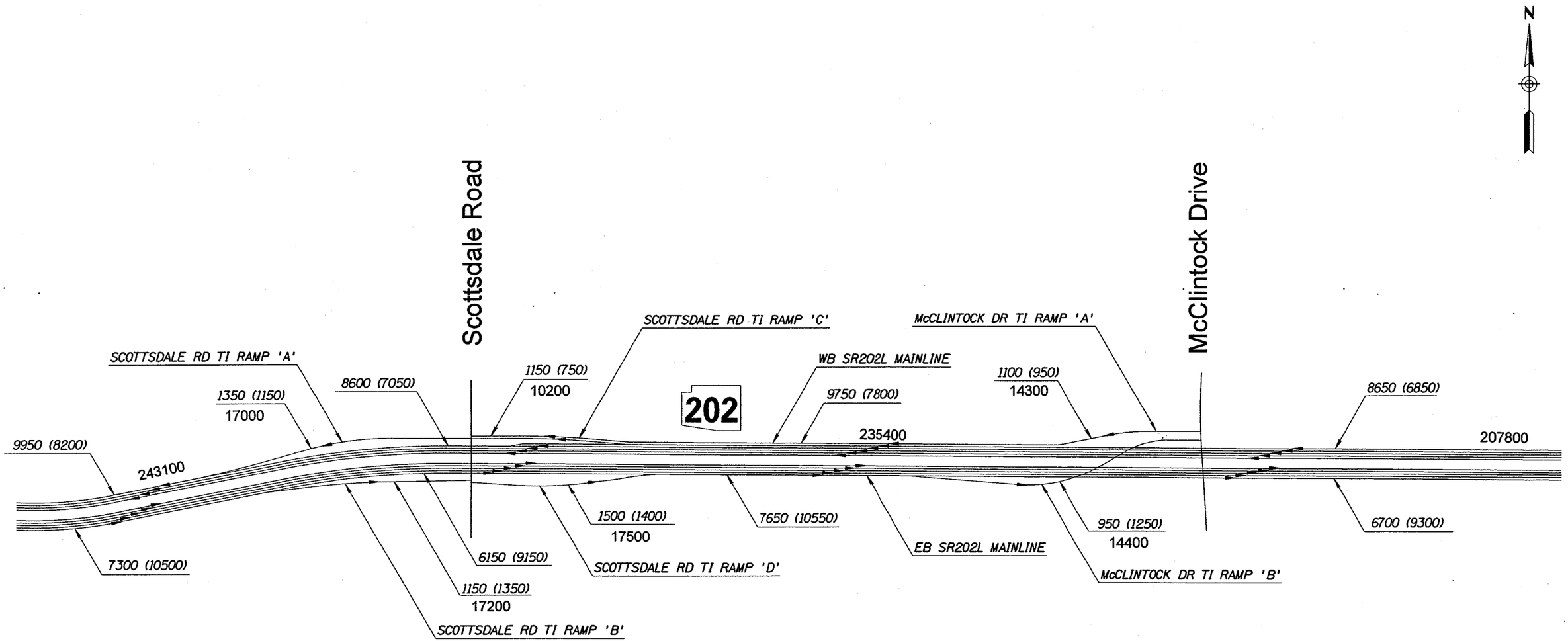

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NOTE: THE HOV LANES ARE NOT SHOWN IN THE FIGURES

FIGURE 8
SHEET 4 OF 5
2030 ALTERNATIVE 1 & ALTERNATIVE 2
TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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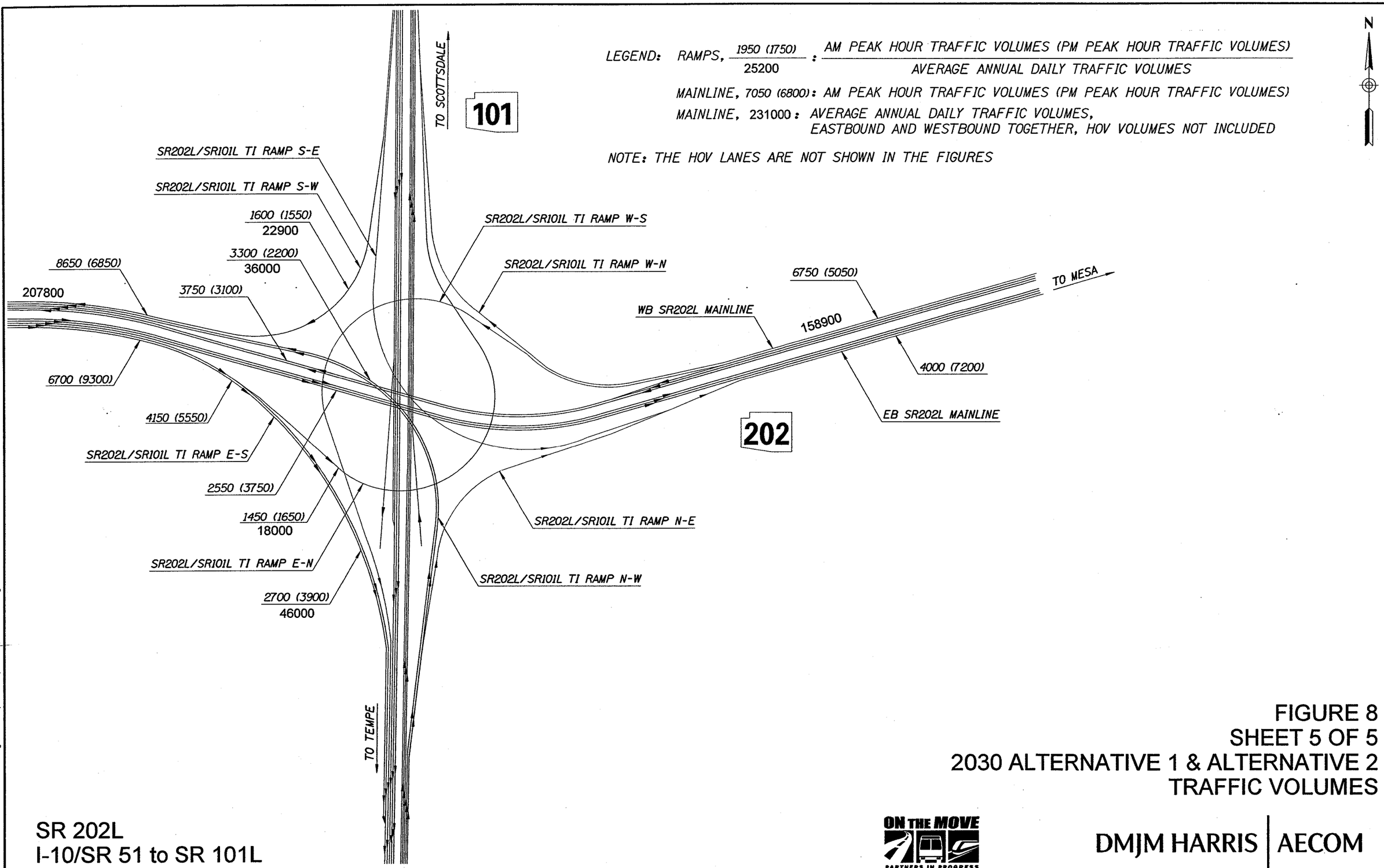

FIGURE 8
SHEET 5 OF 5
2030 ALTERNATIVE 1 & ALTERNATIVE 2
TRAFFIC VOLUMES

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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Table 11 below depicts the vehicle densities (vehicles per mile per lane) and corresponding levels-of-service established in the HCM:

Table 11 – Vehicle Densities and Corresponding Levels-of-Service

Level-of-Service	Density Range (pc/mi/ln)
A	0-11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	>45

Source: 2000 HCM, pg. 23-3

In order to verify the CORSIM output, additional analyses were performed using the Highway Capacity Software (HCS), which uses the procedures from the 2000 Highway Capacity Manual (HCM) to provide the traffic operational characteristics in terms of level-of-service. One of the major disadvantages of using HCS for analyzing a major freeway network is that it does not address the cumulative effects of delay on an entire system. HCS only allows for the evaluation of a single location within an overall system and does not take into account the effects of conditions upstream and downstream. For example, a severe upstream "bottleneck" may limit the amount of traffic reaching a downstream location. Similarly, a severe downstream "bottleneck" may cause queuing to such an extent that it effects an upstream location. Therefore, CORSIM was used to evaluate the entire system and HCS was used to verify the CORSIM results.

The following CORSIM model input assumptions were used for the operational analysis:

- Free flow speed of 65 mph for the mainline general-purpose lanes
- Free flow speed of 55 mph for the system interchange ramps
- Free flow speed of 50 mph for the service interchange ramps
- Commercial vehicle percentage was assumed to be 5% during peak hours

The commercial vehicle percentage is based on recent experience in observing the existing traffic conditions and performing operational analysis for projects on the Regional Freeway System, and not on the existing ADOT count data. The Arizona State Highway System Log shows a daily (24 hour) commercial vehicle percentage of 9% within this study area. However, this is based on 24 hour volumes and is not representative of the operating conditions during the peak hour. Recent traffic counts indicate that roughly 3% of the vehicles in the peak hour would be classified as commercial vehicles. However, the 5% default value suggested by the *Highway Capacity Manual* was used for the operational analysis.

Since the objective of this study is to evaluate capacity improvements for the SR 202L mainline, the operational analysis was constrained to the SR 202L mainline and ramp junctions. An evaluation of the service interchanges in not included in the scope of this study.

2.4.2 Analysis Results

Traffic operational analyses were conducted using the CORSIM traffic simulation computer program to evaluate the level-of-service that would be provided for the Existing Conditions, No-Build, Alternative 1, and Alternative 2 scenarios.

Existing Conditions

The lane configurations, A.M. and P.M. peak hour traffic volumes, and level-of-service (LOS) analysis results for the Existing Conditions (2006) are depicted in Figures 5 and 6. The results of the analysis indicate significant congestion (LOS 'E' or 'F') is currently being experienced on the SR 202L mainline within the following areas:

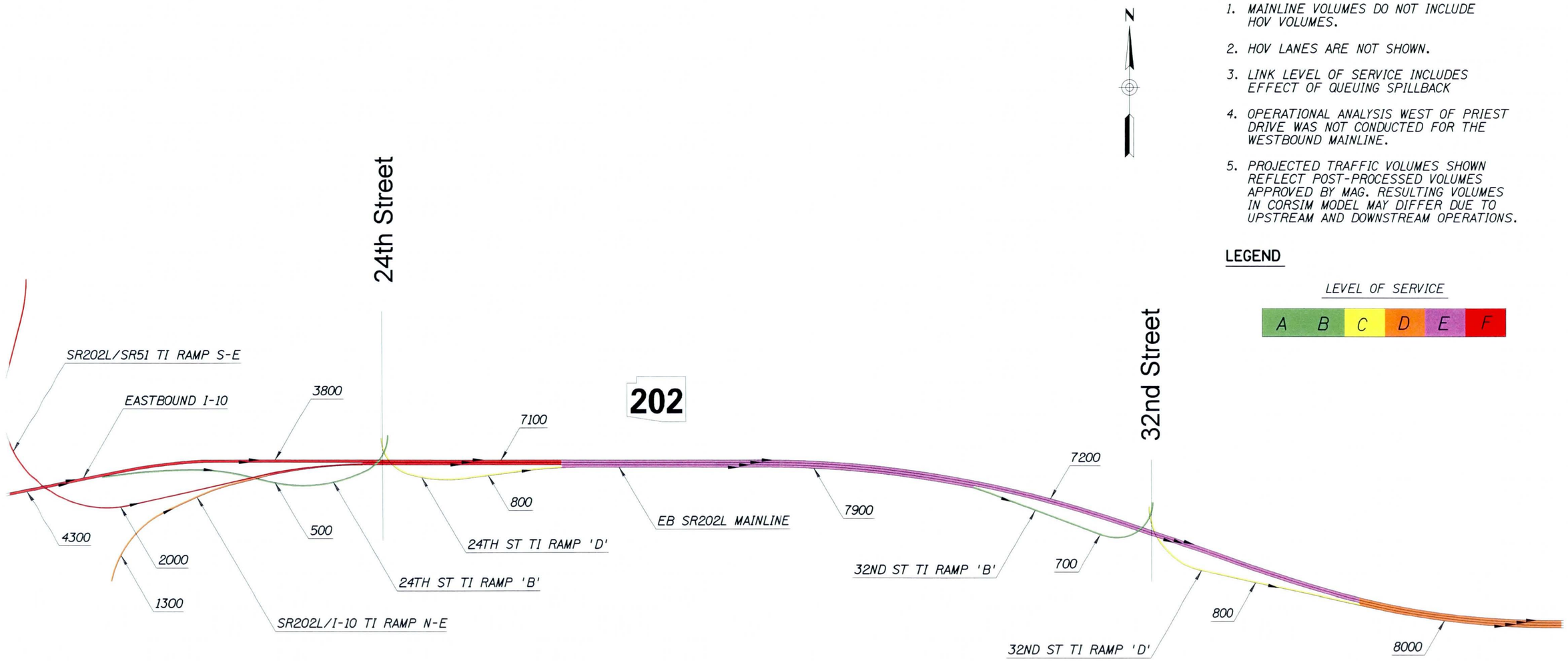
- A.M. Peak Hour:
  - eastbound SR 202L mainline from the 24th Street entrance ramp to the I-10/SR51 TI Ramp S-E entrance ramp
  - westbound SR 202L mainline from the Center Parkway exit ramp to the SR101L/SR202L TI

- P.M. Peak Hour:
  - eastbound SR 202L mainline from the 24th Street entrance ramp to the I-10/SR51 TI Ramp S-E entrance ramp
  - eastbound SR 202L mainline from the SR101L/SR202L TI to the Scottsdale Road entrance ramp

The analysis results indicate the eastbound SR 202L currently experiences congestion during the A.M. and P.M. peak hours between the 24th Street entrance ramp and the I-10/SR51 TI due to an existing "bottleneck" at this location. This "bottleneck" is due to the merging of the directional ramps where Ramp S-E (1 lane) and Ramp N-E (1 lane) merge to develop a single lane entrance into eastbound SR 202L. This single lane ramp entrance combine with the eastbound I-10 directional ramp (2 lanes) to form the eastbound SR 202L mainline (3 lanes) to the east. The current configuration of the ramp connections from the system interchange creates an inefficient entrance condition.

A second "bottleneck" is located at the eastbound approach to the SR101L/SR202L TI (4 general-purpose lanes and 1 HOV lane). The outside lane is dropped at the combined Ramp E-S/E-N exit (2 lanes), with the second lane designed as an option lane with the freeway through movement. Once the combined exit ramp departs the mainline, Ramp E-N (1 lane) is developed as a tapered exit from Ramp E-S (2 lanes). The existing freeway approach roadway and ramp configuration creates an inefficient exit condition causing congested conditions that result in significant vehicle queuing during the P.M. peak hour.

(Text continued on page 80)



NOTES:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK
4. OPERATIONAL ANALYSIS WEST OF PRIEST DRIVE WAS NOT CONDUCTED FOR THE WESTBOUND MAINLINE.
5. PROJECTED TRAFFIC VOLUMES SHOWN REFLECT POST-PROCESSED VOLUMES APPROVED BY MAG. RESULTING VOLUMES IN CORSIM MODEL MAY DIFFER DUE TO UPSTREAM AND DOWNSTREAM OPERATIONS.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 9

SHEET 1 OF 5
2030 NO BUILD AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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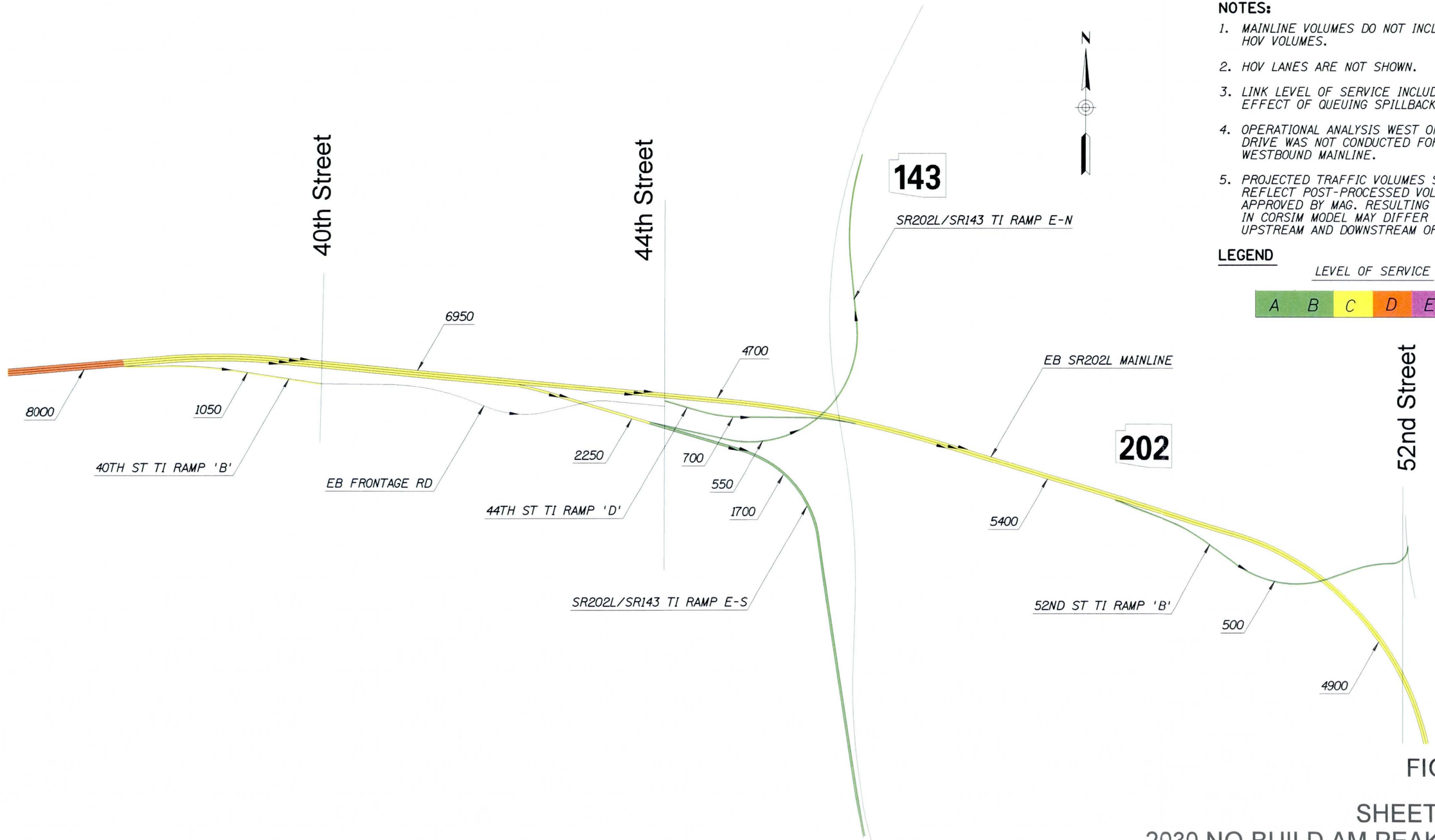

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 9

SHEET 2 OF 5
2030 NO BUILD AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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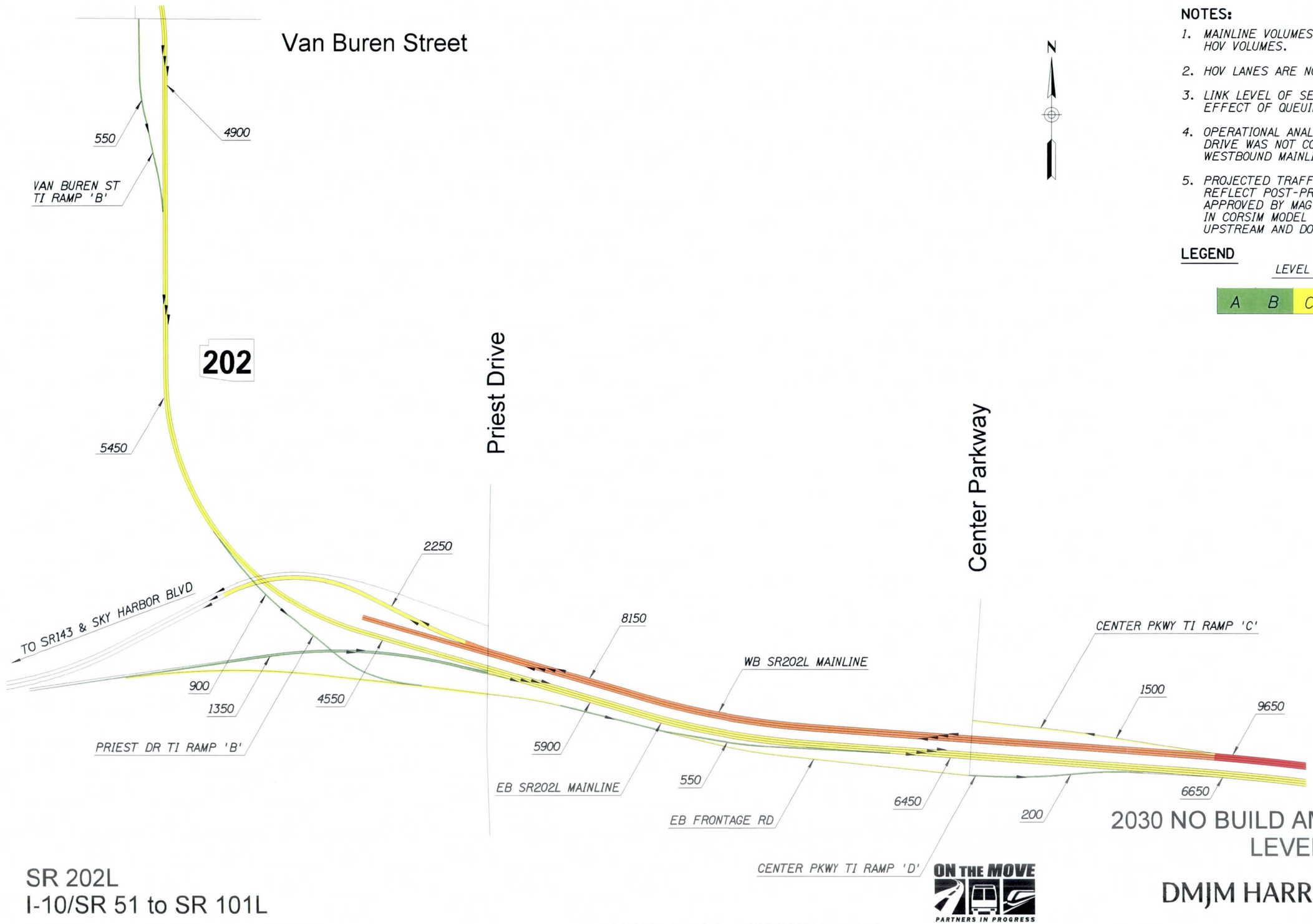

NOTES:

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 9

SHEET 3 OF 5

2030 NO BUILD AM PEAK HOUR LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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NOTES:

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

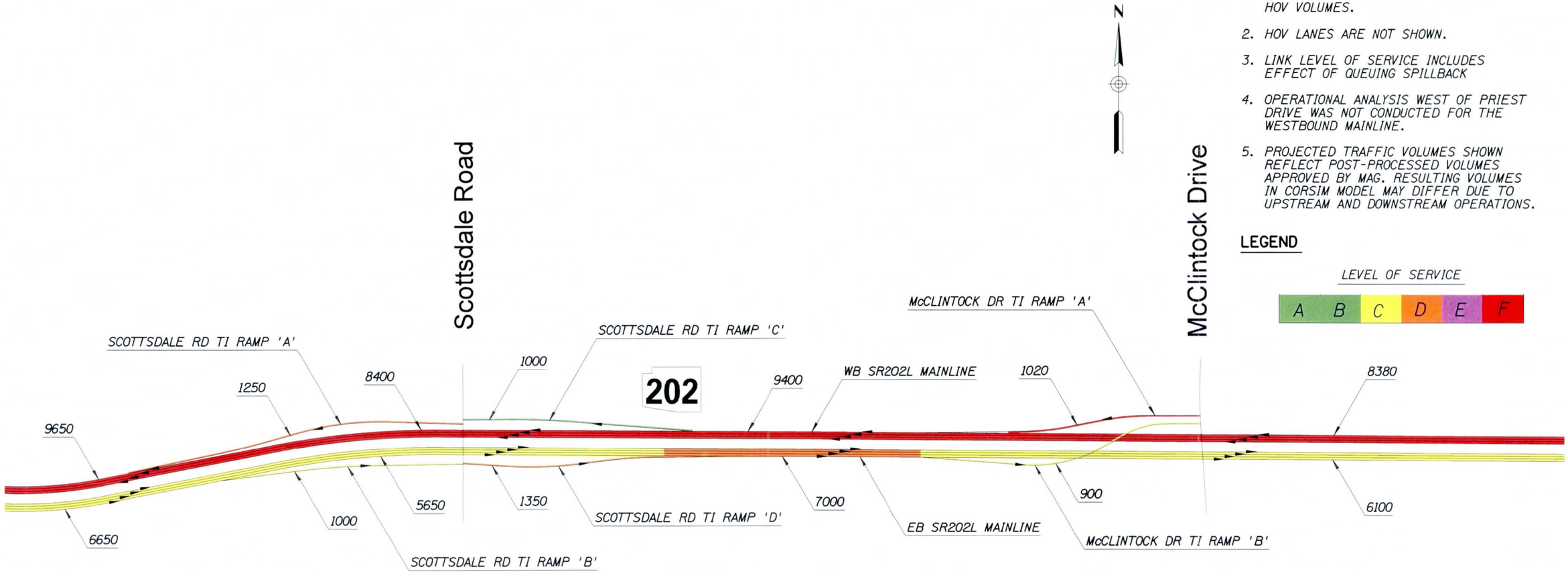

FIGURE 9

SHEET 4 OF 5
2030 NO BUILD AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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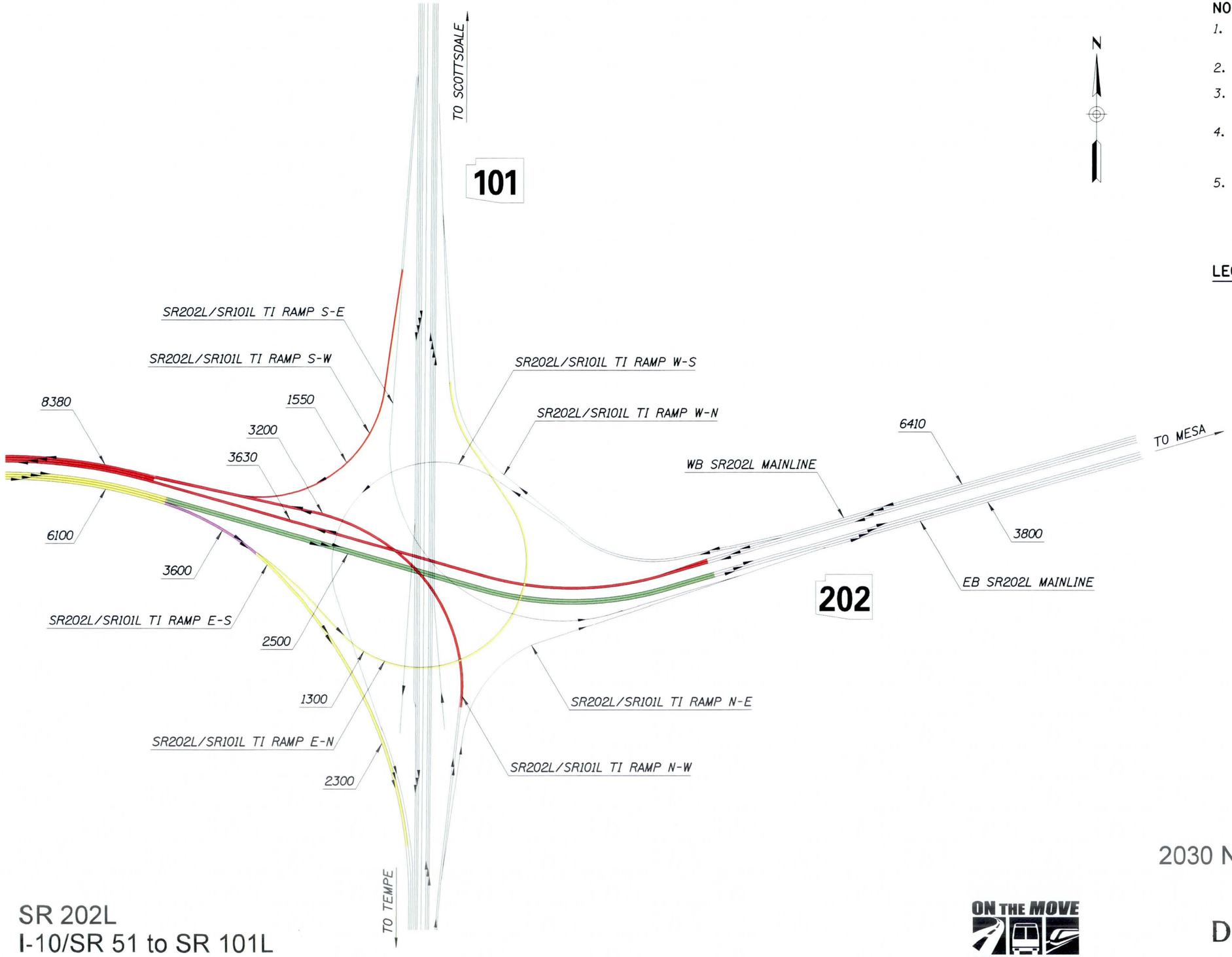

NOTES:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK
4. OPERATIONAL ANALYSIS WEST OF PRIEST DRIVE WAS NOT CONDUCTED FOR THE WESTBOUND MAINLINE.
5. PROJECTED TRAFFIC VOLUMES SHOWN REFLECT POST-PROCESSED VOLUMES APPROVED BY MAG. RESULTING VOLUMES IN CORSIM MODEL MAY DIFFER DUE TO UPSTREAM AND DOWNSTREAM OPERATIONS.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

FIGURE 9

SHEET 5 OF 5
2030 NO BUILD AM PEAK HOUR
LEVEL OF SERVICE

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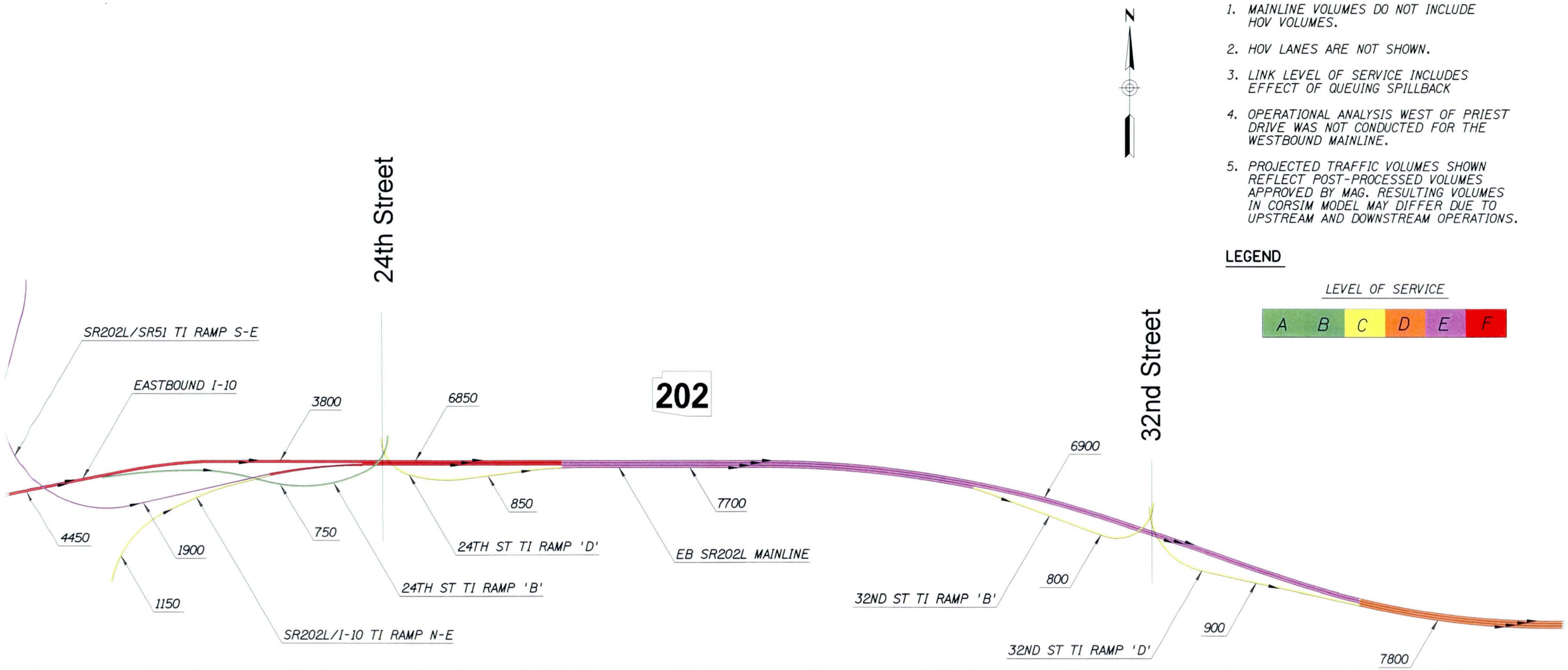

NOTES:

1. *MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.*
2. *HOV LANES ARE NOT SHOWN.*
3. *LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK*
4. *OPERATIONAL ANALYSIS WEST OF PRIEST DRIVE WAS NOT CONDUCTED FOR THE WESTBOUND MAINLINE.*
5. *PROJECTED TRAFFIC VOLUMES SHOWN REFLECT POST-PROCESSED VOLUMES APPROVED BY MAG. RESULTING VOLUMES IN CORSIM MODEL MAY DIFFER DUE TO UPSTREAM AND DOWNSTREAM OPERATIONS.*

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 10

SHEET 1 OF 5
2030 NO BUILD PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 10

SHEET 2 OF 5
2030 NO BUILD PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 10

SHEET 3 OF 5

2030 NO BUILD PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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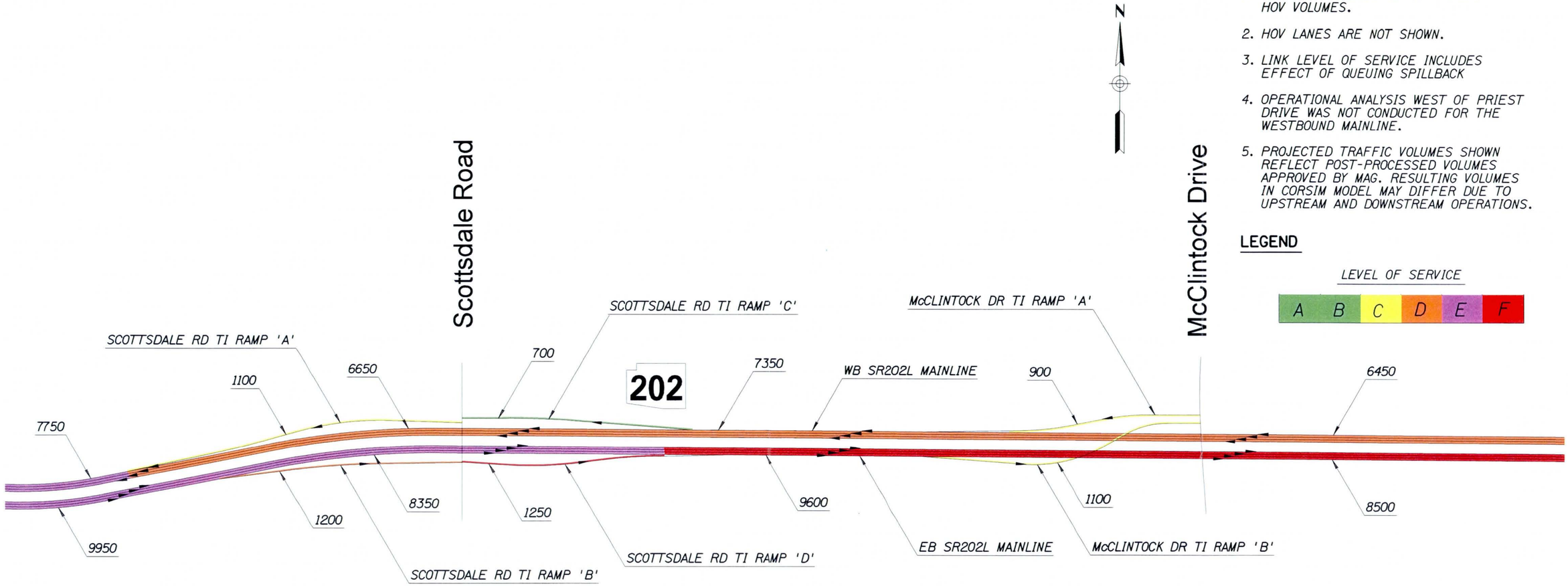

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 10

SHEET 4 OF 5
2030 NO BUILD PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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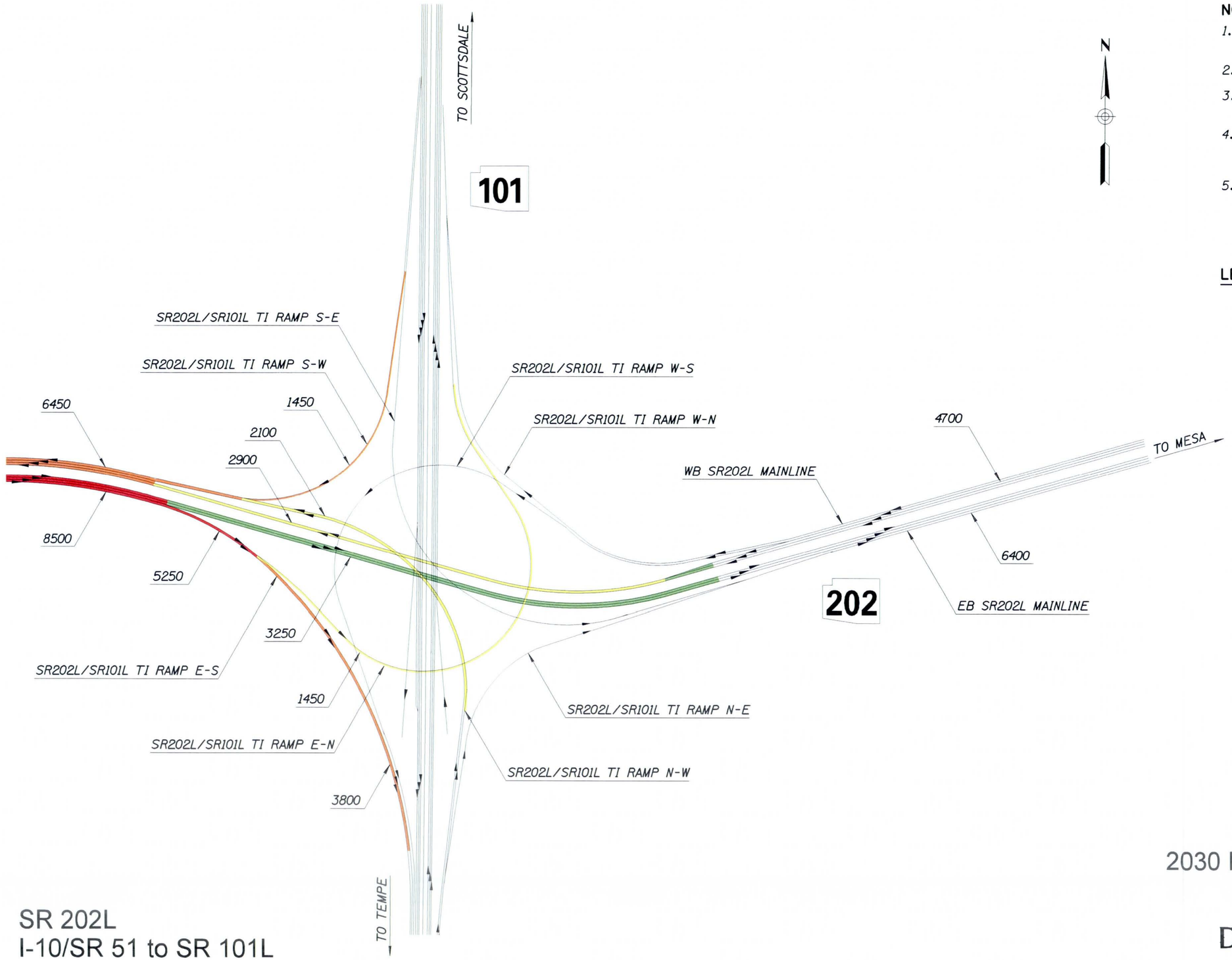

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

SR 202L
I-10/SR 51 to SR 101L

FIGURE 10

SHEET 5 OF 5
2030 NO BUILD PM PEAK HOUR
LEVEL OF SERVICE

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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In addition, the southbound SR 101L mainline generally experiences a high degree of congestion during the P.M. peak hour. The congestion on SR 101L may contribute to queuing on the SR101L/SR202L TI Ramp E-S, which in turn, may impact the level-of-service on the directional ramp and the eastbound SR 202L mainline. However, the SR 101L mainline is outside the study limits and no improvements are being considered for the system TI ramp connections to the SR 101L with this project.

In the westbound direction of travel, congestion is occurring during the A.M. peak hour due to a "bottleneck" on the westbound SR 202L mainline approaching the SR101L/SR202L TI. Three general-purpose lanes and an auxiliary lane are provided from Dobson Road to the interchange. The outside lane is dropped at the combined Ramp W-N/W-S exit (2 lanes), with the second lane designed as an option lane with the freeway through movement (3 lanes). West of the directional ramp gore, and outside mainline lane is dropped with an AASHTO lane drop to provide two general-purpose and one HOV lane through the system interchange. This configuration provides insufficient capacity on the mainline causing significant congestion.

The analysis results also indicate the westbound SR 202L currently experiences congestion during the A.M. peak hours between the Center Parkway exit ramp and the SR101L/SR202L TI. One "bottleneck" occurs at the Center Parkway exit ramp, which creates traffic queues that extend to the east. This "bottleneck" is occurring because the traffic demand on the SR 202L mainline exceeds the capacity of the mainline in this area. An additional general-purpose lane would be warranted on this segment of SR202L, but is outside of the limits of this study.

Another "bottleneck" is located on the westbound SR 202L mainline departing the SR101L/SR202LTI. This "bottleneck" is due to the configuration of the directional ramp connections with the westbound mainline. Ramp S-W (1 lane) and Ramp N-W (2 lanes) merge to develop a two lane entrance into westbound SR 202L. This two lane ramp entrance, combine with the westbound SR 202L mainline (2 lanes), to develop four general-purpose lanes and one HOV lane departing the system interchange. The current configuration of the ramp connections from the system interchange creates an inefficient entrance condition.

No-Build Conditions

The No-Build alternative lane configurations, 2030 A.M. and P.M. peak hour traffic volume projections, and LOS analysis results are shown in Figures 9 and 10. Under this scenario, significant congestion would be expected to occur within the following segments of the SR 202L mainline:

- A.M. Peak Hour:
  - eastbound SR 202L mainline from the 32nd Street entrance ramp to the I-10/SR51 TI Ramp S-E entrance ramp
  - westbound SR 202L mainline from the Center Parkway exit to the SR101L/SR202L TI

- P.M. Peak Hour:
  - eastbound SR 202L mainline from the 32nd Street entrance ramp to the I-10/SR51 TI Ramp S-E entrance ramp
  - eastbound SR 202L mainline from the SR101L/SR202L TI to the Priest Drive exit ramp
  - westbound SR 202L mainline from the Sky Harbor Boulevard exit ramp to the Scottsdale Road entrance ramp

The projected growth in traffic demand between 2006 and 2030 will result in increased congestion resulting in significantly longer traffic queue lengths in the A.M. and P.M. peak hours. The congestion anticipated in the A.M. peak hour would likely extend further to the east on the SR 202L mainline, thereby causing significant congestion on the SR101L/SR202L TI directional ramps and possibly the SR 101L mainline. In the P.M. peak hour, the additional traffic demand would be expected to extend the eastbound queue by approximately three miles to the west due to insufficient capacity at the SR101L/SR202L TI.

Alternative 1

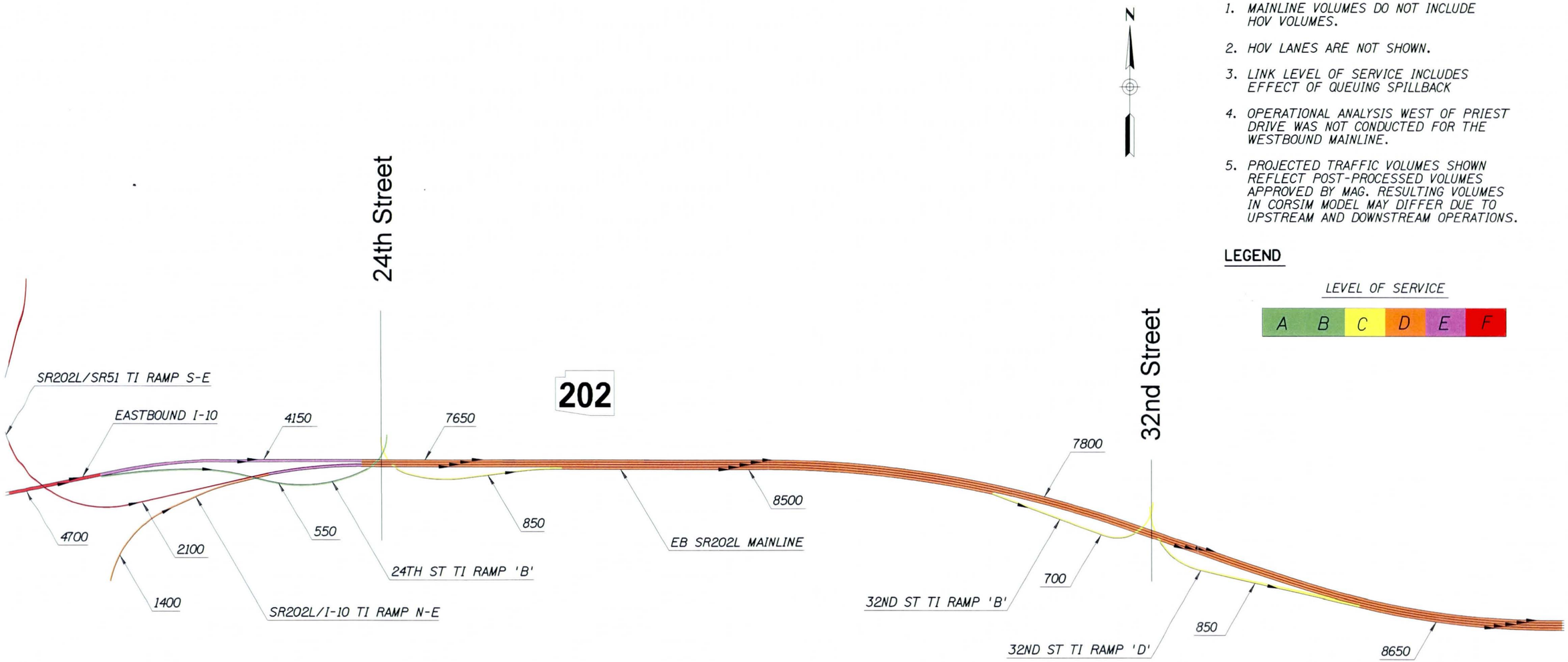
The Alternative 1 lane configurations, 2030 A.M. and P.M. peak hour traffic volume projections, and LOS analysis results are shown in Figures 11 and 12, respectively. Under this scenario, significant congestion would be expected to occur within the following segments of the SR 202L mainline:

- A.M. Peak Hour:
  - eastbound SR 202L mainline from 24th Street to the I-10/SR51 TI Ramp S-E entrance ramp
  - westbound SR 202L mainline from the Center Parkway exit ramp to the east side of the SR101L/SR202L TI

- P.M. Peak Hour:
  - eastbound SR 202L mainline from approximately 24th Street to the I-10/SR51 TI Ramp S-E entrance ramp
  - eastbound SR 202L mainline from the SR101L/SR202L TI to the Center Parkway entrance ramp
  - westbound SR 202L mainline from the Sky Harbor Boulevard/SR143 exit ramp to Scottsdale Road entrance ramp

Alternative 1 would remove the "bottleneck" downstream of the I-10/SR51 TI by reconfiguring Ramp S-E and Ramp N-E to allow each ramp to enter the SR 202L mainline with a "lane-add" design, developing four general-purpose lanes and one HOV lane continuing to the east.

(Text continued on page 92)



NOTES:

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4. OPERATIONAL ANALYSIS WEST OF PRIEST DRIVE WAS NOT CONDUCTED FOR THE WESTBOUND MAINLINE.
5. PROJECTED TRAFFIC VOLUMES SHOWN REFLECT POST-PROCESSED VOLUMES APPROVED BY MAG. RESULTING VOLUMES IN CORSIM MODEL MAY DIFFER DUE TO UPSTREAM AND DOWNSTREAM OPERATIONS.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 11

SHEET 1 OF 5
2030 BUILD ALTERNATIVE 1 AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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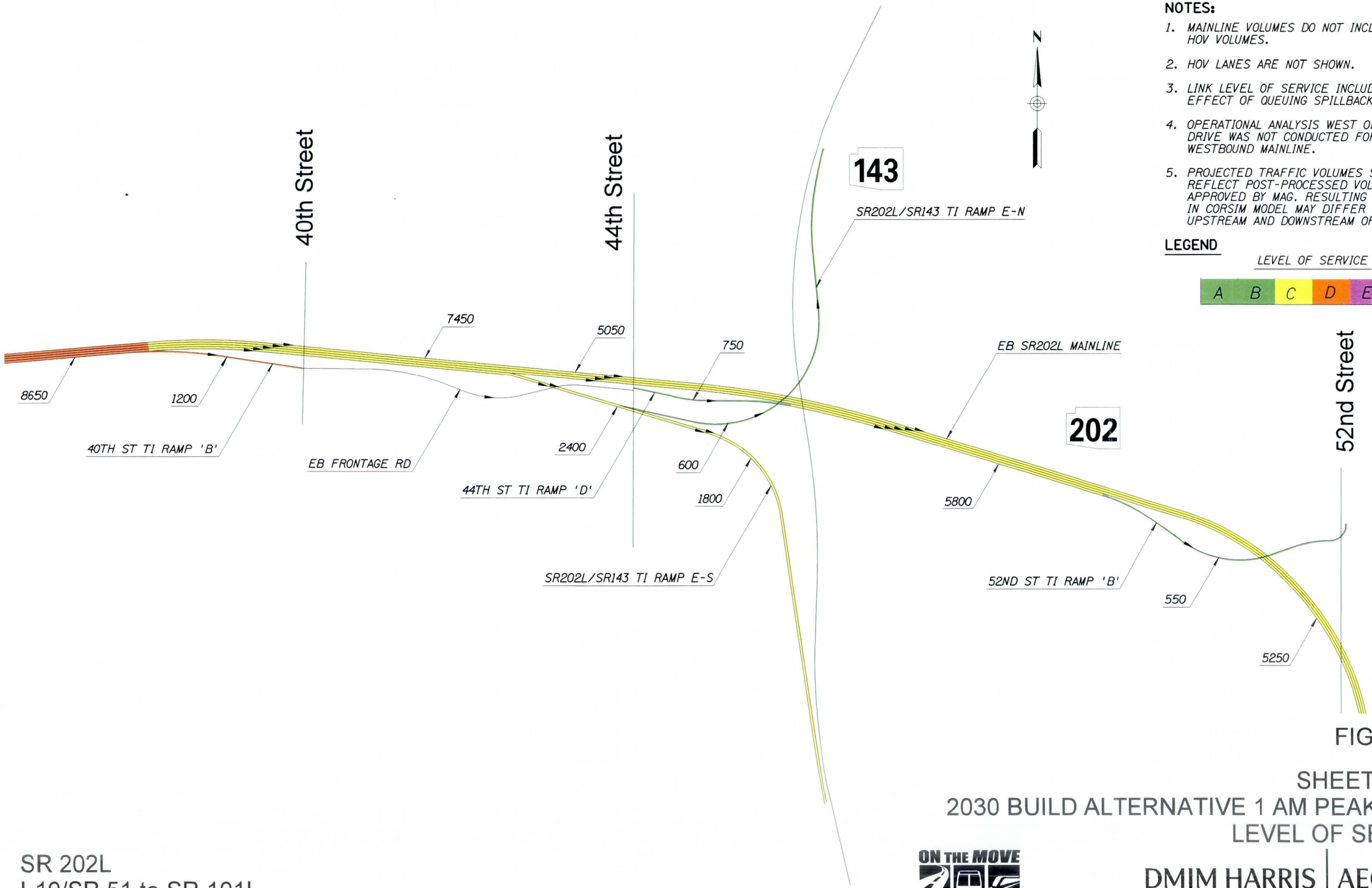

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 11

SHEET 2 OF 5

2030 BUILD ALTERNATIVE 1 AM PEAK HOUR LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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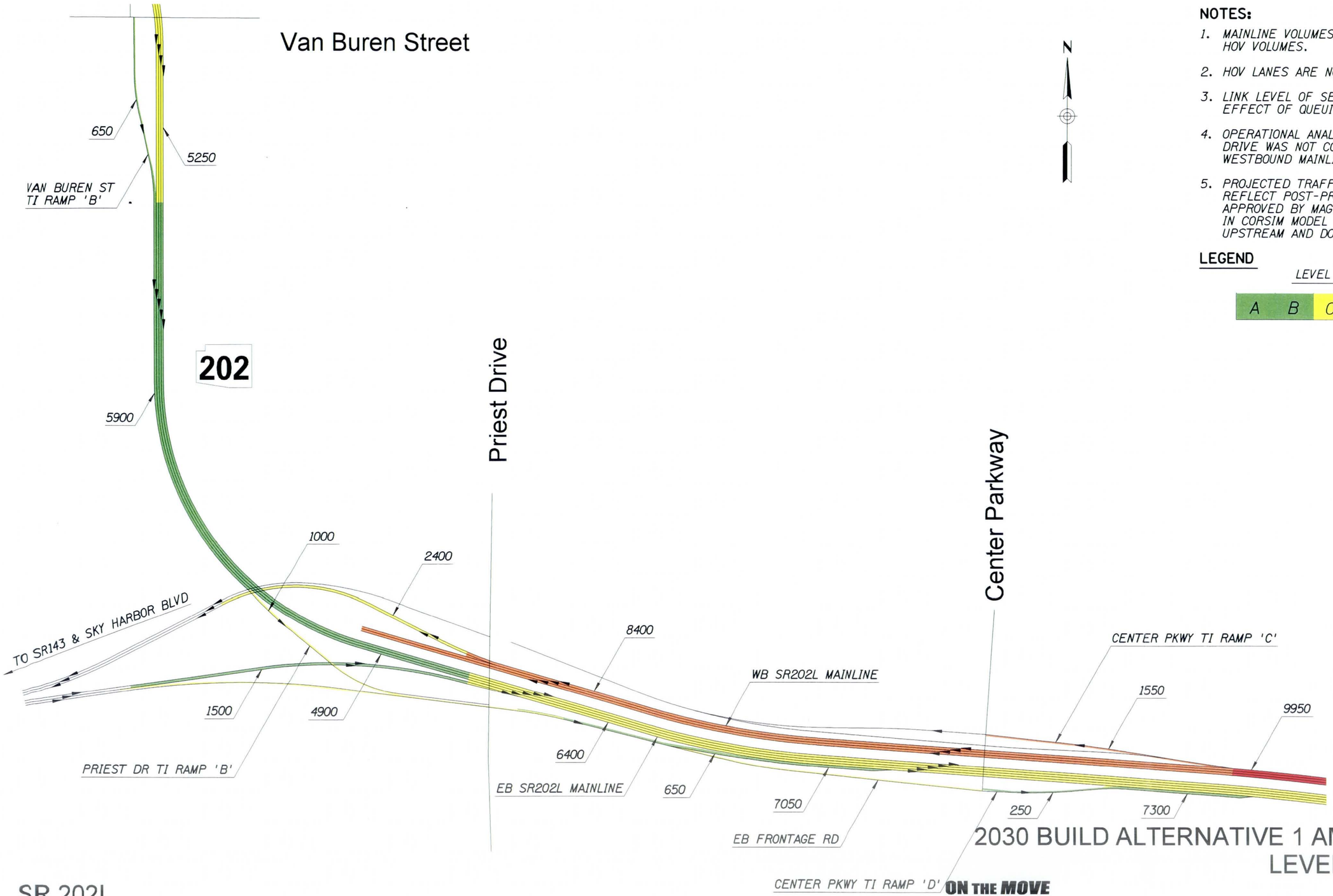

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 11

SHEET 3 OF 5

2030 BUILD ALTERNATIVE 1 AM PEAK HOUR LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

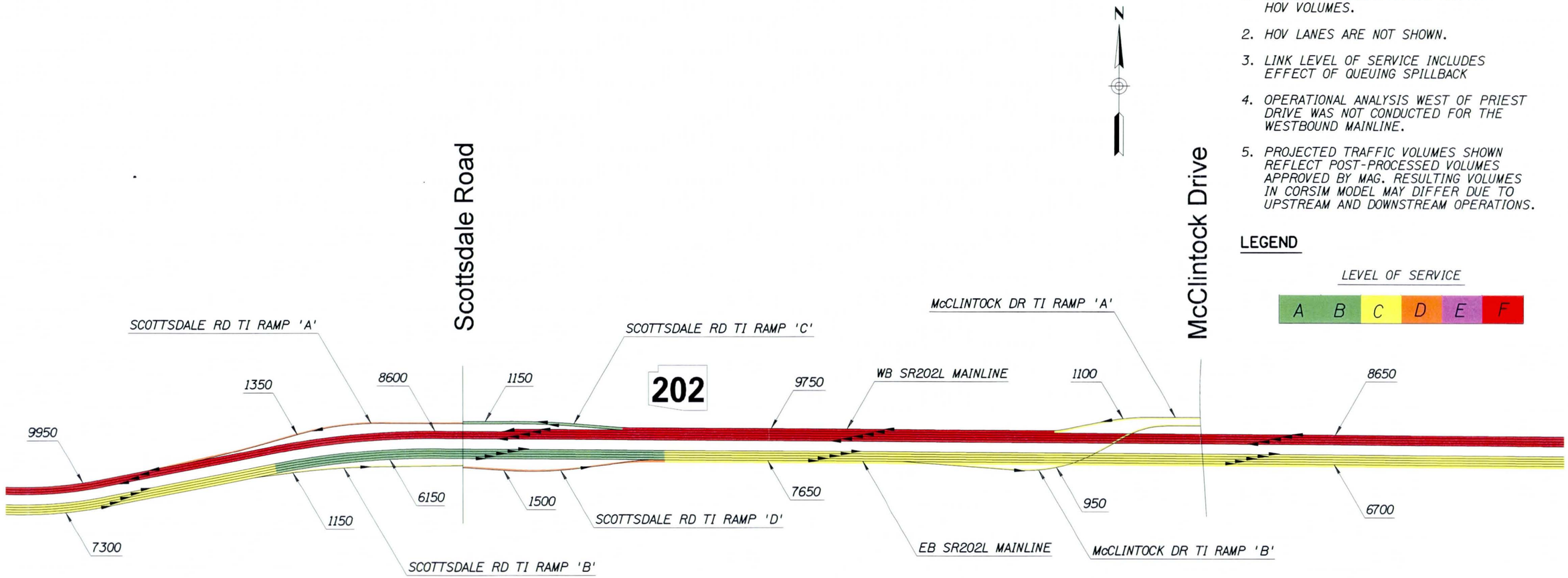

FIGURE 11

SHEET 4 OF 5
2030 BUILD ALTERNATIVE 1 AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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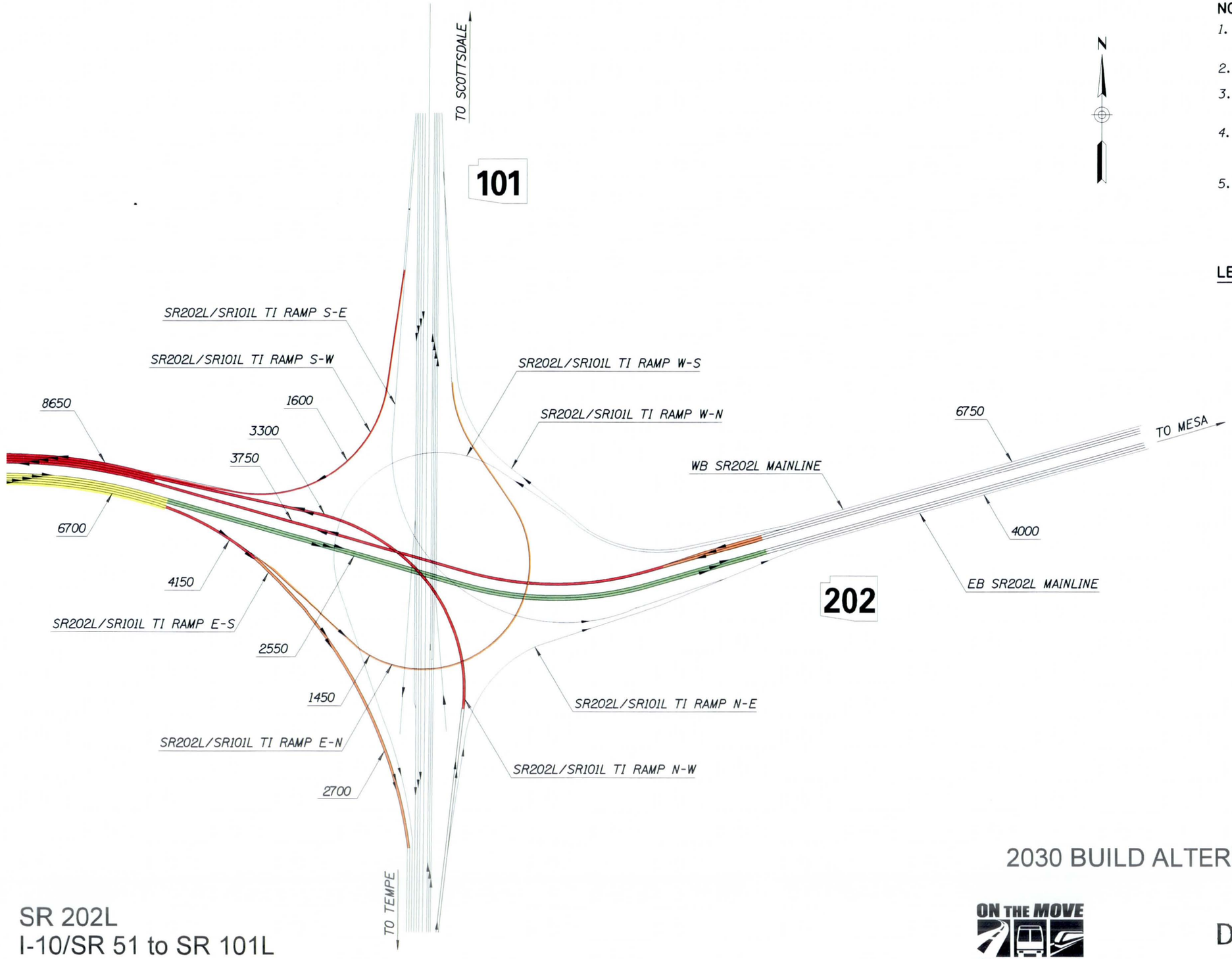

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 11

SHEET 5 OF 5
2030 BUILD ALTERNATIVE 1 AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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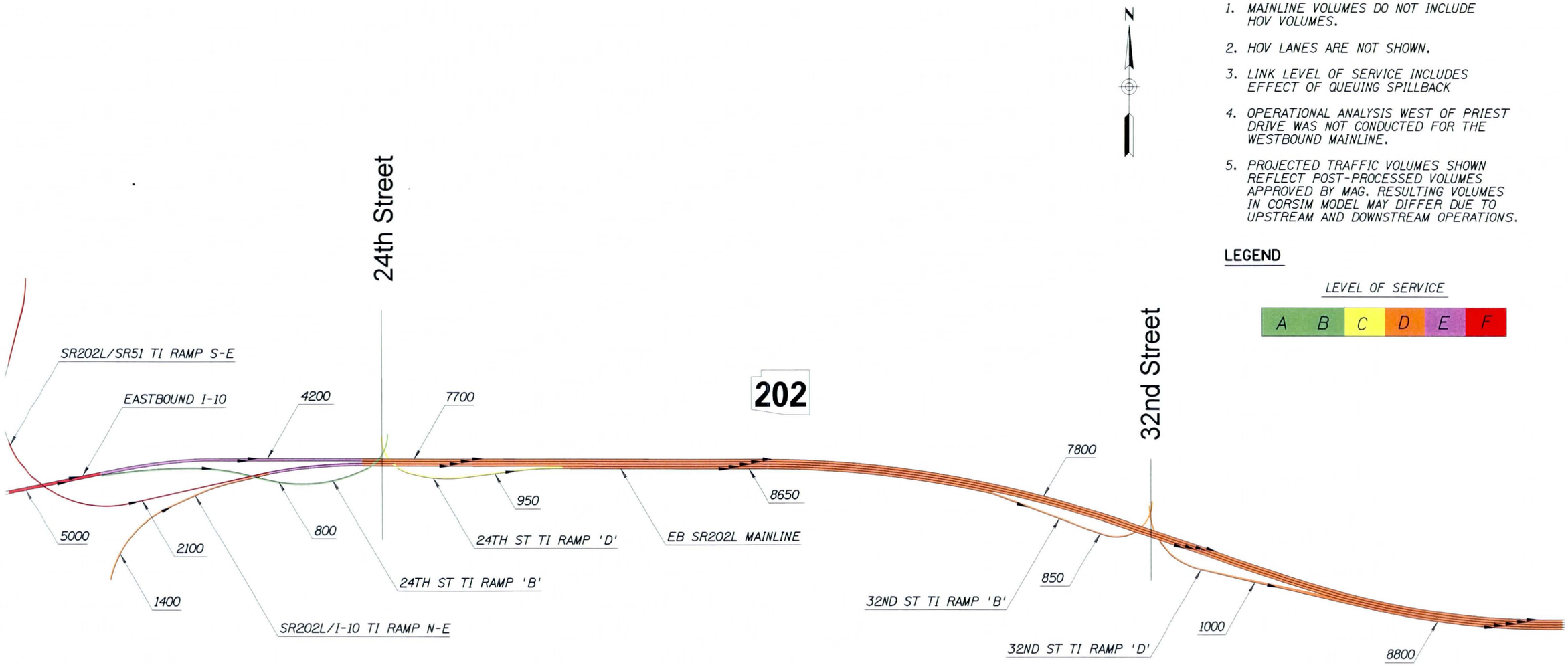

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 12

SHEET 1 OF 5
2030 BUILD ALTERNATIVE 1 PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 12

SHEET 2 OF 5

2030 BUILD ALTERNATIVE 1 PM PEAK HOUR LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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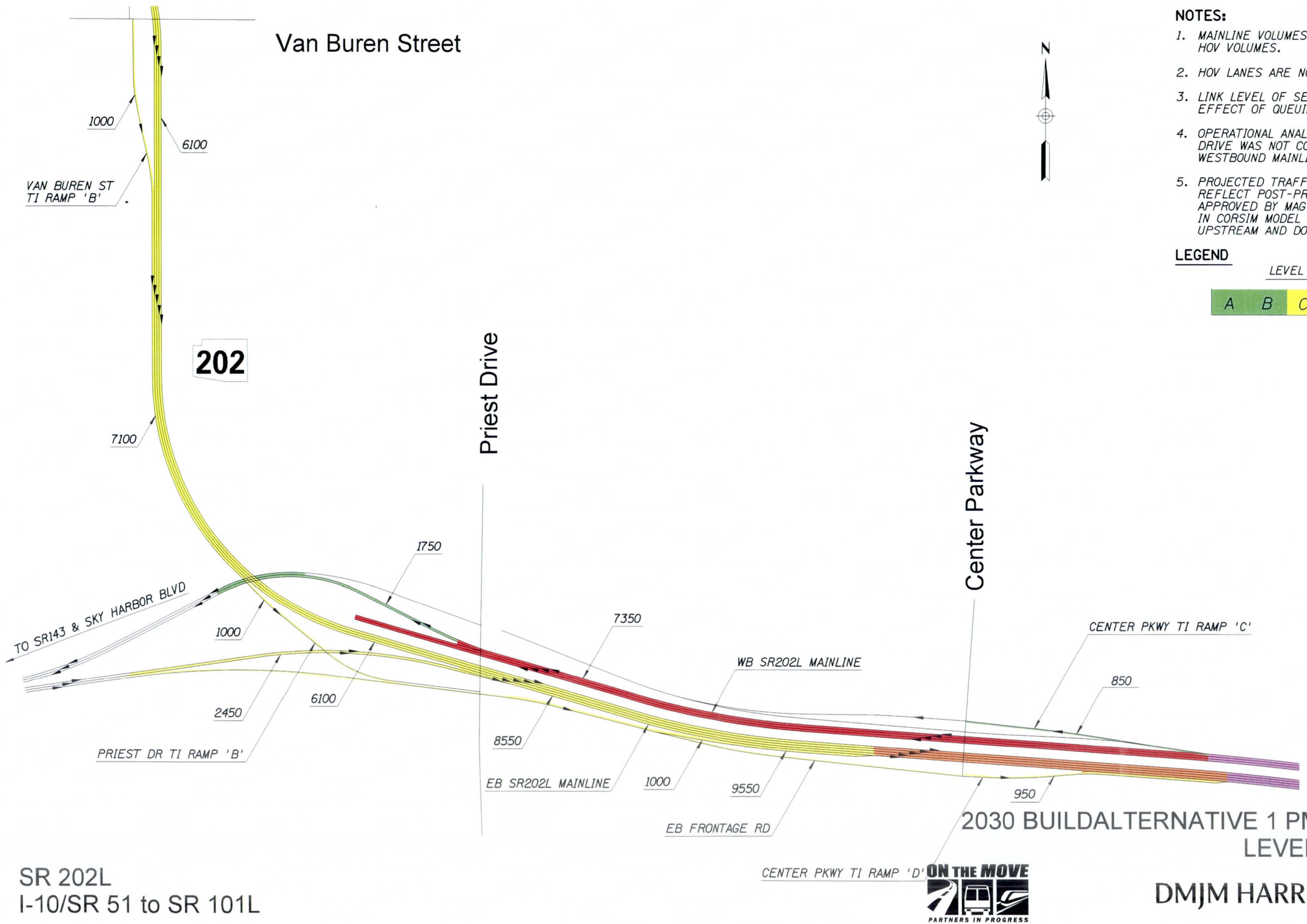

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 12

SHEET 3 OF 5

2030 BUILDALTERNATIVE 1 PM PEAK HOUR LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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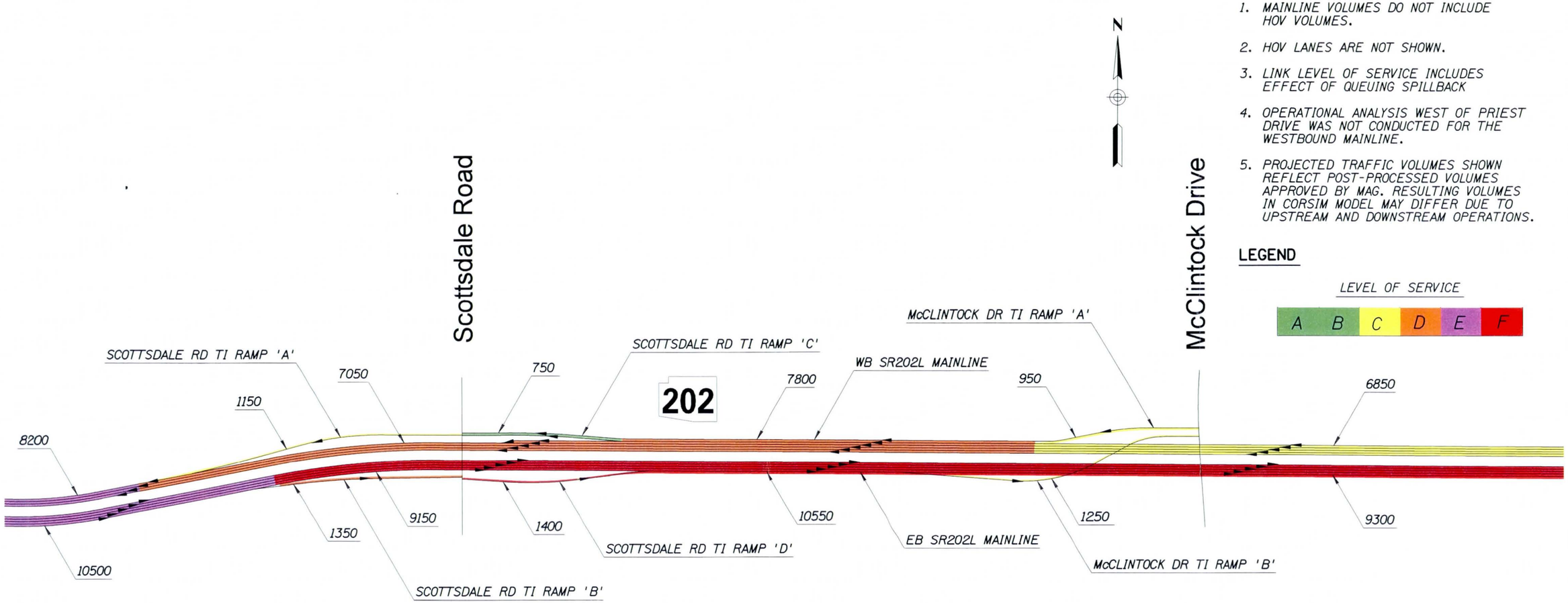

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

FIGURE 12

SHEET 4 OF 5
2030 BUILD ALTERNATIVE 1 PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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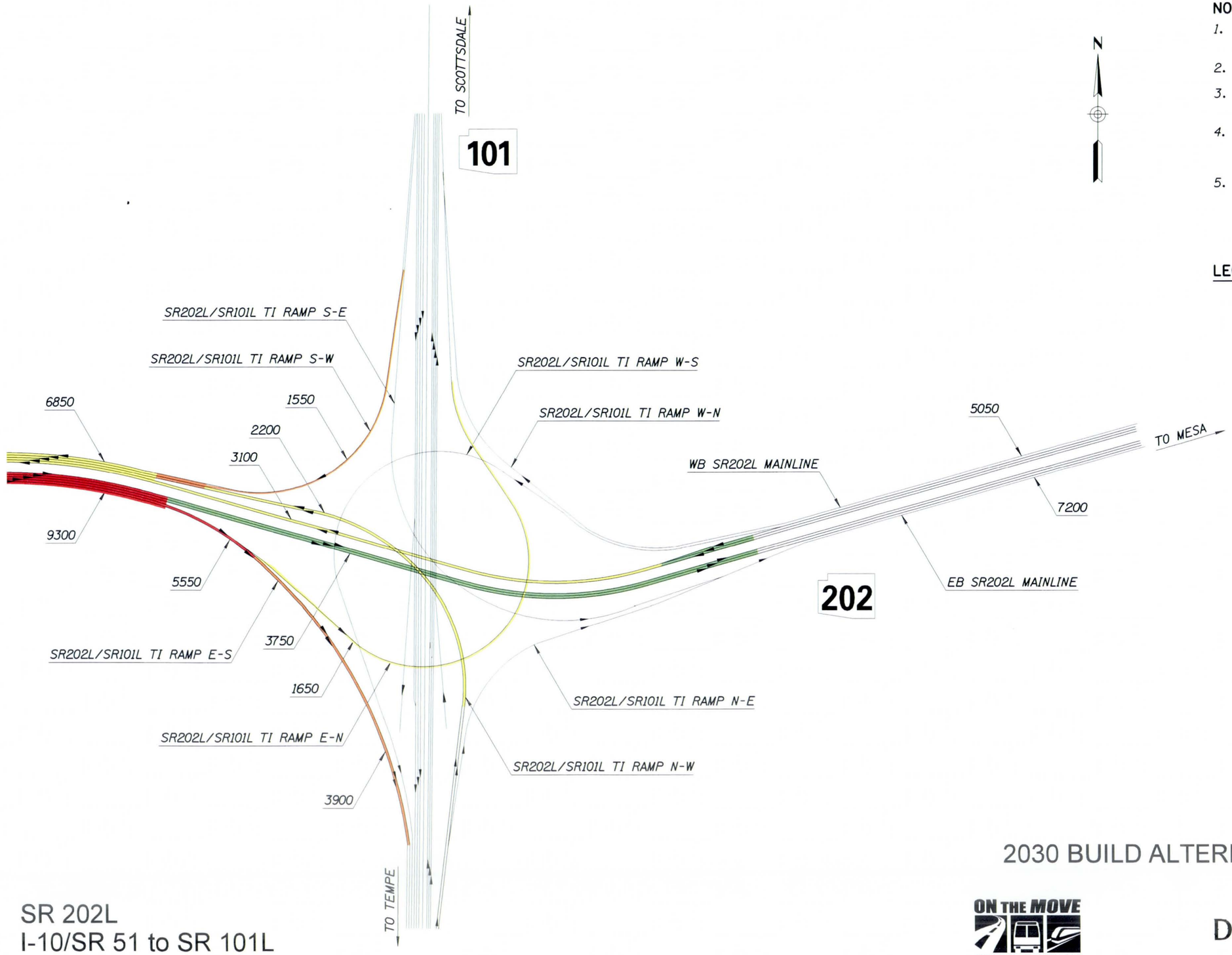

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LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

SR 202L
I-10/SR 51 to SR 101L

NOT TO SCALE - SCHEMATIC ONLY

FIGURE 12

SHEET 5 OF 5
2030 BUILD ALTERNATIVE 1 PM PEAK HOUR
LEVEL OF SERVICE

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

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A high degree of congestion would continue to occur on the eastbound approach (5 general-purpose lanes and 1 HOV lane) to the SR101L/SR202L TI. The outside two lanes would be dropped at the combined Ramp E-S/E-N exit. Once the ramp departs the mainline, Ramp E-N (1 lane) would be developed as a tapered exit from Ramp E-S (2 lanes). This mainline approach and ramp configuration would continue to result in congested conditions that result in significant vehicle queuing during the P.M. peak hour.

In the westbound direction of travel, congestion would continue to occur during the A.M. peak hour due to the current "bottleneck" on the westbound SR 202L mainline approaching the SR101L/SR202L TI. Since this alternative would not improve the existing lane configuration approaching the system interchange, congestion would be anticipated similar to the No Build alternative.

The analysis results also indicate the westbound SR 202L currently experiences congestion during the A.M. peak hour between the Center Parkway exit ramp and the SR101L/SR202L TI. This "bottleneck" would continue to occur since the westbound mainline would not be improved west of the Scottsdale Road TI since this area is outside the limits of this study.

Alternative 1 would improve the westbound SR 202L mainline departing the SR101L/SR202LTI by reconfiguring the Ramp N-W/S-W entrance to allow each ramp to enter the mainline with a "lane-add" design, thereby eliminating the current "bottleneck" at this location. Ramp S-W (1 lane) and Ramp N-W (2 lanes), would merge to develop a three lane entrance into westbound SR 202L. This three lane ramp entrance, combined with the westbound SR 202L mainline (2 lanes) would develop five general-purpose lanes and one HOV lane departing the system interchange and continue to Scottsdale Road. An auxiliary lane would also be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp. This configuration would improve the capacity of the westbound roadway between the system interchange and McClintock Drive.

Alternative 2

The Alternative 2 lane configuration, 2030 A.M. and P.M. peak hour traffic volume projections, and LOS analysis results are shown in Figures 13 and 14, respectively. Under this scenario, significant congestion would be expected to occur within the following segments of the SR 202 mainline:

- A.M. Peak Hour:
  - eastbound SR 202L mainline from 24th Street to the I-10/SR51 TI Ramp S-E entrance ramp
  - westbound SR 202L mainline from Center Parkway exit ramp to the SR101L/SR202L TI entrance ramp

(Text continued on page 97)

NOTE:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

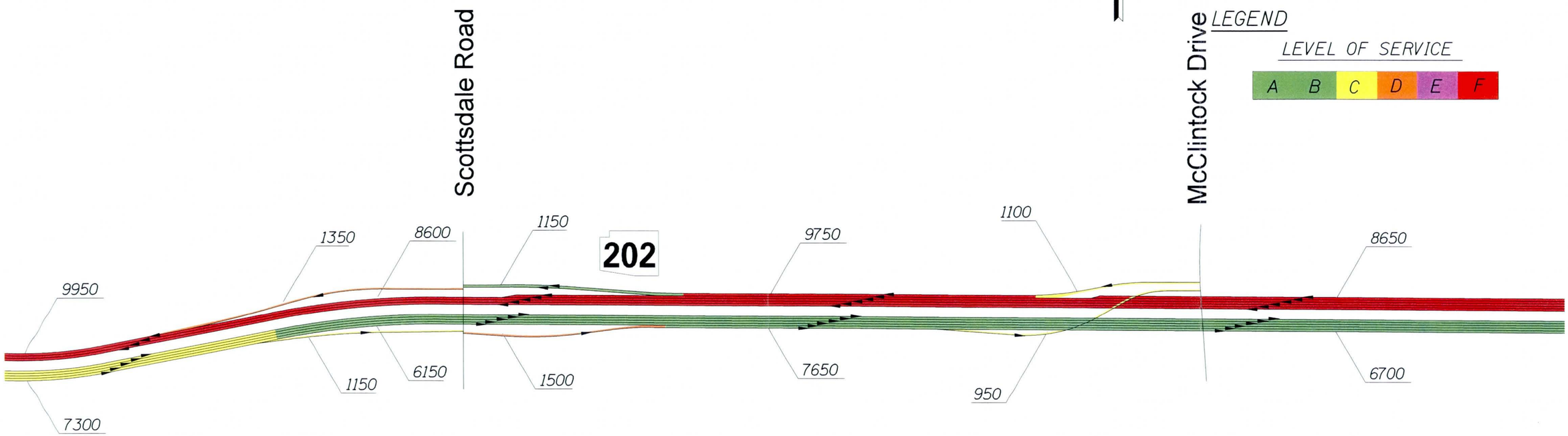

FIGURE 13

SHEET 1 OF 2
2030 BUILD ALTERNATIVE 2 AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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9/25/2006

NOTE:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

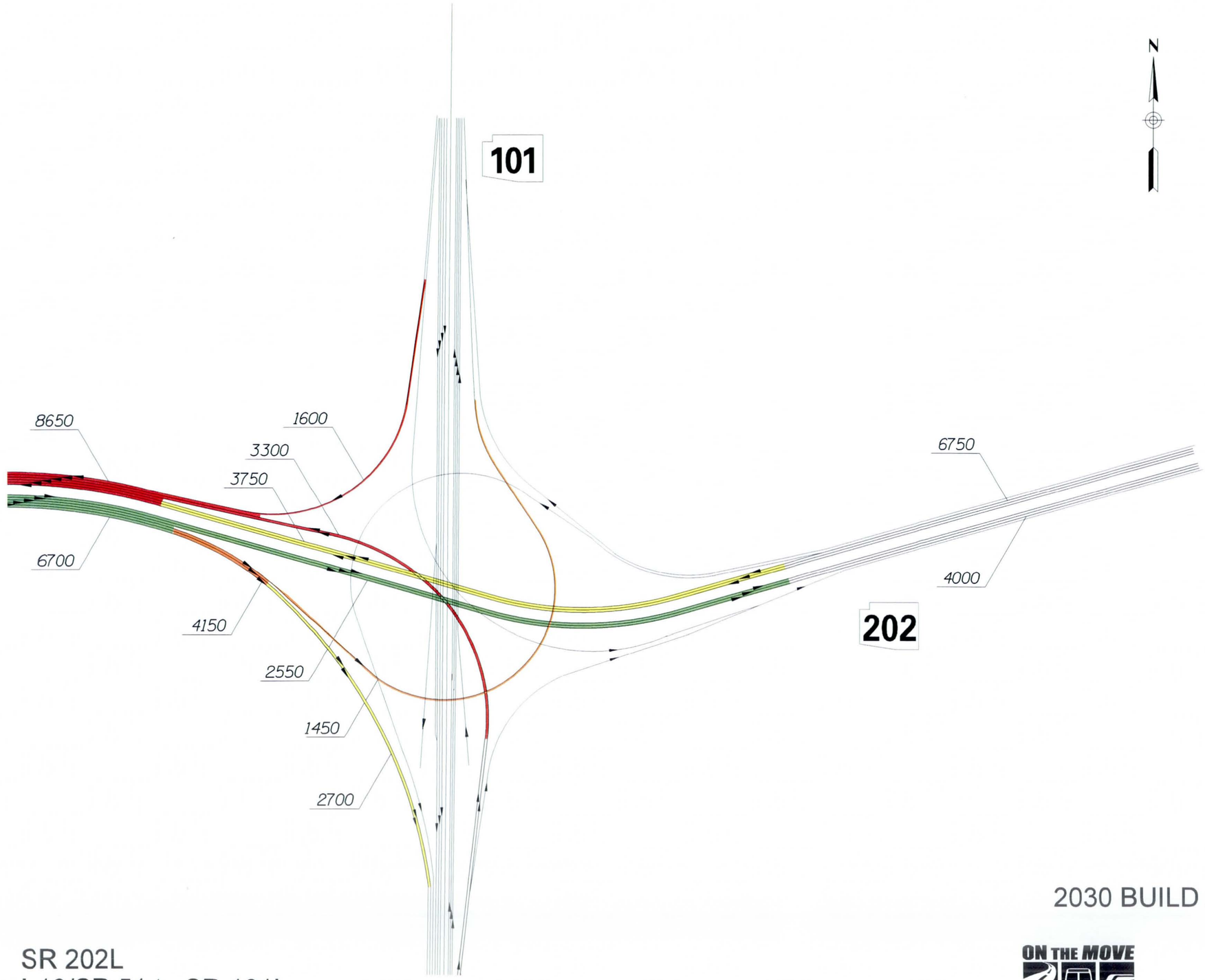

FIGURE 13

SHEET 2 OF 2
2030 BUILD ALTERNATIVE 2 AM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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9/25/2006

NOTE:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

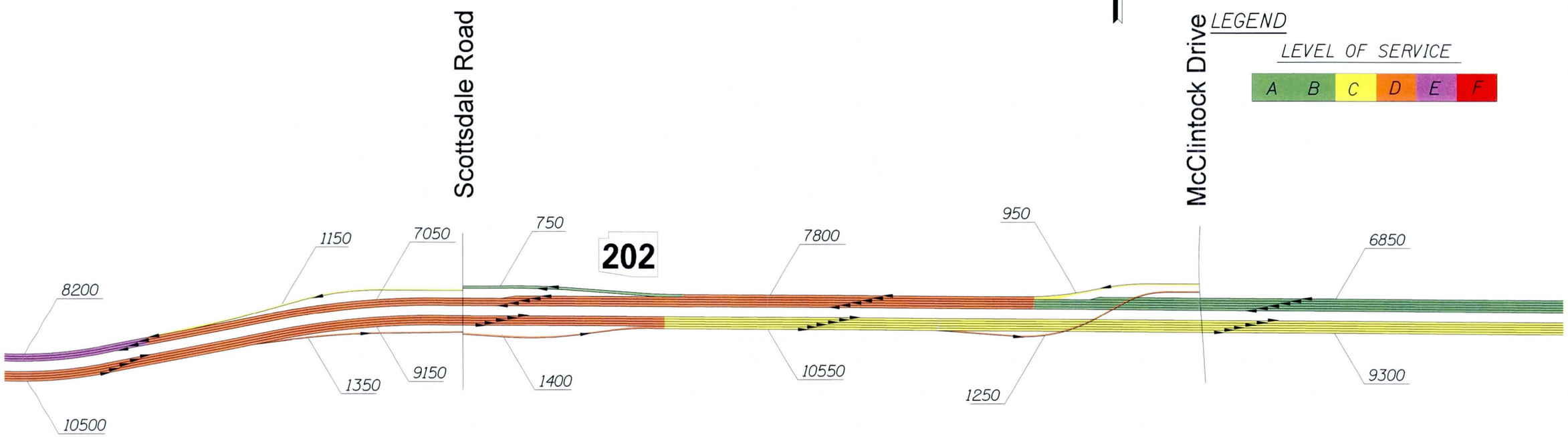

FIGURE 14

SHEET 1 OF 2
2030 BUILD ALTERNATIVE 2 PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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NOTE:

1. MAINLINE VOLUMES DO NOT INCLUDE HOV VOLUMES.
2. HOV LANES ARE NOT SHOWN.
3. LINK LEVEL OF SERVICE INCLUDES EFFECT OF QUEUING SPILLBACK.

LEGEND

LEVEL OF SERVICE

A	B	C	D	E	F

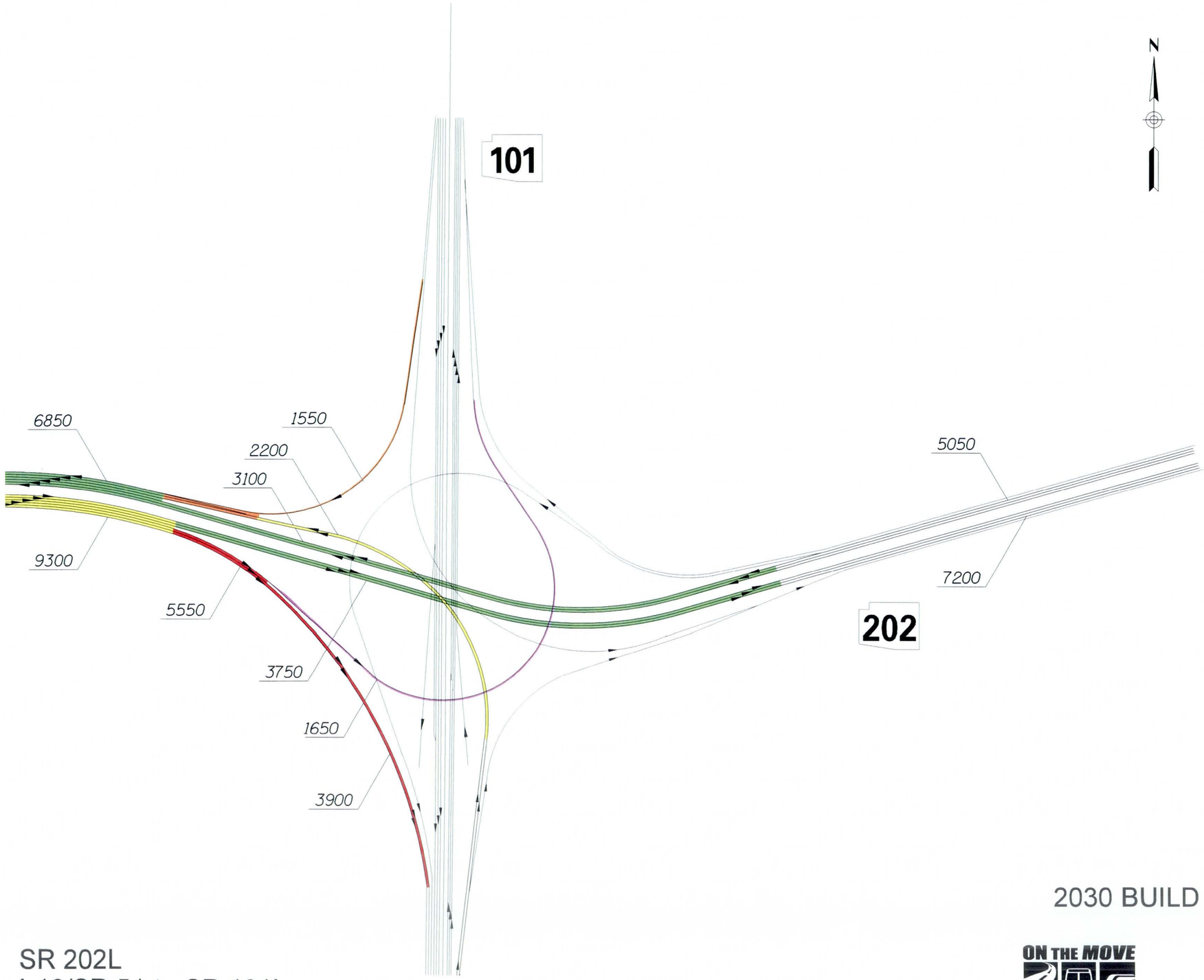

FIGURE 14

SHEET 2 OF 2
2030 BUILD ALTERNATIVE 2 PM PEAK HOUR
LEVEL OF SERVICE

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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- P.M. Peak Hour:
  - eastbound SR 202L mainline from approximately 24 Street to the I-10/SR51 TI Ramp S-E entrance ramp
  - westbound SR 202L mainline from the Sky Harbor Boulevard/SR143 exit ramp to Scottsdale Road entrance ramp

Similar to Alternative 1, Alternative 2 would remove the "bottleneck" downstream of the I-10/SR51 TI by reconfiguring Ramp S-E and Ramp N-E to allow each ramp to enter the SR 202L mainline with a "lane-add" design. This revised configuration would develop four general-purpose lanes and one HOV lane that would continue to the east.

Alternative 2 would eliminate the "bottleneck" on the eastbound approach (6 general-purpose lanes and 1 HOV lane) to the SR101L/SR202L TI. The outside three lanes would be dropped at the combined Ramp E-S/E-N exit, with three general-purpose and one HOV lane continuing to the east on the SR 202L mainline. Each directional ramp lane would be developed in advance of the system interchange. Once the combined directional ramp (3 lanes) departs the mainline, Ramp E-N (1 lane) would diverge from Ramp E-S (2 lanes). This mainline approach and ramp configuration would improve the level-of-service on the eastbound mainline to LOS 'C' in the P.M. peak hour and eliminate the queuing on the mainline.

In the westbound direction of travel, the "bottleneck" would be eliminated for the westbound SR 202L mainline approaching the SR101L/SR202L TI by providing three general-purpose and one HOV lane through the interchange.

The analysis results also indicate the westbound SR 202L experiences congestion during the A.M. peak hours between the Center Parkway exit ramp and the SR101L/SR202L TI. This "bottleneck" would continue to occur since the westbound mainline would not be improved west of the Scottsdale Road TI.

Alternative 2 would improve the westbound SR 202L mainline departing the SR101L/SR202LTI by reconfiguring the Ramp N-W/S-W entrance to allow each ramp to enter the mainline with a "lane-add" design, thereby eliminating the "bottleneck" at this location. Ramp S-W (1 lane) and Ramp N-W (2 lanes) would merge to develop a three lane entrance into the westbound SR 202L mainline. This three lane ramp entrance, combined with the westbound SR 202L mainline (3 lanes), would develop six general-purpose lanes and one HOV lane departing the system interchange. The outside general-purpose lane would be dropped prior to the McClintock Drive entrance ramp with a tapered merge design. The fifth general-purpose lane would continue to Scottsdale Road, where it would be dropped with an AASHTO lane drop configuration. An auxiliary lane would also be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp. This configuration would improve the capacity of the westbound roadway between the system interchange and McClintock Drive.

2.5 SUMMARY OF OPERATIONAL ANALYSIS

The operational analysis results are summarized below for two segments along the eastbound SR 202L mainline, and one segment along the westbound mainline. The eastbound mainline includes 24th Street to 32nd Street, and McClintock Drive to SR101L/SR202L TI, for the eastbound mainline. The westbound SR 202L mainline was evaluated between the SR101L/SR202L TI and McClintock Drive. The results of the operational analysis are summarized in Tables 12 through 14.

Table 12 – Miles of LOS 'E' or 'F' for Each Alternative

Description	Miles of LOS 'E' or 'F'		
	Eastbound	Westbound	Total
2030 No-Build	8.0	5.3	13.3
2030 Build Alternative 1	3.8	5.2	9.0
2030 Build Alternative 2	1.0	4.5	5.5

Alternative 1 generally would add one general-purpose lane in each direction of travel within the study area. The Alternative 1 conditions are expected to experience approximately 9 miles of queuing (LOS 'E' and 'F'). This alternative would remove "bottlenecks" that restrict traffic flow and thereby allow more vehicles to travel through the corridor which in turn creates additional congestion downstream.

The additional capacity provided with Alternative 1 would be insufficient to meet the anticipated traffic demand. Significant "bottlenecks" would still exist in the westbound direction within the SR 101L system TI, where only two general-purpose lanes would be provided on the westbound mainline, and on the mainline in the eastbound direction of travel approaching the SR101L/SR202L TI.

Alternative 2 would provide an additional eastbound general-purpose lane approaching the SR101L/SR202L TI when compared to Alternative 1. An additional westbound general-purpose lane would also be provided through the SR101L/SR202L TI. The Alternative 2 conditions would be expected to experience approximately 5 miles of queuing (LOS 'E' or 'F').

As shown in Table 12, Alternative 2 provides the least amount of LOS 'E' or 'F' queuing length within the study corridor. The westbound "bottleneck" within the SR101L system TI would be removed under Alternative 2. However, this improvement does not significantly reduce the westbound congestion since no westbound improvements are planned west of Scottsdale Road. A significant operational improvement is anticipated in the eastbound direction of travel.

Between 24th Street and 32nd Street, Alternatives 1 and 2 would eliminate the "bottleneck" at the I-10/SR51 TI, improving the eastbound level-of-service from LOS 'E' to LOS 'D', and result in the ability to carry an additional 1,600 vph in the A.M. peak hour compared to the No-Build Alternative as shown in Table 13.

Between McClintock Drive and SR 101L, Alternatives 1 and 2 are not anticipated to provide a significant operational improvement in the westbound direction of travel during the A.M. peak hour. As shown in Table 13, Alternatives 1 and 2 are anticipated to carry additional westbound traffic, but are still anticipated to operate at LOS 'F' during the A.M. peak hour due to the capacity of the mainline west of Scottsdale Road.

Table 13 – AM Peak Hour Performance Measures

Description	2030 No-Build	2030 Build Alternative 1	2030 Build Alternative 2
Between 24th Street and 32nd Street			
Eastbound			
Number of General Purpose Lanes	3	4	4
Traffic Volume (vph)	5,900	7,500	7,500
Travel Speed (mph)	50	60	60
Density (veh/ln-mile)	40 (LOS E)	31 (LOS D)	31 (LOS D)
Between McClintock Drive and the SR101L/SR202L TI			
Eastbound			
Number of General Purpose Lanes	4	5	6
Traffic Volume (vph)	4,600	5,000	5,600
Travel Speed (mph)	61	60	63
Density (veh/ln-mile) (LOS)	19 (LOS C)	19 (LOS C)	15 (LOS B)
Westbound			
Number of General Purpose Lanes	4	5	6
Traffic Volume (vph)	6,300	7,800	7,800
Travel Speed (mph)	15	18	18
Density (veh/ln-mile) (LOS)	104 (LOS F)	88 (LOS F)	79 (LOS F)

Note: Traffic volume shown reflects the volume that can be accommodated based on the CORSIM model output.

Between 24th Street and 32nd Street, Alternatives 1 and 2 would eliminate the "bottleneck" at the I-10/SR51 TI thereby improving the eastbound level-of-service from LOS 'E' to LOS 'D' in the P.M. peak hour. The capacity of the roadway would be improved to allow an additional 1,300 vph in the P.M. peak hour when compared to the No-Build alternative as shown in Table 14.

Between McClintock Drive and the SR101L/SR202L TI, Alternative 1 is not anticipated to provide a significant improvement to the eastbound level-of-service during the P.M. peak hour when compared to the No-Build alternative. However, Alternative 2 would be expected to improve the level-of-service from LOS 'F' to LOS 'C', and provide the capacity for an additional 1,900 vph in the P.M. peak hour when compared to the No-Build Alternative.

Table 14 – PM Peak Hour Performance Measures

Description	2030 No-Build	2030 Build Alternative 1	2030 Build Alternative 2
Between 24th Street and 32nd Street			
Eastbound			
Number of General Purpose Lanes	3	4	4
Traffic Volume (vph)	5,900	7,200	7,300
Travel Speed (mph)	51	60	60
Density (veh/ln-mile)	38 (LOS E)	30 (LOS D)	30 (LOS D)
Between McClintock Drive and the SR101L/SR202L TI			
Eastbound			
Number of General Purpose Lanes	4	5	6
Traffic Volume (vph)	5,700	6,000	7,600
Travel Speed (mph)	27	26	60
Density (veh/ln-mile) (LOS)	71 (LOS F)	82 (LOS F)	22 (LOS C)
Westbound			
Number of General Purpose Lanes	4	5	6
Traffic Volume (vph)	6,200	6,800	7,100
Travel Speed (mph)	55	62	62
Density (veh/ln-mile) (LOS)	29 (LOS D)	23 (LOS C)	17 (LOS B)

Note: Traffic volume shown reflects the volume that can be accommodated based on the CORSIM model output.

3.0 DESIGN CONCEPT ALTERNATIVES

3.1 INTRODUCTION

Two design concepts were developed to provide additional general-purpose lanes through the SR 202L corridor from the I-10/SR51 TI to the SR101L/SR202L TI. These alternatives were developed to conform with the adopted regional transportation plans, achieve geometric design requirements, improve traffic operations, minimize environmental impacts, minimize right-of-way acquisition and utility impacts, and minimize construction costs.

Public agencies that have been coordinated with during the alternative development and evaluation process include ADOT; MAG; Valley Metro Rail; SRPMIC; FHWA; and the cities of Phoenix, Tempe, Scottsdale and Mesa.

3.2 EVALUATION CRITERIA

Six screening criteria were developed to evaluate the "No-Build" and each "Build" alternatives. Each evaluation criterion is described below:

- **Conformance with Adopted Regional Transportation Plans:** This criterion evaluated the ability of the alternatives to achieve the goals and objectives of the Regional Transportation Plan.
- **Geometric Design:** The alternatives were evaluated for the use of applicable geometric design criteria.
- **Traffic Operations:** This criterion evaluated the alternatives for potential benefits to the operational performance and levels of service of the freeway system within the study area.
- **Environmental Considerations:** The criterion evaluated the alternatives for its social and economic considerations, amount of disturbance to developed areas and vegetation, potential noise and air quality impacts, potential changes in visual character and quality, potential impacts to cultural and biological resources and hazardous materials issues.
- **Right-of-Way Requirements and Utility Impacts:** The alternatives were evaluated based upon the right-of-way acquisition requirements and potential conflicts with existing public utilities.
- **Construction Cost:** This criterion evaluated the construction cost of the alternatives.

3.3 SR 202L DESIGN CONCEPT ALTERNATIVES CONSIDERED

3.3.1 Introduction

Alternative freeway widening concepts were developed for SR 202L based on the features required to meet the operational goals for the projected traffic volumes and anticipated travel patterns.

Consideration was given to the SR 202L mainline, system interchange and service interchange ramp operations and geometric design requirements; right-of-way acquisition and utility impacts; environmental impacts and mitigation requirements; conformance with regional transportation plans; and project costs.

No changes are proposed to the existing SR202L horizontal and vertical alignments. SR 202L would be widened to provide the additional mainline general-purpose lanes and auxiliary lanes, and realign the existing system and service interchange ramps to coincide with the widened mainline pavement.

Each alternative will retain the existing HOV lanes to encourage carpooling and support the existing and planned Bus Rapid Transit (BRT) and express bus routes that use the HOV lanes.

A brief description of each alternative, along with the results of the alternative evaluation, is included in this section.

3.3.2 No-Build Alternative

The "No-Build" Alternative would not result in any of the improvements identified in the RTPFP. The current congested freeway conditions would be expected to worsen as the traffic demand continues to grow in the future.

This alternative would also retain the existing 4' median shoulder width on the eastbound mainline between 24th Street and Priest Drive, and 10' outside shoulders throughout the corridor. These narrow shoulders could introduce operational and safety concerns in the future.

Based on the evaluation of the operational performance of the existing roadway configuration with the updated 2030 traffic volume projections, along with an evaluation of the current roadway shoulder widths, the No Build alternative has been determined to be inadequate and was eliminated from further consideration.

3.3.3 SR 202L Eastbound

3.3.3.1 Alternative 1

A design concept was developed to construct one additional general-purpose lane on eastbound SR 202L from the I-10/SR51 TI to the SR101L/SR202L TI, as presented in Appendix D and described as follows:

- Add one general-purpose lane from the I-10/SR51 TI to the SR101L/SR202L TI
- Add an auxiliary lane between the 44th Street TI entrance ramp and the 52nd Street exit ramp, and between the Van Buren Street TI entrance ramp and the Priest Drive TI exit ramp

The additional eastbound general-purpose lane would be developed at the I-10/SR51 TI. The Ramp S-E/N-E entrance would be reconfigured to eliminate the existing ramp merging configuration, and allow each directional ramp (I-10 HOV lane, I-10 eastbound, Ramp S-E and Ramp N-E) to enter the eastbound SR 202L mainline with a "lane-add" design to develop one HOV and four general-purpose lanes to the 32nd Street entrance ramp. The existing auxiliary lane would be retained between the 24th Street entrance ramp and the 32nd Street exit ramp.

Five general-purpose lanes and one HOV lane would be provided between the 32nd Street entrance ramp and the SR101L/SR143 TI. The additional general-purpose lane would be developed with the 32nd Street entrance ramp and would be dropped at the combined Ramp E-S/E-N exit at the SR101L/SR143 TI. This two lane exit would be developed as a mandatory exit from the outside freeway lane, with the second lane designed as an optional lane with the freeway through movement.

Four general-purpose lanes and one HOV lane would be provided between the SR101L/SR143 TI and Priest Drive. Auxiliary lanes would be provided between the 44th Street entrance ramp and the 52nd Street exit ramp, and the Van Buren Street entrance ramp and the Priest Drive exit ramp.

Five general-purpose lanes and one HOV lane would be provided between Priest Drive and the SR101L/SR202L TI. The additional general-purpose lane would be developed with the eastbound Sky Harbor Boulevard connector. This two lane entrance ramp would provide a connection to the freeway mainline by adding two freeway lanes, with the right lane merging into the mainline prior to the Priest Drive entrance ramp gore. The Priest Drive and Center Parkway entrance ramps would enter the mainline with a parallel entrance configuration. The eastbound connector road between Priest Drive and Center Parkway would be realigned to retain the Priest Drive entrance ramp connection to the widened SR 202L mainline.

The Scottsdale Road exit would be developed as a tapered exit from the outside general-purpose lane. The Scottsdale Road entrance would be designed as a parallel

entrance, transitioning into an auxiliary lane that would continue to the McClintock Drive exit ramp.

Five general-purpose lanes and one HOV lane would be provided on the eastbound mainline approaching the SR101L/SR202L TI. The combined Ramp E-S/E-N exit (2 lanes) would be developed as a two lane mandatory exit from the outside freeway lanes. Three general-purpose lanes and one HOV lane would continue to the east on the SR 202L mainline. Ramp E-N would be developed as a single lane "left exit" from Ramp E-S with a tapered exit design. Ramp E-S (2 lanes) would continue to the south to connect with SR 101L.

This alternative would widen the existing roadway to provide a continuous 10' median shoulder, 12' HOV lane, 12' general-purpose lanes, and a 12' outside shoulder throughout the study area. The system and service interchange ramps would be realigned to match the widened mainline roadway.

The existing onsite drainage systems would be reconfigured by constructing new catch basins at the new shoulder location, and extending the existing lateral pipes to the new catch basins. The existing offsite drainage systems would not be impacted by the proposed roadway improvements. The proposed onsite drainage system concept is shown in Appendix D and described in Section 4.8 of this report.

The additional piers required for the widening of the existing Salt River and Indian Bend Wash bridges would not impact the hydraulic conditions of each waterway. Coordination will be required with the City of Tempe and the FCDMC to obtain approval of the necessary floodplain permits, design details for the interface of the bridge foundations with the Indian Bend Wash drop structure and the Salt River CSA bank protection, and construction requirements at Tempe Town Lake. Coordination will also be required with ADOT and the Corps of Engineers to obtain a Section 404 Individual Permit for construction access roads and new bridge piers that would be located within the river channel.

The existing bridge structures would be widened to accommodate the proposed roadway widening. The existing retaining walls would typically be removed and reconstructed adjacent to the new roadway shoulder. Noise walls would be provided at the locations and heights determined by the noise technical analysis. The preliminary noise wall locations are shown in Appendix D.

The existing FMS system would be impacted by the proposed roadway widening. The proposed FMS system modifications are described in Section 4.10.3 of this report.

The existing signing, pavement markings and lighting would be modified in accordance with the proposed lane requirements and roadway widths associated with Alternative 1. The revised signing and pavement markings associated with this alternative is provided in Appendix D.

No new right-of-way acquisition is anticipated with this alternative. Temporary Construction Easements (TCE's) may be required to support the construction of various project features throughout the corridor.

The existing utilities that may be impacted by this alternative are discussed in Section 4.13 of this report. No significant utility impacts are anticipated with this alternative.

This alternative would require some minor reconfiguration of the existing parking lot beneath the Mill Avenue overpass, removal and relocation of portions of existing multiuse pathways, relocation of some existing light poles, and removal and reconnection of retaining wall decorative features along Tempe Town Lake between Mill Avenue and College Avenue.

The anticipated construction cost for this alternative is $140,600,000. The order of magnitude construction itemized cost estimate is presented in Section 5 of this report.

3.3.3.2 Alternative 2

An additional design concept was developed to construct additional general-purpose lanes on eastbound SR 202L from the I-10/SR51 TI to the SR101L/SR202L TI, as presented in Appendix D and described as follows:

- Add one general-purpose lane from the I-10/SR 51 TI to Scottsdale Road
- Add two general-purpose lanes from Scottsdale Road to the SR101L/SR202L TI
- Add an auxiliary lane between the 44th Street TI entrance ramp and the 52nd Street exit ramp, between the Van Buren Street TI entrance ramp and the Priest Drive TI exit ramp, and between the Center Parkway TI entrance ramp and the Scottsdale Road TI exit ramp.

The Alternative 2 roadway configuration is similar to Alternative 1 between the I-10/SR51 TI and Priest Drive. Five general-purpose lanes and one HOV lane would be provided on the eastbound SR 202L mainline between Priest Drive and the Scottsdale Road entrance ramp. The additional general-purpose lane would be developed with the eastbound Sky Harbor Boulevard connector. This two lane entrance ramp would add two freeway lanes, with the right lane merging into the mainline prior to the Priest Drive entrance ramp gore. The Priest Drive entrance ramp would enter the mainline with a parallel entrance configuration. The eastbound connector road between Priest Drive and Center Parkway would be realigned to retain the Priest Drive entrance ramp connection to the widened SR 202L mainline.

The Center Parkway entrance ramp would be designed as a parallel entrance transitioning into an auxiliary lane that would continue to the Scottsdale Road exit ramp. The Scottsdale Road entrance ramp would be designed with a parallel entrance configuration that would develop an additional general-purpose lane. The McClintock Drive exit ramp would be designed as a tapered exit from the outside freeway lane.

Six general-purpose lanes and one HOV lane would be provided on the eastbound mainline approaching the SR101L/SR202L TI. The combined Ramp E-S/E-N exit (3 lanes) would be developed as a three lane mandatory exit from the outside freeway lanes. Three general-purpose lanes and one HOV lane would continue to the east on the SR 202L mainline. Ramp E-N would bifurcate from Ramp E-S to develop the single lane directional ramp to northbound SR 101L. Ramp E-S (2 lanes) would continue to provide access to southbound SR 101L.

This alternative would widen the existing roadway to provide a continuous 10' median shoulder, 12' HOV lane, 12' general-purpose lanes, and a 12' outside shoulder. The system and service interchange ramps would be realigned to match the widened mainline roadway.

The existing onsite drainage systems would be reconfigured by constructing new catch basins at the new shoulder location, and extending the existing lateral pipes to the new catch basins. The existing offsite drainage systems would not be impacted by the proposed roadway improvements. The proposed onsite drainage system concept is shown in Appendix D and described in Section 4.8 of this report.

The additional piers required for the widening of the existing Salt River and Indian Bend Wash bridges would not impact the hydraulic conditions of each waterway. Coordination will be required with the City of Tempe and the FCDMC to obtain approval of the necessary floodplain permits, design details for the interface of the bridge foundations with the Indian Bend Wash drop structure and Salt River CSA bank protection, and construction requirements at Tempe Town Lake. Coordination will also be required with ADOT and the Corps of Engineers to obtain a Section 404 Individual Permit for construction access roads and bridge piers that would be located within the river channel.

The existing bridge structures would be widened to accommodate the proposed roadway widening. The existing retaining walls would typically be removed and reconstructed adjacent to the new roadway shoulder. Noise walls would be provided at the locations and heights determined by the noise technical analysis. The preliminary noise wall locations are shown in Appendix D.

The existing FMS system would be impacted by the proposed roadway widening. The proposed FMS system modifications are depicted in Appendix D and described in Section 4.10.3 of this report.

The existing signing, pavement markings and lighting would be modified in accordance with the proposed lane requirements and roadway widths associated with Alternative 2. The revised signing and pavement markings associated with this alternative are provided in Appendix D.

No new right-of-way acquisition is anticipated with this alternative. Temporary Construction Easements (TCE's) may be required to support the construction of various project features throughout the corridor.

The existing utilities that may be impacted by this alternative as described in Section 4.13 of this report. No significant utility impacts are anticipated with this alternative.

This alternative would require some minor reconfiguration of the existing parking lot beneath the Mill Avenue overpass, and removal and relocation of portions of existing multiuse pathways, relocation of some existing light poles and removal and reconnection of retaining wall decorative features, along Tempe Town Lake between Mill Avenue and College Avenue.

The anticipated construction cost for this alternative is $148,800,000. The order of magnitude construction itemized cost estimate is presented in Section 5.0 of this report.

3.3.4 SR 202L Westbound

3.3.4.1 Alternative 1

A design concept was developed to construct one additional general-purpose lane on westbound SR 202L from the SR101L/SR202L TI to Scottsdale Road as presented in Appendix D.

This alternative would widen the existing roadway to provide a continuous 10' median shoulder, 12' HOV lane, 12' general-purpose lanes, and a 12' outside shoulder. The system and service interchange ramps would be realigned to match the widened mainline roadway.

The existing westbound SR 202L mainline configuration (two general-purpose lanes and one HOV lane) would be retained through the system interchange.

Alternative 1 would improve the westbound SR 202L mainline departing the SR101L/SR202L TI by reconfiguring the Ramp N-W/S-W entrance to allow each ramp to enter the mainline with a "lane-add" design, thereby eliminating the current" bottleneck" at this location. Ramp S-W (1 lane) and Ramp N-W (2 lanes) would merge to develop a three lane entrance into westbound SR 202L. This three lane ramp entrance, combined with the westbound SR 202L mainline (2 lanes) would provide five general-purpose lanes and one HOV lane departing the system interchange.

The additional general-purpose lane would be dropped at the Scottsdale Road TI with an AASHTO lane drop, with four general-purpose lanes and one HOV lane continuing to the west to match the existing freeway configuration.

An auxiliary lane would also be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp. The Scottsdale Road exit ramp would be designed

as a two-lane exit with the auxiliary lane dropped at the exit ramp, and the outside general-purpose lane designed as an option lane with the freeway through movement.

The existing onsite drainage systems would be reconfigured by constructing new catch basins at the new shoulder location, and extending the existing lateral pipes to the new catch basins. The existing offsite drainage systems would not be impacted by the proposed roadway improvements. The proposed onsite drainage system concept is shown in Appendix D and described in Section 4.8 of this report.

The additional piers required for the widening of the existing Salt River and Indian Bend Wash bridges would not impact the hydraulic conditions of each waterway. Coordination will be required with the City of Tempe and the FCDMC to obtain approval of the necessary floodplain permits, design details for the interface of the bridge foundations with the Indian Bend Wash drop structure and Salt River CSA bank protection, and construction requirements at Tempe Town Lake. Coordination will also be required with ADOT and the Corps of Engineers to obtain a Section 404 Individual Permit for construction access roads and bridge piers that would be located within the river channel.

The existing bridge structures would be widened to accommodate the proposed roadway widening. The existing retaining walls would typically be removed and reconstructed adjacent to the new roadway shoulder. Noise walls would be provided at the locations and heights determined by the noise technical analysis. The preliminary noise wall locations are shown in Appendix D.

The existing FMS system would be impacted by the proposed roadway widening. The proposed FMS system modifications are depicted in Appendix D and described in Section 4.10.3 of this report.

The existing signing, pavement markings and lighting would be modified in accordance with the proposed lane requirements and roadway widths associated with Alternative 1. The revised signing and pavement markings associated with this alternative are provided in Appendix D.

No new right-of-way acquisition is anticipated with this alternative. Temporary Construction Easements (TCE's) may be required to support the construction of various project features throughout the corridor.

The existing utilities that may be impacted by this alternative are described in Section 4.13 of this report. No significant utility impacts are anticipated with this alternative.

The anticipated construction cost for this alternative is $34,400,000. The order of magnitude construction itemized cost estimate is presented in Section 5.0 of this report.

3.3.4.2 Alternative 2

An additional design concept was developed to construct two additional general-purpose lanes on westbound SR 202L from the SR101L/SR202L TI to Scottsdale Road, as presented in Appendix D and described as follows:.

- Add two general-purpose lanes from the SR101L/SR202L TI to McClintock Drive
- Add one general-purpose lane from McClintock Drive to Scottsdale Road
- Add an auxiliary lane from the McClintock Drive entrance ramp to the Scottsdale Road exit ramp.

This alternative would provide three general-purpose lanes and one HOV lane on the SR 202L mainline through the SR101L/SR202L TI, eliminating the current bottleneck at this location.

Alternative 2 would improve the westbound SR 202L mainline departing the SR101L/SR202L TI by reconfiguring the Ramp N-W/S-W entrance to allow each ramp to enter the mainline with a "lane-add" design. Ramp S-W (1 lane) and Ramp N-W (2 lanes) would merge to develop a three lane entrance into westbound SR 202L. This three lane ramp entrance, combined with the westbound SR 202L mainline (3 lanes) would provide six general-purpose lanes and one HOV lane departing the system interchange.

The outside general-purpose lane would be terminated east of the McClintock Drive entrance ramp with a 65:1 merge taper, providing five general-purpose lanes and one HOV lane approaching Scottsdale Road. The outside general-purpose lane would be terminated again at the Scottsdale Road TI with an AASHTO lane drop configuration, providing four general-purpose lanes and one HOV lane continuing to the west to match the existing freeway configuration.

An auxiliary lane would also be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp. The Scottsdale Road exit ramp would be designed as a two-lane exit with the auxiliary lane dropped at the exit ramp, and the outside general-purpose lane designed as an option lane with the freeway through movement.

This alternative would widen the existing roadway to provide a continuous 4' median shoulder, 12' HOV lane, 12' general-purpose lanes, and a 12' outside shoulder between SR 101L and Scottsdale Road. West of Scottsdale Road, the HOV and general-purpose lanes would be shifted with striping to restore the 10' median shoulder to match the existing roadway configuration that continues to the west.

The mainline roadway width would be reduced to provide a 2' median shoulder, 11' HOV lane, 11' general-purpose lanes, and a 10' outside shoulder at the Ramp N-W/S-W gore due to physical restrictions caused by the existing bridge structures, bridge piers, and roadway geometrics. This restriction is limited to approximately 600' within the system interchange area. West of the Ramp N-W/S-W gore, the 4' median shoulder and

12' lane widths would be restored with striping tapers that would be developed through the mainline horizontal curve.

The existing onsite drainage systems would be reconfigured by constructing new catch basins at the new shoulder location, and extending the existing lateral pipes to the new catch basins. The existing offsite drainage systems would not be impacted by the proposed roadway improvements. The proposed onsite drainage system concept is shown in Appendix D and described in Section 4.8 of this report.

The additional piers required for the widening of the existing Salt River and Indian Bend Wash bridges would not impact the hydraulic conditions of each waterway. Coordination will be required with the City of Tempe and the FCDMC to obtain approval of the necessary floodplain permits, design details for the interface of the bridge foundations with the Indian Bend Wash drop structure and Salt River CSA bank protection, and construction requirements at Tempe Town Lake. Coordination will also be required with ADOT and the Corps of Engineers to obtain a Section 404 Individual Permit for construction access roads and bridge piers that would be located within the river channel.

The existing bridge structures would be widened to accommodate the proposed roadway widening. The existing retaining walls would typically be removed and reconstructed adjacent to the new roadway shoulder. Noise walls would be provided at the locations and heights determined by the noise technical analysis. The preliminary noise wall locations are shown in Appendix D.

The existing FMS system would be impacted by the proposed roadway widening. The proposed FMS system modifications are depicted in Appendix D and described in Section 4.10.3 of this report.

The existing signing, pavement markings and lighting would be modified in accordance with the proposed lane requirements and roadway widths associated with Alternative 2. The revised signing and pavement markings associated with this alternative are provided in Appendix D.

No new right-of-way acquisition is anticipated with this alternative. Temporary Construction Easements (TCE's) may be required to support the construction of various project features throughout the corridor.

The existing utilities that may be impacted by this alternative are described in Section 4.13 of this report. No significant utility impacts are anticipated with this alternative.

The anticipated construction cost for this alternative is $35,200,000. The order of magnitude construction itemized cost estimate is presented in Section 5.0 of this report.

3.3.5 Evaluation of SR 202L Mainline Alternatives

The "No-Build" and "Build" alternatives were evaluated in terms of their technical merits and environmental impacts when compared with the evaluation criteria.

3.3.5.1 No-Build Alternative

The "No-Build" Alternative would not result in any of the improvements identified in the RTPFP. The current congested freeway conditions would be expected to worsen as the traffic demand continues to grow in the future.

This alternative would also retain the existing 4' median shoulder width on the eastbound mainline between 24th Street and Priest Drive, and 10' outside shoulders throughout the corridor. These narrow shoulders could introduce operational and safety concerns in the future.

Based on the evaluation of the operational performance of the existing roadway configuration with the updated 2030 traffic volume projections, along with an evaluation of the current roadway shoulder widths, the No Build alternative has been determined to be inadequate and was eliminated from further consideration.

3.3.5.2 Alternative 1 (Eastbound)

The advantages of the Alternative 1 (Eastbound) roadway alternative are as follows:

- This alternative would provide improved capacity and LOS 'D' or better operating conditions for the segment of SR 202L between the I-10/SR51 TI and Priest Drive. Between 24th Street and 32nd Street, an additional 1,600 vph would be accommodated in the A.M. peak hour at LOS 'D', and an additional 1,300 vpd would be accommodated in the P.M. peak hour at LOS 'D'. By comparison, the No-Build alternative would operate at LOS 'E' in the A.M. and P.M. peak hours.
- This alternative would improve the east departure of the SR51/SR101L TI by eliminating the existing "bottleneck" at the Ramp S-E/N-E entrance.
- Auxiliary lanes would be provided between the 24th Street entrance ramp and the 32nd Street exit ramp, between 44th Street entrance ramp and 52nd Street exit ramp, and the between Van Buren Street entrance ramp and Priest Drive exit ramp which will provide more efficient configuration for traffic entering and exiting the freeway.
- This alternative would provide improved capacity for the segment of SR 202L between the McClintock Drive and the SR101L/SR202L TI. An additional 300 vph could be accommodated in the P.M. peak hour and reduce the length of queuing by approximately 2 miles when compared to the No-Build alternative.
- An additional lane would be provided on the SR 202L mainline approaching the SR101L/SR202L TI, allowing the combined Ramp E-S/E-N exit to be developed as a two lane mandatory exit.
- No new right-of-way would be required for this alternative.

- The bridge widening required over the Salt River and Indian Bend Wash would not impact the hydraulics of the waterways.
- No significant utility relocations would be required with this alternative.
- No significant impacts would occur to existing features within Rio Salado Park and Tempe Town Lake.
- Lowest estimated project cost ($140,600,000).

The disadvantages of the Alternative 1 (Eastbound) roadway configuration are as follows:

- The segment of the SR 202L mainline between the Center Parkway and SR101L/SR202L TI would continue to operate at LOS 'F' during the P.M. peak hour.
- The eastbound SR202L approach to the SR101L/SR202L TI would not provide the general-purpose lanes required in advance of a system interchange in accordance with the current ADOT design practice.
- This alternative would not provide an auxiliary lane between the Center Parkway entrance ramp and the Scottsdale Road TI.

3.3.5.3 Alternative 2 (Eastbound)

The advantages of the Alternative 2 (Eastbound) roadway configuration are as follows:

- This alternative would provide the same capacity improvements as Alternative 1 for the segment of the SR202L mainline between the I-10/SR51 TI and Priest Drive.
- Auxiliary lanes would be provided between the 24th Street entrance ramp and the 32nd Street exit ramp, between 44th Street entrance ramp and 52nd Street exit ramp, between Van Buren Street entrance ramp and Priest Drive exit ramp, and between the Center Parkway entrance ramp and the Scottsdale Road exit ramp.
- This alternative would provide greatly improved capacity and level-of-service for the segment of SR 202L between the Priest Drive and the SR101L/SR202L TI. The level-of-service would be improved to LOS 'C', as compared to LOS 'F" with Alternative 1. An additional 1,900 vph would be accommodated during the P.M. peak hour as compared to Alternative 1. Less than 1 mile of traffic queuing would be anticipated approaching the SR101L/SR202L TI.
- An additional two lanes would be provided approaching the SR101L/SR202L TI. The combined Ramp E-S/E-N exit would be developed with a three lane mandatory exit from the eastbound mainline in accordance with the current ADOT design practice.
- No new right-of-way would be required for this alternative.
- The bridge widening required over the Salt River and Indian Bend Wash would not impact the hydraulics of the waterways.
- No significant utility relocations would be required with this alternative.
- No significant impacts would occur to existing features within Rio Salado Park and Tempe Town Lake.

The disadvantages of the Alternative 2 (Eastbound) roadway configuration are as follows:

- Highest estimated project cost ($148,800,000).

3.3.5.4 Alternative 1 (Westbound)

The advantages of the Alternative 1 (Westbound) roadway configuration are as follows:

- This alternative would provide improved capacity for the segment of SR 202L between the SR101L/SR202L TI and Scottsdale Road. An additional 1,500 vph would be accommodated in the A.M. peak hour when compared with the No-Build Alternative.
- This alternative would improve the west departure of the SR101L/SR202L TI by eliminating the existing "bottleneck" at the Ramp S-E/N-E entrance.
- An auxiliary lane would be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp.
- No new right-of-way would be required for this alternative.
- The bridge widening required over the Salt River and Indian Bend Wash would not impact the hydraulic condition at these waterways.
- No significant utility relocations would be required with this alternative.
- Lowest estimated project cost ($34,400,000)

The disadvantages of the Alternative 1 (Westbound) roadway configuration are as follows:

- The segment of the SR 202L mainline between the SR101L/SR202L TI and Center Parkway would continue to operate at LOS 'F' in the P.M. peak hour. However, this operating condition is caused by existing capacity restrictions that occur west of Scottsdale Road.
- The westbound SR202L mainline would remain in the current configuration of two general-purpose lanes and one HOV lane at the SR101L/SR202L TI. The existing "bottleneck" would continue to provide a capacity restriction for the segment of the SR 202L mainline to the east of the system interchange.

3.3.5.5 Alternative 2 (Westbound)

The advantages of the Alternative 2 (Westbound) roadway configuration are as follows:

- This alternative would provide improved capacity for the segment of SR 202L between the SR101L/SR202L TI and Scottsdale Road. An additional 900 vph would be accommodated in the A.M. peak hour when compared with the Alternative 1.
- This alternative would improve the west departure of the SR101L/SR202L TI by eliminating the existing "bottleneck" at the Ramp S-E/N-E entrance.

- The westbound SR 202L mainline approaching the SR101L/SR202L TI would be improved to provide three general-purpose lanes and one HOV lane through the system TI, thereby eliminating the current "bottleneck" at this location.
- An auxiliary lane would be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp.
- The two general-purpose lanes added to the SR 202L mainline departing the SR101L/SR202L TI would be terminated with a frequency of one "lane-drop" per mile. This configuration is consistent with current ADOT design practice.
- This segment of the SR 202L would be constructed with the ultimate number of lanes with this project. This alternative would allow for future capacity improvements to the SR 202L mainline west of this study area as additional funding becomes available.
- No new right-of-way would be required for this alternative.
- The bridge widening required over the Salt River and Indian Bend Wash would not impact the hydraulic condition of the waterways.
- No significant utility relocations would be required with this alternative.

The disadvantages of the Alternative 2 (Westbound) roadway configuration are as follows:

- The segment of the SR 202L mainline between the SR101L/SR202L TI and Center Parkway would continue to operate at LOS 'F' in the P.M. peak hour due to existing capacity restrictions on the SR 202L mainline that occur west of Scottsdale Road.
- Highest estimated project cost ($35,200,000).

3.3.5.6 Recommended SR 202L Mainline Alternatives

Alternative 2 is recommended as the Preferred Alternative for the SR 202L mainline in the eastbound and westbound directions of travel. In making this recommendation, the design team completed a multidiscipline screening process that included agency input.

Roadway geometric design, traffic operational characteristics, right-of-way impacts, environmental impacts, and estimated construction cost were the criteria used for the selection process.

This final selection of the Preferred Alternative will occur after completion of additional coordination meetings with the local agencies, and after the completion of a public information meeting to solicit comments from the local community. Comments received from the agencies and stakeholders will be evaluated prior to the final selection of the Preferred Alternative.

3.4 SERVICE INTERCHANGES

3.4.1 Introduction

The widening of the SR 202L mainline would require modifications of the existing single-point urban interchanges at 24th Street, 32nd Street, 44th Street and Scottsdale Road.

The interchange modification options were developed in order to retain the existing lane configurations for the crossroads and ramp terminals, optimize the geometric design elements of the ramp and intersection roadways, minimize environmental impacts, maintain the improvements within the existing right-of-way, minimize construction costs, and minimize impacts to local traffic during construction.

Each interchange was also evaluated to determine if minor modifications to the ramp intersections could be made to support the WB-67 design vehicle.

3.4.2 24th Street Single Point Urban Interchange

The widening of the 24th Street TI Overpass (Structure No. 2021, MP 0.70) and bridge abutments would impact the existing 24th Street TI intersection by requiring Ramp B to be realigned as shown on Figure 15 on page 118. One option was considered for the reconfiguration of this interchange.

The 24th Street horizontal and vertical alignments and approach lanes would be retained in their current configuration.

The proposed realignment of Ramp B would improve the horizontal geometry for the opposing left-turn movements by increasing the separation distance between vehicle paths. All right-turning roadways would be modified to accommodate the WB-67 design vehicle.

The existing traffic signals would be relocated in accordance with the modified interchange design.

3.4.3 32nd Street Single Point Urban Interchange

The widening of the 32nd Street TI Overpass (Structure No. 2022, MP 1.75) and bridge abutments would impact the existing 32nd Street TI by requiring a portion of Ramp B to be realigned as shown on Figure 16 on page 119. Ramp D would remain in its current configuration. One option was considered for the reconfiguration of this interchange.

The 32nd Street horizontal and vertical alignments and approach lanes would be retained in their current configuration.

The new Ramp B alignment would require a new compound curve for the left-turn roadway that would conform to the requirements of ADOT's Roadway Design

Guidelines (RDG). All right-turning movements would be modified to accommodate the WB-67 design vehicle.

The existing traffic signals would be relocated in accordance with the modified interchange design.

3.4.4 44th Street Single Point Urban Interchange

The widening of the 44th Street TI Overpass (Structure No. 2140, MP 2.90) and addition of new bridge piers would impact the existing 44th Street TI. Two options for the reconfiguration of this interchange are shown on Figures 17 and 18 on pages 120 and 121.

The 44th Street horizontal and vertical alignments and approach lanes would be retained in their current configuration.

The first option would widen the existing bridge by conventionally widening the existing abutment and constructing new piers in-line with the existing piers. This bridge configuration would require three of the existing ramps (Ramps B, C and D) to be realigned to avoid the new piers as depicted on Figure 17. A large retaining wall would be required along the north side of the SR143 TI Ramp E-S.

The new Ramp B alignment would require a new compound curve for the left-turn roadway that would conform to the requirements of the RDG. All right turning movements would be modified to accommodate the WB-67 design vehicle.

The existing traffic signals would be relocated in accordance with the modified interchange design. The order of magnitude construction cost for this option is $3,900,000.

The second option would widen the existing structure by using "straddle bents". The new piers would span over the existing left-turning roadways and be placed within a raised median island at the crossroad intersection. The existing abutments would be widened in-line with existing structure. The existing ramp left-turn movements would remain in the current configuration. This interchange option is depicted on Figure 18.

The piers would be protected from traffic with raised curb that would be placed around the median island. The piers would be set back a minimum of 2' behind the face of curb.

The order of magnitude construction cost estimate for the second alternative is $2,800,000.

Option 2 is recommended as the preferred option at the 44th Street TI because it would reduce the required reconstruction of the existing ramps and the ramp intersection,

could result in a shorter construction period, and would result in a savings of approximately $1,100,000.

3.4.5 Scottsdale Road Single Point Urban Interchange

The widening of the Scottsdale Road TI Overpass (Structure No. 2263, MP 7.71) would impact the existing Scottsdale Road TI by potentially requiring realignment of the intersection ramps at the crossroad intersection. Two options for the reconfiguration of this interchange are shown on Figures 19 and 20 on pages 122 and 123.

The Scottsdale Road horizontal and vertical alignments and approach lanes would be retained in their current configuration.

The first option would widen the existing single span bridge by widening the existing abutment and superstructure. The widened abutment would be placed in-line with the existing abutment with chamfered corners. All of the existing ramps would be realigned to avoid the abutments.

The new ramp alignments would require the ratio of the compound curvature for the left-turning roadways to exceed the criteria recommended in the RDG. All right-turning movements will be modified to accommodate the WB-67 design vehicle.

The existing traffic signals would be relocated in accordance with the modified interchange design. The order of magnitude construction cost for this alternative is $4,300,000.

The second option would widen the existing bridge abutments by using straddle bents that would span over the existing left-turn ramp roadways, thereby avoiding any realignment of the ramps near the crossroad intersection. All right-turning movements would be modified to accommodate the WB-67 design vehicle. This interchange option is shown on Figure 20.

The piers would be protected from traffic with raised curb that would be placed around the median island. The piers would be set back a minimum of 2' behind the face of curb.

The order of magnitude construction cost estimate for Option 2 is $4,300,000.

Option 2 is recommended as the preferred option at the Scottsdale Road TI because it would not require the reconstruction of the existing ramps. Since the ramps would not be reconstructed at the crossroad, this option would be anticipated to reduce traffic impacts during construction.

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9	ARIZ.				

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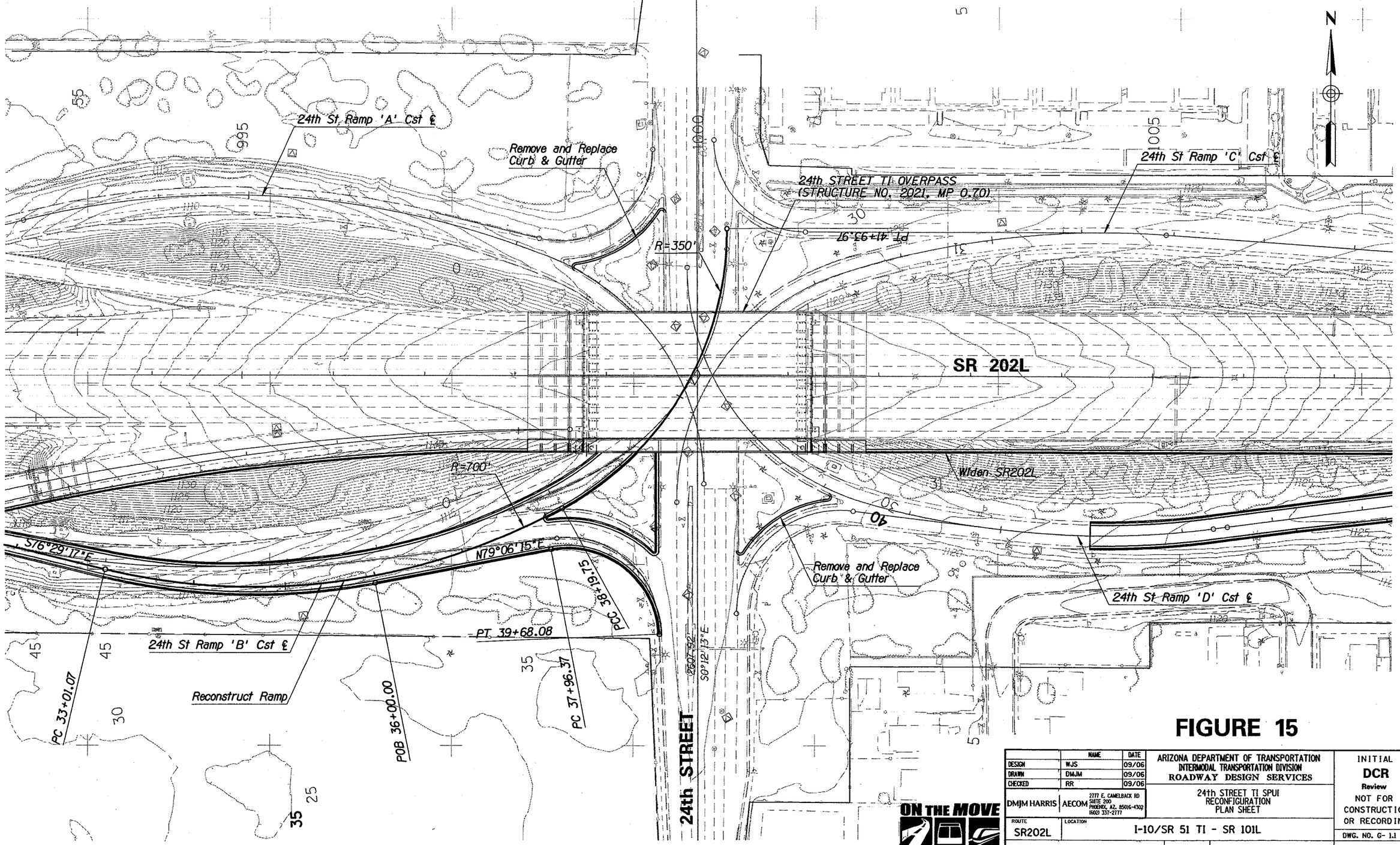

FIGURE 15

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

DMJM HARRIS | AECOM 2777 E. CAMELBACK RD SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

24th STREET TI SPUI RECONFIGURATION PLAN SHEET

ROUTE: SR202L | LOCATION: I-10/SR 51 TI - SR 101L

TRACS NO. H6871 01L

INITIAL DCR Review NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. G- 1.1

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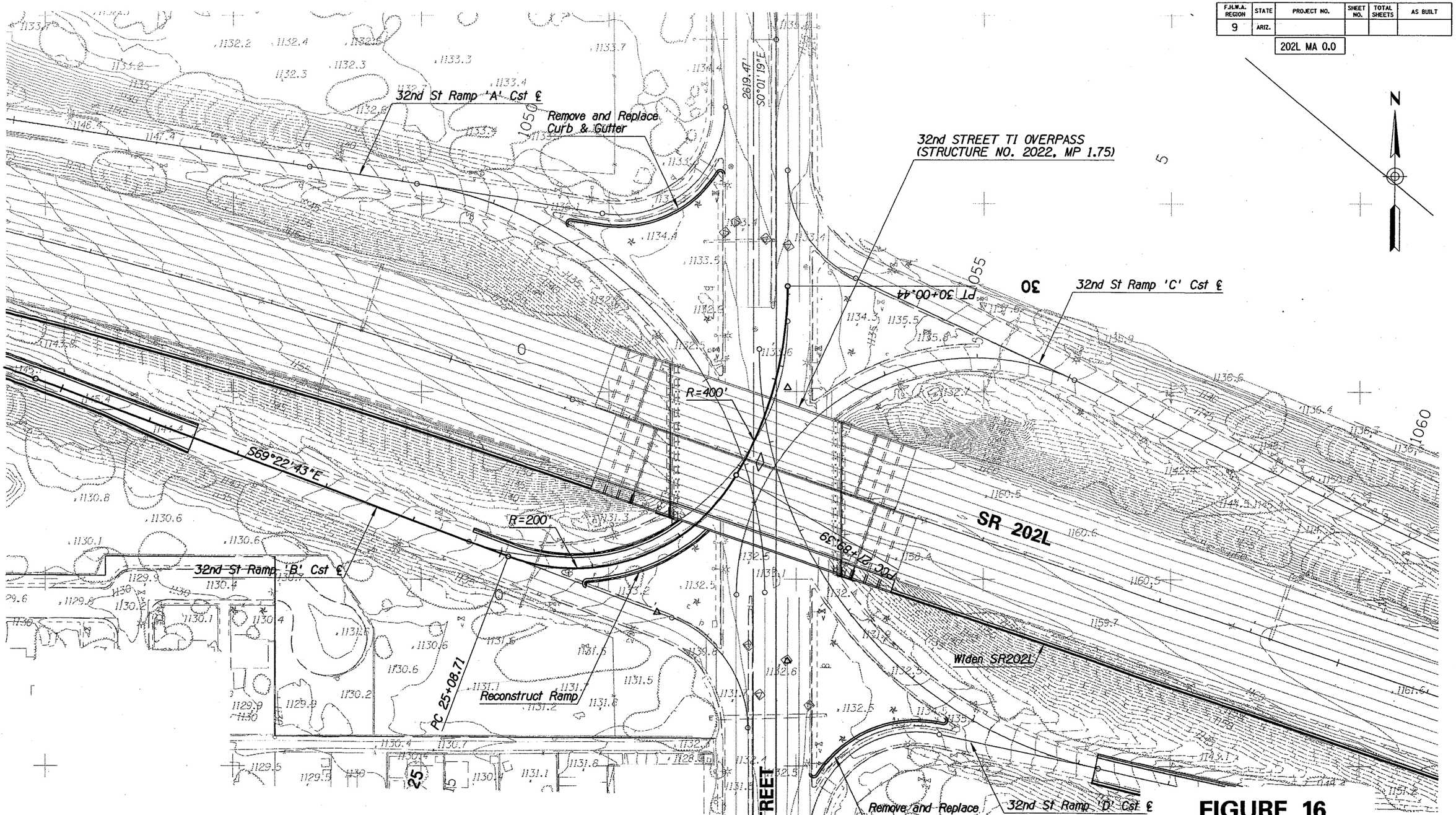

FIGURE 16

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

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ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

32nd STREET TI SPUI
RECONFIGURATION
PLAN SHEET

ROUTE: SR202L | LOCATION: I-10/SR 51 TI - SR 101L

TRACS NO. H6871 01L

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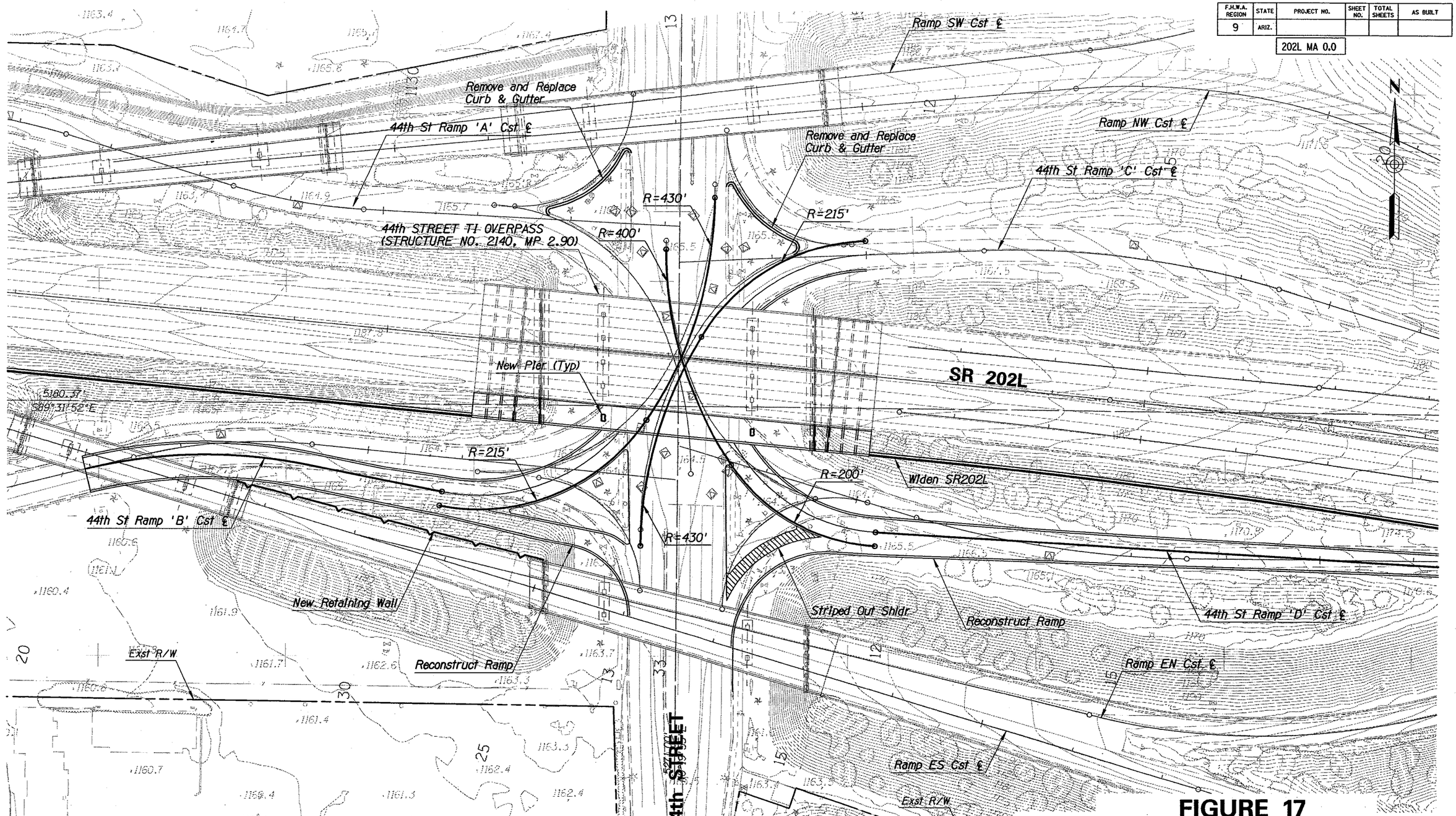

FIGURE 17

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

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ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

44th STREET TI SPUI
RECONFIGURATION OPTION 1
PLAN SHEET

ROUTE: SR202L
LOCATION: I-10/SR 51 TI - SR 101L

TRACS NO. H6871 01L

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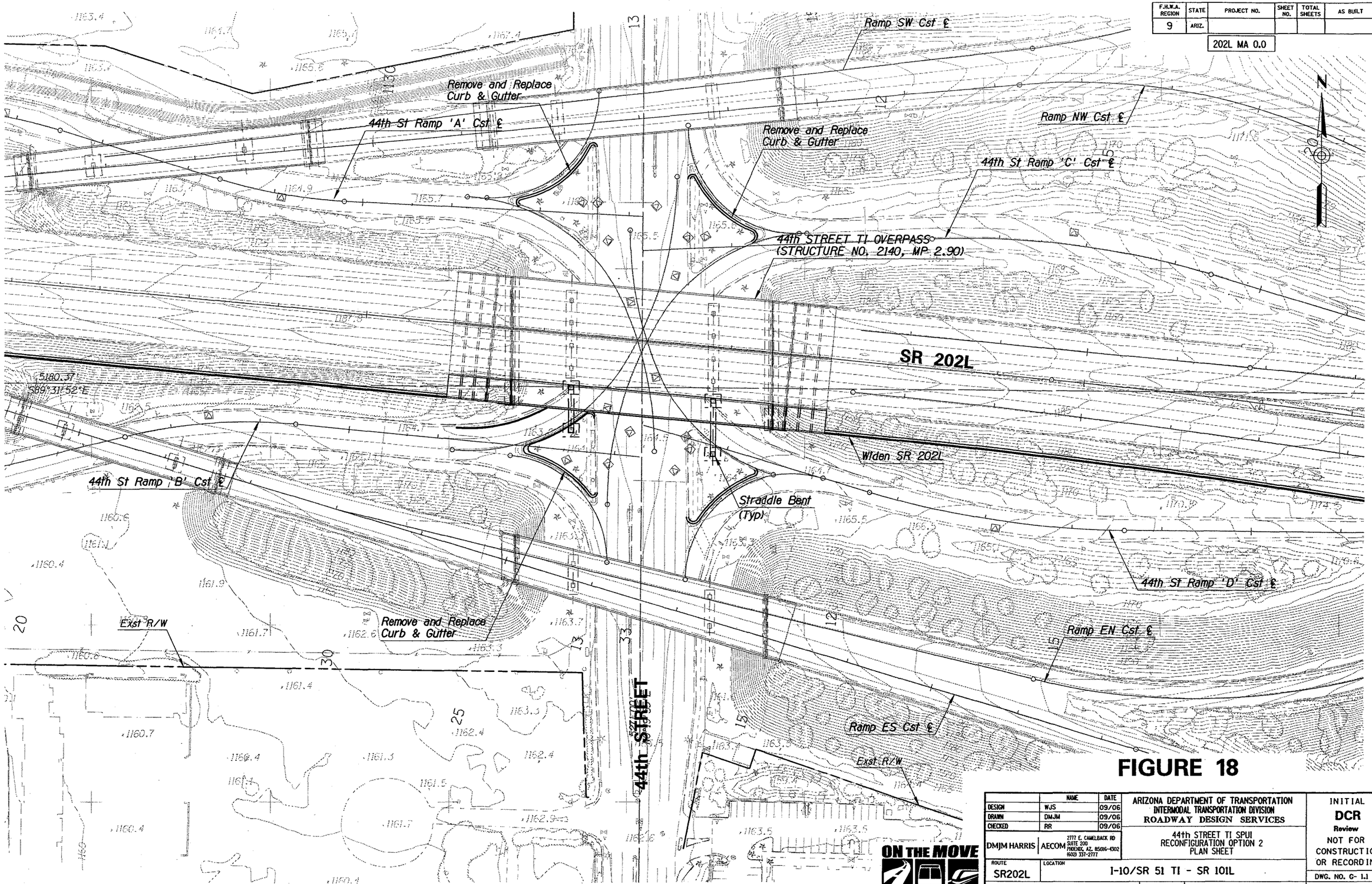

FIGURE 18

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

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ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

44th STREET TI SPUI
RECONFIGURATION OPTION 2
PLAN SHEET

ROUTE: SR202L | LOCATION: I-10/SR 51 TI - SR 101L

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Proposed Ramps	Left Turn Curve Ratio
A	3:1
B	3.33:1
C	4:1
D	3.33:1

NOTE: RDG Recommends 2:1 Maximum Left Turn Curve Ratio

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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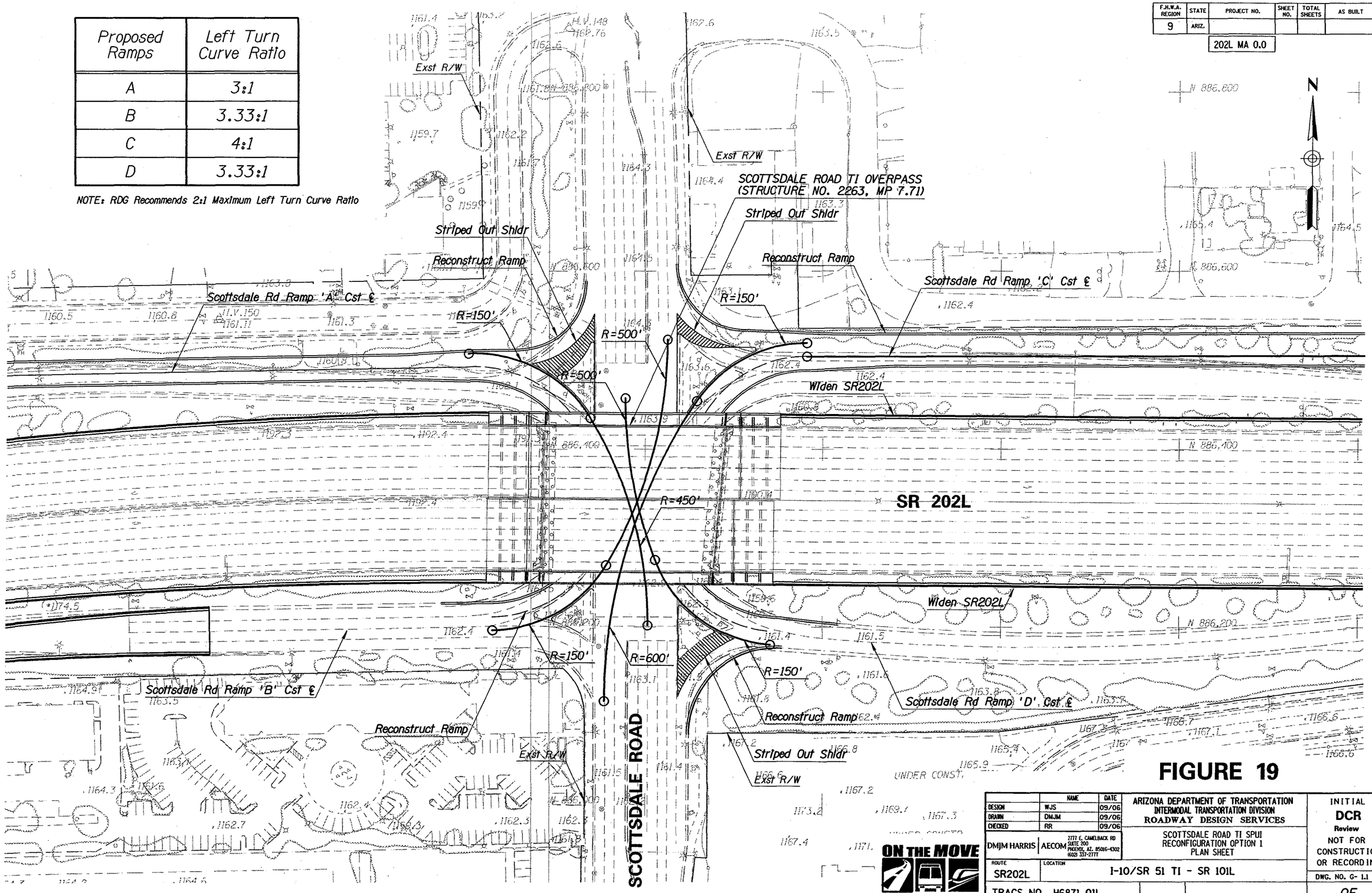

FIGURE 19

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SCOTTSDALE ROAD TI SPUI
RECONFIGURATION OPTION 1
PLAN SHEET

DMJM HARRIS | AECOM 2777 E. CAMELBACK RD SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ROUTE: SR202L | LOCATION: I-10/SR 51 TI - SR 101L

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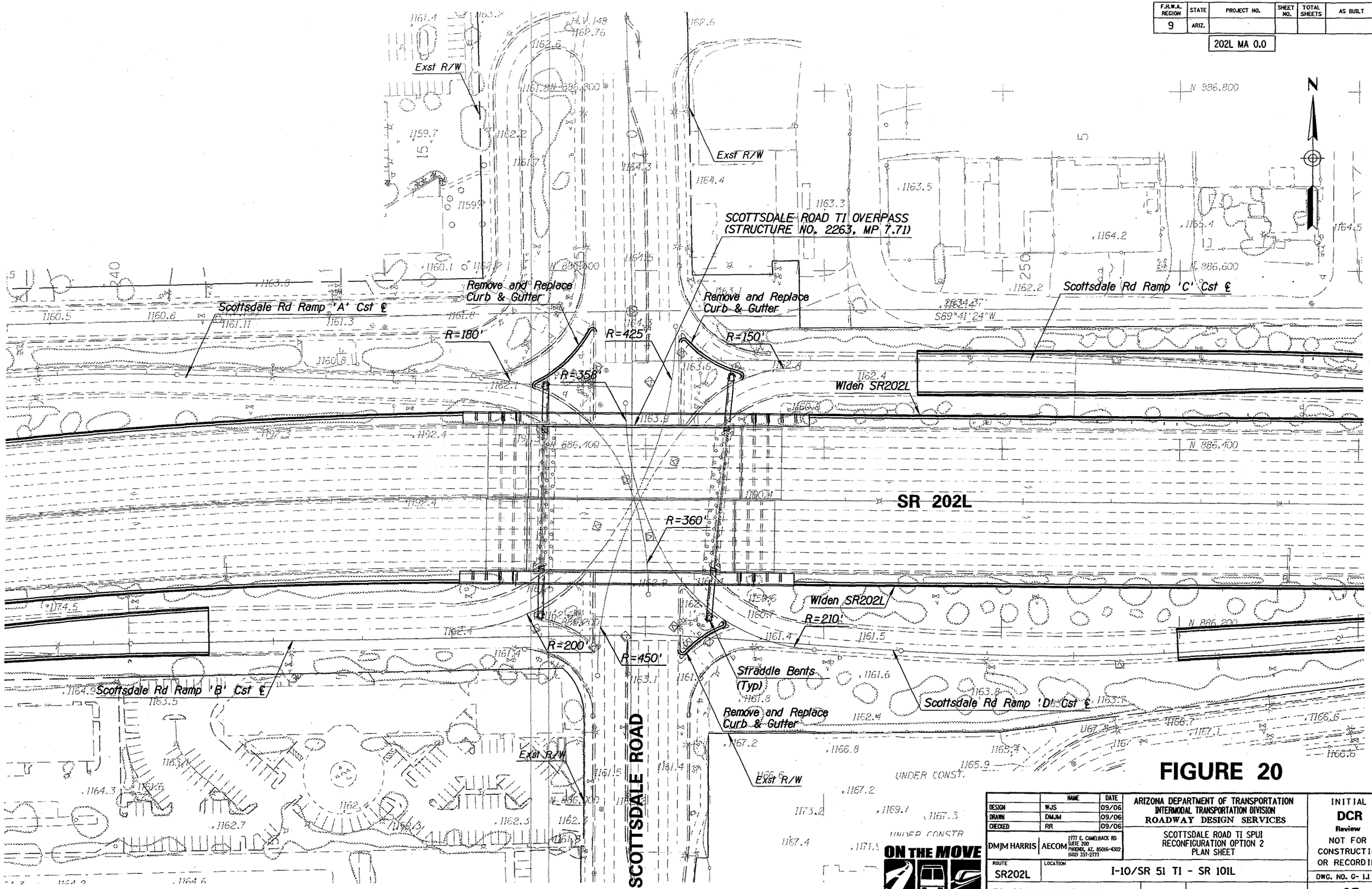

FIGURE 20

	NAME	DATE
DESIGN	WJS	09/06
DRAWN	DMJM	09/06
CHECKED	RR	09/06

DMJM HARRIS | AECOM 2777 E. CAMELBACK RD SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ON THE MOVE PARTNERS IN PROGRESS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SCOTTSDALE ROAD TI SPUI
RECONFIGURATION OPTION 2
PLAN SHEET

ROUTE: SR202L | LOCATION: I-10/SR 51 TI - SR 101L

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4.0 MAJOR DESIGN FEATURES OF THE RECOMMENDED ALTERNATIVE

4.1 DESIGN CONTROLS

SR 202L is classified as an Urban Principal Freeway/Expressway. A summary of the design controls for the mainline lanes is provided in Table 15. A summary of the design controls for the mainline and service interchange ramps are provided in Tables 15, 16 and 17.

Table 15 – Design Controls for SR 202L Mainline

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year:	2030
Design Speed (Existing):	60 mph (MP 0.00 to MP 2.50) 65 mph (MP 2.50 to MP9.80)
Superelevation:	Match existing (0.06 ft/ft maximum)
Cross Slope:	2.0%
Lane Width:	12 ft.
Shoulder Width:	
- Median:	10 ft. (EB), 4 ft. (WB)
- Outside:	12 ft.
Maximum Horizontal Curve:	3 degree, 27 minutes
Maximum Gradient:	Not applicable, match existing
Taper Rate:	65:1
Slope Standards:	
- Cut slopes:	Varies, 3:1 maximum
- Fill slopes:	Varies, 3:1 maximum
Minimum Vertical Clearance: - Highway structure: - Pedestrian overpass:	 16.5 ft. 17.5 ft.

Table 16 – Design Controls for System Interchange Ramps

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year:	2030
Design Speed:	55 mph
Superelevation:	Match Existing (0.06 ft/ft maximum)
Cross Slope:	2.0%
Pavement Width:	
- Single lane ramps:	28 ft.
- Two lane ramps:	36 ft., plus 2 ft. offset to barrier
- Three lane ramps:	48 ft., plus 2 ft. offset to barrier
Lane Width:	12 ft.
Shoulder Width:	
- Inside shoulder:	4 ft., plus 2 ft. offset to barrier
- Outside shoulder:	8 ft., plus 2 ft. offset to barrier
Maximum Horizontal Curvature:	5 degree, 15 minute

Table 16 – Design Controls for System Interchange Ramps (continued)

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Maximum Gradient:	+4%, -5%
Slope Standards:	
- Cut slopes:	Varies, 3:1 maximum
- Fill slopes:	Varies, 3:1 maximum
Minimum Vertical Clearance: - Highway structure: - Pedestrian overpass:	 16.5 ft. 17.5 ft.

Table 17 – Design Controls for Service Interchange Ramps

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year:	2030
Design Speed:	
- Nose of gore (exit ramps):	55 mph (MP 0.00 to MP 2.50) 60 mph (MP 2.50 to MP 9.80)
- Nose of gore (entrance ramps):	50 mph (MP 0.00 to MP 2.50) 55 mph (MP 2.50 to MP 9.80)
- Nose of gore	60 mph
- Ramp body:	50 mph
- Ramp terminal:	35 mph
Superelevation:	Match Existing (0.06 ft/ft maximum)
Pavement Width:	
- Single lane exit ramp:	22 ft., plus 2 ft. offset to barrier
- Two lane exit ramp:	34 ft., plus 2 ft. offset to barrier
- Entrance ramp:	28 ft., plus 2 ft. offset to barrier
Lane Width:	12 ft.
Maximum Horizontal Curve:	6 degree, 45 minute
Maximum Gradient:	+4%, -5%, +/- 3% at crossroad
Slope Standards:	
- Cut slopes:	Varies, 3:1 maximum
- Fill slopes:	Varies, 3:1 maximum
Minimum Vertical Clearance: - Highway structure: - Pedestrian overpass:	 16.5 ft. 17.5 ft.

4.2 ROADWAY CONFIGURATION

4.2.1 Eastbound

The additional eastbound general-purpose lane would be developed at the I-10/SR51 TI. The Ramp S-E/N-E entrance would be reconfigured to eliminate the existing ramp merging configuration, and allow each directional ramp (I-10 HOV lane, I-10 eastbound, Ramp S-E and Ramp N-E) to enter the eastbound SR 202L mainline into its own lane to develop one HOV and four general-purpose lanes at 24th Street. This freeway section

would continue to the 32nd Street entrance ramp. The existing auxiliary lane would be retained between the 24th Street entrance ramp and the 32nd Street exit ramp.

Five general-purpose lanes and one HOV lane would be provided between the 32nd Street entrance ramp and the SR101L/SR143 TI. The additional general-purpose lane would be developed with the 32nd Street entrance ramp and would be dropped at the combined Ramp E-S/E-N exit at the SR101L/SR143 TI. This two lane exit would be developed as a mandatory exit from the outside freeway lane, with the second lane designed as an optional lane with the freeway through movement.

Four general-purpose lanes and one HOV lane would be provided between the SR101L/SR143 TI and Priest Drive. New auxiliary lanes would be added between the 44th Street entrance ramp and the 52nd Street exit ramp, and between the Van Buren Street entrance ramp and the Priest Drive exit ramp.

Five general-purpose lanes and one HOV lane would be provided on the eastbound SR 202L mainline between Priest Drive and the Scottsdale Road entrance ramp. The additional general-purpose lane would be developed with the eastbound Sky Harbor Boulevard connector. This two lane entrance ramp would add two freeway lanes, with the right lane merging into the mainline prior to the Priest Drive entrance ramp gore. The Priest Drive entrance ramp would enter the mainline with a parallel entrance configuration. The eastbound connector road between Priest Drive and Center Parkway would be realigned to retain the Priest Drive entrance ramp connection to the widened mainline.

The Center Parkway entrance ramp would be designed as a parallel entrance that transitions into an auxiliary lane that would continue to the Scottsdale Road exit ramp. The Scottsdale Road entrance ramp would be designed with a parallel entrance configuration that would transition into an additional general-purpose lane that continues to the SR101L/SR202L TI. The McClintock Drive exit ramp would be designed as a tapered exit from the outside freeway lane.

Six general-purpose lanes and one HOV lane would be provided on the eastbound mainline approaching the SR101L/SR202L TI. The combined Ramp E-S/E-N exit (3 lanes) would be developed as a three lane mandatory exit from the outside freeway lanes. Three general-purpose lanes and one HOV lane would continue to the east on the SR 202L mainline. Ramp E-N would bifurcate from Ramp E-S to develop the single lane directional ramp connection to northbound SR 101L. Ramp E-S (2 lanes) would continue to provide access to southbound SR 101L.

The service and system interchange ramps would be realigned to match the widened SR 202L mainline. Minor realignment of the ramps would be required at the 24th Street, 32nd Street and 44th Street crossroad intersections.

4.2.2 Westbound

The westbound SR 202L mainline would provide three general-purpose lanes and one HOV lane through the SR101L/SR202L TI, eliminating the current bottleneck at this location.

The second additional westbound general-purpose lane would be developed at the SR101L/SR202L TI. The Ramp N-W/S-W entrance would be reconfigured to eliminate the existing ramp merging configuration, which would allow the SR 202L mainline and directional ramps to enter the westbound SR 202L mainline in their own lane.

The added lanes would provide six general-purpose lanes and one HOV lane departing the SR101L/SR202L TI. The outside general-purpose lane would be terminated east of the McClintock Drive entrance ramp with a 65:1 merge taper, providing five general-purpose lanes and one HOV lane approaching Scottsdale Road. The outside general-purpose lane would be terminated again at the Scottsdale Road TI with an AASHTO lane drop configuration, providing four general-purpose lanes and one HOV lane continuing to the west to match the existing freeway configuration.

An auxiliary lane would also be provided between the McClintock Drive entrance ramp and the Scottsdale Road exit ramp. The Scottsdale Road exit ramp would be designed as a two-lane exit with the auxiliary lane dropped at the exit ramp, and the outside general-purpose lane designed as an option lane with the freeway through movement.

This alternative would widen the existing roadway to provide a continuous 4' median shoulder, 12' HOV lane, 12' general-purpose lanes, and a 12' outside shoulder between SR 101L and Scottsdale Road. West of Scottsdale Road, the HOV and general-purpose lanes would be shifted with striping to restore the 10' median shoulder to match the existing roadway configuration that continues to the west.

The westbound mainline roadway width would be reduced to provide a 2' median shoulder, 11' HOV lane, 11' general-purpose lanes, and a 10' outside shoulder at the Ramp N-W/S-W gore due to physical constraints caused by existing directional ramp bridge structures, bridge piers, and roadway geometrics. This restriction is limited to approximately 600 feet within the system interchange area. West of the Ramp N-W/S-W gore, the 4' median shoulder and 12' lane widths would be restored with striping tapers within the mainline horizontal curve.

The service and system interchange ramps would be realigned to match the widened SR 202L mainline.

4.3 HORIZONTAL AND VERTICAL ALIGNMENTS

Plan and profile sheets are provided in Appendix D for the Recommended Alternative. The plans include the horizontal and vertical alignments for the existing SR 202L mainline, system and service interchange ramps, and arterial streets. No modifications

are proposed to the existing horizontal and vertical alignments for the SR 202L mainline and crossroads.

4.4 ACCESS CONTROL

Access control already exists and will be maintained in accordance with ADOT and FHWA Access Control Policy requirements.

4.5 RIGHT-OF-WAY

Acquisition of new right-of-way within the project limits is not anticipated for this project. Temporary Construction Easements (TCE's) will be required for the construction of the Recommended Alternative. The TCE locations and limits will be finalized during final design.

A strip of right-of-way along Mill Avenue was abandoned to the City of Tempe by ADOT Board Resolution. For the current project (H6871 01C), ADOT will reacquire the Mill Avenue right-of-way by resolution. Upon completion of this project, ADOT may again abandon the Mill Avenue surface rights back to City of Tempe, but retain aerial rights for the Mill Avenue Viaduct.

4.6 STRUCTURES

This section describes the issues and recommended structural elements for the widening of SR 202L within the study limits. These elements include recommendations for the widening of existing bridge structures, retaining walls, noise walls, and reinforced box culverts.

4.6.1 Introduction

Twenty-three mainline overpasses would be widened to accommodate the additional new general-purpose lanes and auxiliary lanes associated with the recommended alternative. The overpasses that would be widened include the following structures:

- 24th Street TI Overpass (eastbound widening), Structure No. 2021, MP 0.70
- 32nd Street TI Overpass (eastbound widening), Structure No. 2022, MP 1.75
- Grand Canal Bridge (eastbound widening), Structure No. 2023, MP 2.01
- 40th Street TI Overpass (eastbound widening), Structure No. 2024, MP 2.45
- 44th Street TI Overpass (eastbound widening), Structure No. 2140, MP 2.90
- East Papago TI Underpass EB (eastbound widening), Structure No. 2160, MP 3.25
- 48th Street Overpass EB (eastbound widening), Structure No. 2198, MP 3.45
- Ramp B Overpass EB (eastbound widening), Structure No. 2208, MP 3.89
- 52nd Street Overpass EB (eastbound widening), Structure No. 2210, MP 4.04
- Van Buren Street Overpass EB (eastbound widening), Structure No. 2212, MP 4.20
- Washington Street Overpass EB (eastbound widening), Structure No. 2214, MP 4.52

- SPRR/Grand Canal Bridge EB (eastbound widening), Structure No. 2217, MP 4.83
- Sky Harbor Boulevard WB Overpass EB (eastbound widening), Structure No. 2219, MP 5.02
- Mill Avenue Viaduct EB (eastbound widening), Structure No. 2258, MP 6.34
- West Pedestrian Overpass EB (eastbound widening), Structure No. 2259, MP 7.13
- East Pedestrian Overpass EB (eastbound), Structure No. 2260, MP 7.41
- College Avenue Overpass EB (eastbound widening), Structure No. 2261, MP 7.55
- Scottsdale Road TI Overpass EB (eastbound widening), Structure No. 2263, MP 7.71
- Scottsdale Road TI Overpass WB (westbound widening), Structure No. 2263, MP 7.71
- Indian Bend Wash Bridge EB (eastbound widening), Structure No. 2265, MP 8.06
- Indian Bend Wash Bridge WB (westbound widening), Structure No. 2265, MP 8.06
- Salt River Bridge EB (eastbound widening), Structure No. 2268, MP 8.17
- Salt River Bridge WB (westbound widening), Structure No. 2269, MP 8.17

The existing Priest Drive and Center Parkway underpasses would not be modified as a result of the proposed improvements. Retaining walls would be necessary near the south abutments at these bridges to accommodate the additional freeway lanes.

The existing bridge superstructures are either cast-in-place post-tensioned concrete box girder or precast prestressed AASHTO concrete girder bridges. A summary of the existing bridge structures is provided on Table 4 on page 26.

This study included an evaluation of potential alternatives to widen the existing bridges. This evaluation included the examination of numerous issues that included the ability to maintain minimum vertical clearances during construction, minimum vertical clearances for the widened bridge structures, maintenance of traffic during construction, constructibility of the widened portion of the bridge, potential impacts to the existing ramps and ramp intersections, aesthetics, and construction costs. While this document is not intended to select the final bridge configuration at each location, the anticipated and feasible structure type(s) are discussed for each location.

The existing bridge configuration and possible widening scenarios are provided in Table 4 on page 26 and Table 18 on page 168.

4.6.2 Possible Bridge Widening Alternatives

Several bridge superstructure widening alternatives were considered for the existing structures that would be impacted by the proposed project.

Cast-in-Place Post-Tensioned Concrete Box Girder

Post-tensioned structures are utilized extensively on the Regional Freeway System and are the predominant structure type within this segment of SR 202L.

The advantages of utilizing post-tensioned box girders for the widening of the existing structures include:

- This superstructure configuration would be consistent with the majority of the existing bridges that would be widened with the project and could match the aesthetics of the existing bridges.
- A similar superstructure configuration as the existing bridge would allow the designer to predict structural behavior with greater accuracy.
- This superstructure configuration would accommodate various roadway geometric situations that occur at interchange ramp taper and gore areas.
- The widened portion of the bridge can be built on falsework above traffic. If the required falsework vertical clearance is not available, the superstructure could be built at the elevation needed to provide the minimum vertical clearance and then hydraulically lowered into the final position.

The disadvantages of utilizing post-tensioned box girders for widening of existing structures would be:

- Overpass structures located over roads would require the construction of the bridge with falsework in order to maintain traffic. The use of falsework would introduce the following issues for evaluation:
  - Reduced vertical clearances: A minimum of 16' vertical clearance over active traffic lanes is desirable during construction. The falsework clearance has been reduced below this limit on some previous projects by using overhead crash beams. However, the use of crash beams for sites with reduced vertical clearance is now discouraged due to safety and operational concerns. The minimum falsework clearance could be mitigated by constructing the widened portion of the bridge on falsework at an elevation higher than the existing bridge, and then lowering the superstructure onto the abutments and piers by hydraulically jacking. However, this would make the construction of the bridge more complex and resulting in increased costs for the bridge.
  - Traffic impacts during construction: The use of falsework would require temporary closures of a crossroad left-turn and through lanes during portions of the bridge construction activities due to the presence of falsework support towers and restrictions on the maximum span length for the falsework girders. Typical falsework spans are generally limited to a maximum opening of 60 feet. Increasing the falsework spans would require larger falsework girders that may not be readily available to the contractor, which could increase the project cost and construction schedule duration.
  - Construction costs: Post-tensioned structures are typically more cost effective if constructed on soffit fill. The majority of the bridges on this project support freeway crossings over arterial streets, irrigation canals, railroads, transit lines and waterways which will preclude a soffit fill construction method. Therefore, the widening of the existing bridges with this superstructure configuration would require the use of falsework, which would increase the cost of the bridge construction.

- Construction duration: A cast-in-place post-tensioned superstructure would generally exceed the duration required for precast girder bridge construction by approximately 30 days. The construction duration for bridge widening post-tensioned after deck placement should also be increased by approximately 60 days to allow for creep and shrinkage in the widened structures to occur prior to placing a concrete deck closure pour. The overall increase in construction duration by utilizing a post tensioned box girder option for the bridge widening instead of precast girders would be anticipated to be approximately 90 days.
- Multi-span bridges make the construction of falsework and lowering the superstructure into place by hydraulic jacking problematic: The hydraulic jacking of the superstructure must be sequenced carefully to ensure that unintentional redistribution of forces do not lead to overstressing the superstructure.
- Matching the new and existing bridge decks: Many variables must be considered that affect the long and short term camber of a bridge including temperature, creep and shrinkage. Larger closure pours, the placement of additional deck thickness with subsequent deck milling, placement of an asphalt overlay, developing more detailed camber calculations, providing additional creep and shrinkage testing of the concrete mix, and providing higher construction quality control can help ensure the existing and new bridge deck elevations will match at the interface.

Precast Prestressed Concrete Girders

A significant number of precast, prestressed concrete girder bridges have been constructed throughout the Regional Freeway System. The UPRR/Grand Canal Overpass, Indian Bend Wash Overpass, and Salt River Bridge utilized a variety of AASHTO concrete girder superstructure designs. AASHTO girders or precast prestressed box beams are an excellent alternative structure type for the widening of both CIP post-tensioned concrete box girder and precast girder bridges.

The advantages of utilizing precast sections include:

- Reduced construction duration: The majority of the creep and shrinkage that would occur in the precast girders would be completed prior to erection of the girder. Therefore, the widened portion of the bridge deck can be placed with one pour, and would not require a closure pour.
- Falsework: The use of precast girders would eliminate the need for falsework, thereby reducing the impacts to traffic during the construction of the bridge. Crossroad closures would be required during the erection of the girders, placement of stay-in-place deck forms, and concrete placement of the deck.

The disadvantages of utilizing precast sections would include:

- Depth of superstructure: A precast girder bridge would generally required a deeper superstructure section, which could impact the vertical clearance over the crossroad.
- Roadway geometry: A precast girder superstructure is not as conducive as post-tensioned boxes to accommodate unique roadway geometry situations that occur at

traffic interchange ramp connections. Therefore, and additional deck "wasted deck" area may be necessary at certain locations.

Spliced Girders

Spliced girder superstructure bridges include precast segments that are post-tensioned together to form one composite superstructure unit. Relatively few spliced girders have been previously constructed for bridges on the Regional Freeway System.

The advantages of spliced girder superstructure construction would include:

- Span length: The use of spliced precast girders could extend the allowable span lengths over conventional precast girders.
- Falsework requirements: Spliced precast girders could reduce the number of falsework supports, if a composite cast-in-place and precast superstructure bridge configuration is desired for a certain location.
- Constructibility: A spliced precast girder superstructure could be built on falsework at an elevation higher than the final position (to maintain vertical desired clearances beneath the falsework to the crossroad). The superstructure could then be lowered into final position by hydraulic jacking.
- Aesthetics: Spliced girder superstructure alternatives can be detailed to match the aesthetics of the existing structure.
- Traffic impacts during construction: The use of spliced girders may reduce the duration of the bridge construction, thereby reducing the time that crossroad traffic would be impacted.

The disadvantages of spliced girder superstructures would include:

- Design complexity: The design of the bridge widenings would be complicated and would require careful consideration of time-dependent effects of creep and shrinkage.
- Construction complexity: The construction of the bridge would require multiple prestressing stages.

Composite Steel Girders

Composite steel girders were considered for the bridge widenings associated with this project. However, steel girder bridges are not typically cost competitive in Arizona. In addition, steel girders typically require a long fabrication and delivery schedule, and additional maintenance. Therefore, steel girder superstructure alternatives were eliminated from consideration.

4.6.3 Design and Constructibility Requirements

The bridge design and constructibility issues were discussed extensively with representatives of ADOT's Bridge Design Section, Phoenix Construction District, and

representatives of the local agencies. Therefore, the initial evaluation of alternatives for the widening of the existing bridge structures included the items shown below.

Vertical Clearance

A minimum temporary vertical clearance of 15'-0" is typically requested for the construction of a new or widened bridge that would be built over existing arterial streets, and 16'-0" over existing freeways. Vertical clearances less than 16'-0" require overhead crash barriers to be placed in advance of the falsework openings. The crash barrier is intended to positively stop an overheight vehicle prior to entering the falsework opening. Therefore, the development of alternative bridge widening configurations attempted to achieve 16'-0" minimum vertical clearance.

ADOT Bridge Design Section has requested the bridge widening alternatives provide 16'-6" vertical clearance over the crossroads in the final position. If the overpass currently provides less than 16-6" vertical clearance, then the existing clearance should be retained for the widened portion of the overpass where practicable.

Crossings of the Union Pacific Railroad (UPRR), Salt River Project (SRP), and Valley Metro Rail would be required to meet the vertical clearance requirements of these agencies.

Bridge Barriers

The SR 202L mainline bridges would include 32" height F-shaped half barriers at the edge of the bridge deck. Bridges that pass over another freeway at a system interchange would use 42" height F-shaped half barrier.

Concrete Strength

Current bridge design procedures limit the maximum 28 day compressive strength of the concrete to 6,000 psi. If a higher concrete strength is needed for a precast-prestressed girder alternative, the final designer can consider concrete strengths up to 7,000 psi with approval from ADOT Bridge Design Section.

Design Code

ADOT Bridge Design Section's current policy is that Load and Resistance Factor Design (LRFD) will not be required for the design of widenings of existing bridges that were previously designed using the *AASHTO Standard Specifications.* All of the widened bridges would be designed using the allowable stress design or load factor design method in accordance with the *Standard Specifications for Highway Bridges – 17th Edition (2002)*, AASHTO, as superseded by the *ADOT Bridge Practice Guidelines.* Any new bridge structures shall be designed in accordance with the most current ADOT Bridge Design Guidelines.

Design Loads

All of the existing bridge structures were originally designed utilizing the HS-20 loading conditions, with provisions for an additional 25 pounds per square foot of deck area for a future wearing surface. In addition to the HS-20 loading, all of the existing bridges were also designed for the Alternate Interstate loading, except for the following bridges:

- 24th Street TI Overpass
- 32nd Street TI Overpass
- Grand Canal Bridge

The widened structures should be designed utilizing the same live load and additional dead load conditions shown in the as-built drawings.

Maintenance of Traffic, Railroad and Transit System Operations

Minimizing the impacts to the traveling public, railroads and transit system operations will be an important consideration in the bridge widening type selection.

Condition of Existing Bridges

The ADOT Bridge Maintenance records were reviewed to evaluate the condition of the existing bridges. No major deficiencies were noted for any of the existing structures.

4.6.4 Evaluation of Existing Structure Widening Alternatives

The alternatives and initial recommended structure solution for widening each bridge is discussed in this section of the report. A summary of the bridge widenings is presented in Table 18 following the site-specific discussions. The selection of a bridge widening configuration is a preliminary recommendation that has been used for cost estimating purposes and is based upon the information known at the time of this report. A detailed structure evaluation and selection process will be performed during the design phase of the project.

Unless noted otherwise, it is anticipated that all or part of the existing concrete deck overhangs on the existing bridges would be removed to allow the widened portion of the bridge to be connected to the existing superstructure.

4.6.4.1 24th Street TI Overpass (Structure No. 2021, MP 0.70)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over 24th Street. The existing 24th Street TI is a single point urban interchange (SPUI), with all left-turn movements passing below the overpass. The span length of the existing bridge is 243'.

The bridge supports the east and westbound SR 202L roadways and is constructed within a crest vertical curve on a tangent horizontal alignment. The crossroad passes beneath the bridge without requiring the bridge to be on a skew. The bridge cross slope is crowned (2%) sloping toward the outside shoulder of each roadway.

The existing eastbound roadway width on the bridge is 67.92'. The widening of this structure will add one general-purpose lane in the eastbound direction, revising the roadway width on the bridge to 81.92'.

Foundation Type

The existing bridge substructure consists of full height abutments founded on a dual row of battered steel piles and a single row of straight steel piles.

It is anticipated that the widened bridge substructure would match the existing substructure, except that drilled shafts will be utilized instead of steel piles.

Feasible Structure Type and Traffic Control Requirements

The span length of the existing bridge (243') would preclude the use of conventional prestressed, precast girder alternatives for widening this bridge.

A typical CIP post-tensioned box girder superstructure for the bridge widening would require restricted falsework clearances that would impact the operations of the interchange during the bridge construction activities.

Two additional options were considered including a CIP post-tensioned box girder superstructure that would be constructed above the existing structure's finished grade on falsework (to achieve 16'-0" minimum temporary vertical clearance), and then lowered into final position using hydraulic jacks. The second option , a spliced girder superstructure, would construct the bridge using precast segments that are then post-tensioned together to develop a composite superstructure.

Either of these options could be designed and constructed at this location while maintaining the recommended minimum vertical falsework clearance. The temporary interchange configuration would include a minimum of two through-lanes and one left-turn lane in each direction of travel. One left-turn lane and all right-turn lanes would be retained on the ramps during the bridge construction activities.

Site Specific Issues

There are no other site specific issues that would require consideration at this location.

Vertical Clearance

The existing vertical clearance at this structure is approximately 17'-5". The final vertical clearance for the widened superstructure would be approximately 17'-1".

Recommendation

Both the hydraulically jacked CIP post-tensioned box girder and spliced girder alternatives are potential options at this location. The hydraulically jacked CIP PT box girder alternative was selected for cost estimating purposes. A detailed analysis of both options should be evaluated during the final design.

4.6.4.2 32nd Street TI Overpass (Structure No. 2022, MP 1.75)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over 32nd Street. The existing 32nd Street TI is a SPUI, with all left-turn movements passing below the overpass. The span length of the existing bridge is 189 feet.

The bridge is constructed within a crest vertical curve on a tangent horizontal alignment and a skew 18° 57' 09" with the crossroad. The bridge supports east and westbound traffic and is superelevated at a rate of 2.4% toward the south.

The existing eastbound roadway width on the bridge is 67.92'. The widening of this structure will add one general-purpose lane in the eastbound direction, modifying the roadway width on the bridge to 81.92'.

Foundation Type

The existing bridge substructure consists of full height abutments founded on a single row of battered steel piles and a single row of straight steel piles.

It is anticipated that the widened bridge substructure would match the existing substructure, except that drilled shafts will be utilized instead of steel piles.

To eliminate the need to relocate Ramp D, the outside corners of the widened abutment would be chamfered.

Feasible Structure Type and Traffic Control

The span length of the existing bridge (189'), would preclude the use of conventional precast, prestressed girder alternatives for the widened bridge area.

A typical CIP post-tensioned box girder superstructure for the bridge widening would require restricted falsework clearances and would impact the operations of the interchange during the bridge construction activities.

Two additional options were considered including a CIP post-tensioned box girder superstructure that would be constructed above the existing structure's finished grade on falsework (to achieve 16'-0" minimum temporary vertical clearance), and then lowered into final position using hydraulic jacks. The second, a spliced girder superstructure, would construct the bridge using precast segments that are then post-tensioned together to develop a composite superstructure.

Either of these options could be designed and constructed at this location while maintaining the recommended minimum vertical falsework clearance. The temporary interchange configuration would include a minimum of two through-lanes and one left-turn lane in each direction of travel. One left-turn lane and all right-turn lanes would be retained on the ramps during the bridge construction activities.

Site Specific Issues

There are no other site specific issues that would require consideration at this location.

Vertical Clearance

The existing vertical clearance at this structure is approximately 17'-1". Approximately 16'-10" vertical clearance would be provided for the widened bridge configuration.

Recommendation

Both the hydraulically jacked CIP post-tensioned box girder and spliced girder alternatives are potential options at this location. The hydraulically jacked CIP PT box girder option was selected for cost estimating purposes. A detailed analysis of both options should be considered during final design.

4.6.4.3 Grand Canal Bridge (Structure No. 2023, MP 2.01)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge that passes over the Grand Canal and associated SRP maintenance roads. The span length of the bridge is 140'.

The bridge is constructed on a vertical tangent and within a tangent horizontal alignment with a skew of 8° 15' 00" with the crossroad. The bridge supports east and westbound traffic and is superelevated at a rate of 3.2% to the north.

The existing bridge deck includes a taper following the 32nd Street entrance ramp, with the roadway width on the deck varying from approximately 104.7' at Abutment 1 to 96.8' at Abutment 2. The widening of this structure would add one general-purpose lane in the eastbound direction, modifying the roadway width on the bridge to 116.3' and 110' for Abutments 1 and 2, respectively.

Foundation Type

The existing substructure for the Grand Canal Bridge consists of partial height integral abutments founded on a dual row of straight steel piles.

It is anticipated that the widened bridge structure would match the existing substructure, except that drilled shafts will be utilized instead of steel piles.

Feasible Structure Type and Traffic Control

Two feasible bridge widening alternatives were evaluated including matching the superstructure configuration of the existing bridge, and utilizing precast prestressed concrete AASHTO Type VI girders.

If precast girders are utilized, special attention to bridge details will be required to ensure that the connection between the widened portion of the superstructure and substructures are similar to the integral action of the existing bridge structure. Stay-in-place deck forms shall be utilized with precast for deck placement over the canal.

The existing bridge crosses over two SRP maintenance roads that are located on each side of the canal. Coordination will be required with SRP to develop the design and construction details required to allow SRP to continue to operate and maintain their canal during and after the bridge construction activities.

Site Specific Issues

The bank-to-bank width of the Grand Canal is approximately 55'. Maintenance roads are located on each side of the canal. SRP representatives have indicated a minimum temporary vertical clearance of 13'-6" should be provided over their maintenance roads.

Vertical Clearance

The existing vertical clearance above the SRP maintenance roads is approximately 20'-6". Since the existing bridge would be widened on the high side of the superelevated SR 202L mainline, the edge of the widened bridge will be at an elevation higher than the existing conditions.

Recommendation

While it is possible to span the canal with falsework to widen the existing bridge in a manner that would match the existing cast-in-place post-tensioned concrete box girder superstructure, it is anticipated that the preferred alternative may be a precast girder alternative using AASHTO Type VI girders. This alternative would reduce the duration of the bridge construction and minimize impacts to SRP maintenance operations. This alternative was used in the project cost estimate.

A detailed analysis both options should be considered during final design.

4.6.4.4 40th Street TI Overpass (Structure No. 2024, MP 2.45)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over 40th Street. The existing 40th Street TI is a tight diamond interchange with ramp connections in all directions of travel. The span length of the existing bridge is 153'.

The bridge is constructed within a crest vertical curve on a tangent horizontal alignment and a skew of 18° 57' 09" with the crossroad. The bridge supports east and westbound traffic with a 2% normal cross-slope on the eastbound roadway and a variable cross-slope on the westbound roadway.

The existing eastbound roadway width on the bridge is 67.92'. The widening of this structure would add one general-purpose lane and one auxiliary lane in the eastbound direction of travel, modifying the roadway width on the bridge to 93.92'.

Foundation Type

The existing substructure for the 40th Street TI Overpass consists of partial-height abutments founded on a dual row of drilled shafts. It is anticipated that the widened bridge substructure would match the existing substructure.

Feasible Structure Type and Traffic Control

Two alternatives were evaluated to widen the existing structure. The first alternative would be to match the existing cast-in-place post-tensioned concrete box girder bridge to the widened portion of the bridge. The second alternative would utilize a precast prestressed concrete AASHTO girder superstructure configuration.

The use of AASHTO Super VI girders would require the compressive strength of the concrete used for the girders to be raised to 7,500 psi. ADOT policy limits the 28-day concrete compressive strength to 7,000 psi for precast structural elements. Therefore, it

is anticipated the existing structure would be widened using the cast-in-place post-tensioned concrete box girder configuration that would match the existing bridge.

The bridge would be constructed on falsework to maintain traffic through the interchange. In order to maintain a minimum 16'-0" vertical clearance below the falsework, the temporary interchange configuration would include a minimum of one through-lane and one left-lane in each direction of travel. One left-turn lane and all right-turn lanes would be retained on the ramps.

Site-Specific Issues

This overpass is located near the Motorola 52nd Street Superfund Site. Therefore, the allowable depth of excavation may be limited for the new bridge foundations. Site monitoring for hazardous materials may be required during the geotechnical investigation and foundation excavation activities.

Vertical Clearance

The existing vertical clearance at this structure is approximately 17'-10". The vertical clearance that would be provided for the widened structure would be approximately 17'-4".

Recommendation

The CIP post-tensioned box girder alternative was selected as the preferred option for cost estimating purposes. A detailed analysis of other options should be considered during final design.

4.6.4.5 44th Street TI Overpass (Structure No. 2140, MP 2.90)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over 44th Street. The existing 44th Street TI is a SPUI, with all left-turn movements passing below the overpass. The span lengths for the three spans of the existing bridge are 65', 160' and 65' respectively.

The bridge is constructed within a crest vertical curve on a tangent horizontal alignment and a skew of 5° 09' 27" with the crossroad. The bridge supports the east and westbound SR 202L roadways. The SR 202L mainline is crowned to the outside at 2%.

The existing eastbound roadway width on the bridge is 55.92'. The widening of this structure would add one general-purpose lane and one auxiliary lane in the eastbound direction of travel, modifying the roadway width on the bridge to 81.92'.

Proposed Bridge Configuration

Per section 3.4.4 of this report, two options for bridge layouts were considered at this location. The first option would widen the existing structure by conventionally widening the existing abutment and constructing new piers in-line with the existing piers. This bridge configuration would require three of the existing ramps (Ramps B, C and D) to be realigned to avoid the new piers. A large retaining wall would be required along the north side of the SR143 TI Ramp E-S.

The second option would widen the existing structure by using "straddle bents" that would allow the new piers to span over the existing left-turning roadways. The new piers would be placed within a raised median island at the crossroad intersection. The existing abutments would be widened in-line with existing structure.

Option 2 is recommended as the preferred alternative at the 44th Street TI because it would reduce the required reconstruction of the existing ramps, cost less, and requires a shorter construction period.

Foundation Type

The existing substructure for the 44th Street TI overpass consists of full height abutments and piers founded on spread footings.

It is anticipated that the widened substructure would match the existing substructure elements, except that straddle bents may be utilized to extend the pier line to avoid impacting the existing interchange ramps.

Feasible Structure Types and Traffic Control Measures

The main span length of 160' would preclude the use of conventional precast prestressed concrete girder alternatives. Therefore, it is anticipated the widened portion of the bridge would match the existing bridge configuration. A shallower girder section would be could to maintain the existing vertical clearance.

The superstructure could be built on falsework (with 16'-0" vertical clearance) and lowered into place with hydraulic jacking.

A spliced girder option was also evaluated that would utilize precast structural elements that would be post-tensioned together. The splice girder option would not require jacking.

These bridge widening alternatives would allow the interchange to remain open to traffic with two crossroad lanes and one left-turn lane in each direction of travel. One left-turn lane and all right-turn lanes would be retained on the ramps during the bridge construction activities. The construction of the spread footing would restrict ramp traffic to one lane.

Site Specific Issues

This overpass is located near the Motorola 52nd Street Superfund Site. Therefore, the allowable depth of excavation may be limited for the new bridge foundations. Site monitoring for hazardous materials may be required during the geotechnical investigation and foundation excavation activities.

Vertical Clearance

The existing vertical clearance at this structure is approximately 15'-10". The final vertical clearance for the widened superstructure would be approximately 15'-10", with the utilization of a shallower girder section.

Recommendation

Both the hydraulically jacked CIP post-tensioned box girder and spliced girder alternatives are potential options at this location. The hydraulically jacked CIP PT box girder option that is 6" shallower than the existing structure was selected for cost estimating purposes. A detailed analysis of both options should be considered during final design.

4.6.4.6 East Papago TI Underpass EB (Structure 2160, MP 3.25)

Existing Bridge Configuration

The existing bridge is a four span cast-in-place post-tensioned concrete box girder bridge passing over SR 143. The 44th Street TI entrance ramp also merges with the eastbound SR 202L mainline at this location. The span lengths for the four spans of the existing bridge are 42.8', 95', 130' and 50' respectively.

The bridge is constructed within a crest vertical curve on a horizontal curve which creates a variable skew with SR 143. The bridge supports the eastbound SR 202L roadway with variable superelevation to the south. The eastbound bridge exhibits a grade break where the ramp enters the mainline.

Since the 44th Street TI entrance ramp merges into the SR 202L mainline at this location, the roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 86.5' at Abutment 1 to 68.5' at Abutment 2. The widening of this structure would add one general-purpose lane and one auxiliary lane in the eastbound direction of travel, modifying the roadway width on the bridge to 109.5' and 93.9' at Abutments 1 and 2, respectively.

Foundation Type

The existing substructure for this bridge consists of partial height abutments and piers founded on spread footings. It is anticipated that the widened substructure elements would match the existing bridge substructure. However, the existing pier foundation for the SR143/SR202L TI Ramp E-N would be in partial conflict with the widened abutment for the SR 202L mainline overpass. A special foundation design would be necessary for the pier to avoid a conflict with the Ramp E-N foundation.

Feasible Structure Type and Traffic Control

The existing SR 202L mainline structure is a cast-in-place post-tensioned concrete box girder bridge. Three structural options would be feasible for widening the existing structure. The first option would widen the existing bridge using the same superstructure configuration. The superstructure would need to be built on falsework and lowered into place in order to maintain the 16'-0" vertical clearance required for construction over freeways. A long term lane closure would probably be required on SR 143 (in each direction of travel) for the bridge superstructure construction activities.

The second option would utilize "side-by-side" precast prestressed modified Type BIV box beams (54" deep). The use of 54" deep box beams would be feasible with the use of 7,000 psi concrete. While the use of a precast box would not precisely match the aesthetics of the existing bridge, this superstructure alternative would eliminate the need for lane closures on SR 143 during the bridge construction activities. The first span of this bridge is located below the SR143/SR202L Ramp N-E bridge. Special equipment would be needed to erect girders for the span located below the directional ramp bridge.

The third alternative would utilize a cast-in-place conventional reinforced box girder for the first span, and precast boxes for the remaining spans. This option would eliminate the need for the special equipment needed to erect the girders below the ramp bridge.

A precast prestressed AASHTO concrete girder alternative was initially considered, but was eliminated from consideration because the required depth of the superstructure would not provide sufficient vertical clearance over SR 143.

Site-Specific Issues

This overpass is located near the Motorola 52nd Street Superfund Site. Therefore, the allowable depth of excavation may be limited for the new bridge foundations. Site monitoring may be required during the geotechnical investigation and foundation excavation activities.

Vertical Clearance

The existing vertical clearance for this structure is approximately 17'-4". The final vertical clearance for the widened superstructure would be approximately 16'-7", assuming the 54" modified Type BIV box beams are used for the bridge widening.

Recommendation

The side-by-side precast box girder option (all spans) was selected for cost estimating purposes. A detailed analysis of the other options should be considered with the final design.

4.6.4.7 48th Street Overpass EB (Structure No. 2198, MP 3.45)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over 48th Street. The span lengths for the three spans of the existing bridge are 40', 96', and 40'.

The bridge is located within a crest vertical curve on a tangent horizontal alignment with a skew of 17° 18' 22" with 48th Street. The bridge supports the west and eastbound roadways, with a 2% cross-slope on the eastbound roadway and variable cross-slope on the westbound roadway.

The existing eastbound clear roadway width on the bridge is 67.92'. The widening of this structure would add one general-purpose lane and one auxiliary lane in the eastbound direction of travel, modifying the roadway width on the bridge to 93.92'.

Foundation Type

The existing substructure for the 48th Street Overpass consists of partial height abutments founded on a single row of drilled shafts, and piers founded on spread footings. It is anticipated that the widened bridge substructure would match the existing substructure elements.

Feasible Structure Type and Traffic Control

The existing structure was built as a cast-in-place post-tensioned concrete box girder bridge. Two structural alternatives were considered that would provide a minimum 16'-6" vertical clearance over 48th Street. The first alternative would widen the existing bridge using the same superstructure configuration. The widened portion of the structure would be required to be constructed above the final elevation on falsework (to achieve 16'-0" minimum temporary vertical clearance), and then lowered into final position using hydraulic jacks.

The second alternative would utilize "side-by-side" precast prestressed Type BIV box beams. While the use of a precast box would not precisely match the aesthetics of the existing bridge, this superstructure alternative would greatly reduce lane restrictions and traffic impacts on 48th Street.

A precast prestressed AASHTO concrete girder alternative (Type III girders) was initially considered, but AASHTO girders would be deeper than the box beams thereby reducing the vertical clearance to approximately 16 feet.

Site-Specific Issues

This overpass is located near the Motorola 52nd Street Superfund Site. Therefore, the allowable depth of excavation for the new bridge foundations may be limited. Site monitoring may be required during the geotechnical investigation and foundation excavation activities.

Vertical Clearance

The existing vertical clearance for the structure is approximately 17'-3". The final vertical clearance for the widened superstructure would be approximately 16'-6", assuming Type BIV box beams are used for the bridge widening. The existing vertical clearance will be verified by survey during Stage II design.

Recommendation

The precast box option was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.8 Ramp B Overpass EB (Structure No 2208, MP 3.89)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over 52nd Street Ramp B. The span lengths for the three spans of the existing bridge are 40', 70' and 40'.

The bridge is located within a vertical tangent section within a horizontal curve with a variable skew with Ramp B. The bridge supports eastbound roadway with 5.5% superelevation that slopes toward the south.

The existing eastbound clear roadway width on the bridge is 67.92'. The widening of this structure would add one general-purpose lane in the eastbound direction of travel, modifying the roadway width on the bridge to 81.92'.

Foundation Type

The existing substructure consists of stub abutments founded on a single row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

It is anticipated that the widened bridge substructure elements would match the existing bridge, except that drilled shafts would be utilized instead of steel piles.

Feasible Structure Type and Traffic Control

The existing structure is a cast-in-place post-tensioned concrete box girder bridge, and it is anticipated that the widened portion of the bridge would match the existing superstructure configuration.

The bridge would be constructed on falsework. The widened portion of the structure would be required to be constructed above the final elevation on falsework in order to achieve 16'-0" minimum temporary vertical clearance, and then lowered into final position using hydraulic jacks.

Non-standard precast girders would be another feasible option.

Given the location of this structure, a reduced temporary vertical clearance of 14'-0" may be considered at this location. However, overhead crash beams would be required to be located in advance of the falsework opening.

Site-Specific Issues

This overpass is located near the Motorola 52nd Street Superfund Site. Therefore, the allowable depth of excavation for the new bridge foundations may be limited Site monitoring may be required during the geotechnical investigation and foundation excavation activities.

Vertical Clearance

The existing vertical clearance for this structure is approximately 16'-8". The final vertical clearance for the widened superstructure would be approximately 16'-0".

Since this vertical clearance is less than the desired 16'-6", additional options for the superstructure design should be considered including higher strength concrete, variable depth girder at the center span, and lowering the existing Ramp B roadway.

Recommendation

The CIP PT box girder option that would be jacked into position was selected for cost estimating purposes. A detailed analysis of the options should be considered during final design.

4.6.4.9 52nd Street Overpass EB (Structure No. 2210, MP 4.04)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over 52nd Street. The span lengths for the three spans of the existing bridge are 75', 140' and 75'.

The bridge is located within a vertical tangent section and a horizontal curve that results in a variable skew with 52nd Street. The bridge supports the eastbound roadway with 5.5% superelevation toward the south.

The existing eastbound clear roadway width on the bridge is 67.92'. The widening of this structure would add one general-purpose lane in the eastbound direction of travel, modifying the roadway width on the bridge to 81.92'.

Foundation Type

The existing substructure for the 52nd Street Overpass consists of partial-height abutments founded on a single row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

It is anticipated that the widened bridge substructure would match the existing configuration, except that drilled shafts would be utilized instead of steel piles.

Feasible Structure Type and Traffic Control

The existing structure is a cast-in-place post-tensioned concrete box girder bridge. It is anticipated that the widened portion of the bridge would match the existing superstructure configuration.

The bridge widening would be constructed on falsework. It is anticipated that one lane would remain open in each direction of travel during the bridge construction activities. The falsework opening would allow a temporary 15'-0" vertical clearance for 52nd Street, with the widened portion of the bridge construction at its final elevation. Crash beams would be required.

Site-Specific Issues

There are no other site specific issues that would require consideration at this location.

Vertical Clearance

The existing vertical clearance for this structure is approximately 18'-6". The final vertical clearance for the widened superstructure would be approximately 17'-8".

Recommendation

The CIP PT box girder alternative was selected for cost estimating purposes. Jacking of the bridge would not be required to maintain minimum temporary vertical clearance during the construction activities. However, crash beams would be required in advance for the falsework opening during the bridge construction activities.

4.6.4.10 Van Buren Street Overpass EB (Structure No. 2212, MP 4.20)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over Van Buren. The existing Van Buren Street TI is a tight diamond interchange. The span lengths for the two spans of the existing bridge are both 100'.

The bridge is constructed within a crest vertical curve on a horizontal curve resulting in a variable skew with Van Buren Street. The bridge supports the eastbound roadway with 5.5% superelevation sloping to the west.

The existing eastbound roadway width on the bridge is 67.92'. The widening of this structure would add one general-purpose lane in the eastbound direction of travel, modifying the roadway width on the bridge to 81.92'.

Foundation Type

The existing substructure for the Van Buren Street Overpass consists of partial-height abutments founded on a single row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

It is anticipated that the widened bridge substructure would match the existing configuration, except that drilled shafts would be utilized instead of steel piles.

Feasible Structure Type and Traffic Control

The existing structure is a cast-in-place post-tensioned concrete box girder bridge. The widening of the superstructure was evaluated with a precast prestressed concrete girder (AASHTO Type IV and Type BIV box girders), but issues pertaining to the permanent vertical clearance over Van Buren Street would preclude the use of these options. Therefore, it is anticipated that a shallower post-tensioned concrete box girder configuration would be used to widen the existing bridge.

The bridge would be constructed on falsework. The widened portion of the structure would be required to be constructed above the final elevation on falsework (to achieve 16'-0" minimum temporary vertical clearance), and then lowered into final position using hydraulic jacks.

The falsework opening would be designed to maintain two lanes of traffic in each direction of travel during the bridge construction activities.

Site Specific Issues

The existing abutment walls were built integral with the superstructure. Reportedly there were cracks at existing bridge approach slabs that developed at its connection to the integral abutments on the eastbound bridge. Expansion joints have been added since the original construction to alleviate this issue.

This condition should be evaluated with the design of the bridge widening and relocation of the retaining walls.

Vertical Clearance

The existing vertical clearance for this structure is approximately 16'-6½". The maximum depth of the widened superstructure would be limited to approximately 3'-8" to retain a minimum 16'-0" vertical clearance over Van Buren Street.

Recommendation

The CIP PT box girder option was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.11 Washington Street Overpass EB (Structure No. 2214, MP 4.52)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over Washington Street. The span lengths for the three spans of the existing bridge are 55', 105' and 55'.

The bridge is constructed on a vertical tangent profile on a tangent horizontal alignment and a skew of 8° 07' 03" with Washington Street. The SR 202L mainline is crowned to the outside at 2%.

Since the Van Buren Street TI entrance ramp merges into the SR 202L mainline at this location, the roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 90.5' at Abutment 1 to 86.2' at Abutment 2. The widening of this structure would add one general-purpose lane in the eastbound

direction of travel, modifying the roadway width on the bridge to 94.4' and 93.9' feet at Abutments 1 and 2, respectively.

Foundation Type

The existing substructure for the Washington Street Overpass consists of partial-height abutments founded on a single row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

It is anticipated that the widened bridge substructure would match the existing configuration, except that drilled shafts would be utilized instead of steel piles.

Feasible Structure Type and Traffic Control

Due to constructibility and coordination issues related to the Central Phoenix-East Valley Light Rail Transit (LRT) line, a bridge widening configuration using "side-by-side" precast prestressed concrete Type BIV box beams is considered the most feasible structure solution at this location.

Although the aesthetics of the widened superstructure will not precisely match the existing bridge, this bridge widening scenario would significantly reduce the number of traffic closures for Washington Street, and minimize the number of construction coordination issues with the LRT crossing.

Site-Specific Issues

Valley Metro Rail is currently constructing the Central Phoenix-East Valley LRT line that will provide a regional transit route between Phoenix, Tempe and west Mesa. These facilities are anticipated to be operational in 2008.

Two LRT tracks will be placed in the median of Washington Street. In addition, spur track connections will provide access between the LRT mainline at Washington Street to the LRT Maintenance Facility to the south.

The LRT tracks will include overhead catenary power lines that will be attached to the bottom of the Washington Street overpass. Representatives of Valley Metro Rail have indicated the catenary lines will require a 10' minimum clearance for all construction activities while the lines are energized. Since the LRT facility will be operational for commuters during the majority of each day, the catenary lines could be de-energized for short periods of time at nights and weekends.

The post-tensioned box girder bridge widening option would need to consider the safety considerations of placing falsework in close proximity to the LRT catenary lines.

The bridge widening concept with "side-by-side" precast prestressed concrete Type BIV box beams would minimize the impacts associated with the LRT lines. It is anticipated

that a one to two day weekend closure of the LRT line would be needed to de-energize the catenary lines and erect the box girders.

An existing 69 kV power pole foundation may require temporary shoring for the construction of a new spread footing at Pier 2. It should be feasible to erect the beams beneath the power line utilizing a Hydro-Crane (or similar equipment with low boom heights). Special detailing will likely be required to connect the superstructure and substructure elements to minimize the girder lift heights and erection requirements for the span below the power line.

Vertical Clearance

The existing vertical clearance for this structure is approximately 17'-0". The maximum depth of the widened superstructure would be approximately 4'-3", providing approximately 16'-8" vertical clearance for the widened portion of the bridge above Washington Street.

The vertical clearance that would be provided over the LRT tracks appears to be over 16'- 6". The actual clearance will be verified by survey during final design.

Recommendation

The precast box girder alternative was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.12 SPRR/Grand Canal Bridge EB (Structure No. 2217, MP 4.83)

Existing Bridge Configuration

The existing bridge is a four span precast prestressed modified and standard AASHTO Type VI concrete girder bridge passing over a Union Pacific Railroad (UPRR) (formerly the Southern Pacific Railroad [SPRR]) and the Grand Canal. The span lengths for the four spans are 130', 90', 120' and 70'.

The bridge is located within a crest vertical curve and on a horizontal curve that provides a variable skew over the railroad and canal. The bridge supports the eastbound roadway with 5.7% superelevation sloping to the east.

The existing eastbound clear roadway width on the bridge is 67.92'. The widening of this structure will add one general-purpose lane and one auxiliary in the eastbound direction of travel, modifying the roadway width on the bridge to 93.92'.

Foundation Type

The existing substructure for the SPRR/Grand Canal Overpass consists of partial-height abutments founded on a dual row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

Because of the depth of the existing spread footings (varying from 11' to 21' along the eastbound edge) and the proximity of the bridge to the UPRR rail line and the Grand Canal, drilled shafts are anticipated at the piers. It is anticipated that the drilled shafts will be socketed into the shallow granite bedrock layer.

Feasible Structure Types and Traffic Control

The existing superstructure includes a mixture of AASHTO Type VI and Modified Type VI girders. It is anticipated that the widening of this structure would match the superstructure configuration of the existing bridge to minimize impacts associated with the construction of the widened bridge over the railroad and canal.

Close coordination will be needed with representatives of UPRR and SRP to ensure the design and construction operations are in accordance with their policies and procedures.

Site-Specific Issues

VMR is currently building two spur lines to connect the LRT mainline tracks (at Washington Street) with the LRT Maintenance Facility located south of the UPRR and west of SR 202L. A new LRT bridge will carry the spur lines over the UPRR and Grand Canal, within the ADOT right-of-way.

The LRT spur track bridge is located approximately 11'-5" from the edge of the outside edge of the widened SR 202L bridge. Due to the location of the catenary lines, the placement of the girders for the widening of the freeway bridge will likely be staged from the SR 202L mainline.

The UPRR design guidelines would be used for the design and construction for the segment of the bridge that passes over the UPRR right-of-way. Design considerations for the UPRR crossing are covered in their *Guidelines for Design of Highway Separation Structures Over Railroad (Overhead Grade Separation)*, January 1999. Deck removal performed to facilitate the SR 202L bridge widening shall meet the requirements set forth in *Guidelines for Preparation of a Bridge Demolition and Removal Plan for Structures over Railroad*, March 1998. The UPRR requires a 23'-6" minimum permanent vertical clearance for the rail line, which supersedes their guidelines. A Railroad Agreement would also be required for the project elements that would encroach into the railroad right-of-way.

Horizontal and Vertical Clearances

This structure is on a superelevated curve. The widening of this bridge will occur towards the high side of the superelevated roadway and would not impact the vertical clearance requirements for either the UPRR or Grand Canal.

The required horizontal clearance from the railroad tracks is 25'. The widened abutments, piers and superstructure would achieve the required horizontal clearance requirement.

Recommendation

The AASHTO girder alternative was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.13 Sky Harbor Boulevard Overpass EB (Structure No. 2219, MP 5.02)

Existing Bridge Configuration

The existing bridge is a three span cast-in-place post-tensioned concrete box girder bridge passing over the ramp from westbound SR 202L to SR 143 and Sky Harbor Boulevard. The span lengths for the three spans are 70', 120' and 70'.

The bridge is in a vertical tangent profile within a horizontal curve alignment with a variable skew at the ramp. The bridge supports the eastbound roadway and is superelevated at 5.7% sloping down towards the north.

Since the Priest Drive TI exit ramp diverges from the SR 202L mainline at this location, the roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 84.8' at Abutment 1 to 101.1' at Abutment 2. The widening of this structure would add one general-purpose lane in the eastbound direction of travel, modifying the roadway width on the bridge to 93.9' and 101.1' at Abutments 1 and 2, respectively.

Foundation Type

The existing substructure consists of partial-height abutments founded on a single row of battered steel piles and a single row of straight steel piles. The piers are founded on spread footings.

It is anticipated that the widened bridge portion of the substructure would match the existing bridge configuration, except that drilled shafts would be utilized instead of steel piles.

Feasible Structure Types and Traffic Control

Given the ample vertical clearance at this location, it is feasible to match the existing structure configuration or use a precast prestressed girder bridge alternative (AASHTO Type V concrete girders) to widen the bridge. The use of falsework for the cast-in-place box girder option may require shoulder closures along Sky Harbor Boulevard to place the falsework supports, but the falsework opening and vertical clearance should not restrict any traffic movements.

Site-Specific Issues

There are no other site specific issues that would require consideration at this location.

Horizontal and Vertical Clearances

The widening of this bridge would occur on the high side of the superelevated mainline roadway and would not impact the minimum vertical clearance over any roadways.

Recommendation

The AASHTO girder alternative was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.14 Mill Avenue Viaduct EB (Structure No. 2258, MP 6.34)

Existing Bridge Configuration

The existing bridge is a seven span cast-in-place post-tensioned concrete box girder bridge that passes over the LRT line, UPRR tracks, Tempe Town Lake parking lot, and Mill Avenue. The existing superstructure has a hinge located 20'-0" to the east of the third pier. The span lengths for the seven spans are 141.5', 141.5', 141.5', 159.5', 159.5', 159.5' and 119.75'.

The bridge is constructed on a crest vertical curve within a horizontal curve with a variable skew over the rail and street crossings. The bridge supports the east and westbound roadways with variable superelevation on ~~the~~ westbound roadway and a constant 2% cross-slope on the eastbound roadway.

Since the Center Parkway entrance ramp merges into the SR 202L mainline at this location, the eastbound roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 99.1' at Abutment 1 to 78.5' at Abutment 2. The widening of this structure would add one general-purpose lane and an auxiliary lane in the eastbound direction of travel. The clear roadway width will vary from 105.7 to 106.5 across the full length of the bridge.

Foundation Type

The existing substructure for the Mill Avenue Viaduct consists of partial-height abutments founded on dual rows of drilled shaft foundations, and piers founded on drilled shafts. A terraced retaining wall exists at Abutment 2 that reduces the overall height of this abutment.

It is anticipated that the widened substructure would match the existing bridge configuration.

Feasible Structure Types and Traffic Control

It would be feasible to widen the structure by matching the existing cast-in-place post-tensioned concrete box configuration. However, the first span could be constructed with a precast, prestressed concrete girder instead of a cast-in-place post-tensioned concrete box. This would reduce construction duration and temporary impacts to the UPRR.

Sufficient vertical clearance is provided over Mill Avenue to maintain 15'-0" clearance within a falsework opening during the bridge construction activities. It is also anticipated that a minimum vertical clearance of 23' would be maintained over the UPRR for both cast-in-place and precast alternatives. Crash beams would be required on Mill Avenue in advance of the falsework opening during the bridge construction activities.

A portion of the Tempe Town Lake parking lot would be closed to facilitate the bridge construction activities.

Site-Specific Issues

The structure passes over the Tempe Town Lake parking lots, Mill Avenue, UPRR tracks, and the LRT line.

The UPRR design guidelines would be used for the design and construction for the segment of the bridge that passes over the UPRR right-of-way. Design considerations for the UPRR crossing are covered in their *Guidelines for Design of Highway Separation Structures Over Railroad (Overhead Grade Separation)*, January 1999. Deck overhang removal performed to facilitate the SR 202L bridge widening shall meet the requirements set forth in *Guidelines for Preparation of a Bridge Demolition and Removal Plan for Structures over Railroad*, March 1998. The UPRR requires a 23'-6" minimum permanent vertical clearance for the rail line, which supersedes their guidelines. A Railroad Agreement would also be required for the project elements that would encroach into the railroad right-of-way.

The LRT facility will include overhead catenary power lines that will be supported by the bottom of the structure. Representatives of Valley Metro Rail have indicated the catenary lines will require a 10' minimum clearance for all construction activities and will

be designed to accommodate the widening. Since the LRT facility will be operational for commuters during the majority of each day, the catenary lines could be de-energized for short periods of time at nights and weekends.

The post-tensioned box girder bridge widening option would need to consider the safety considerations of placing falsework in such close proximity to the LRT catenary lines for the construction of Span 1.

The first span crosses over the UPRR and LRT tracks. Due to the proximity of the LRT and UPRR tracks, falsework supports (required for the cast-in-place box girder option) would encroach into the 25' horizontal clear distance that is required by UPRR. This situation will require the construction of a temporary crash wall. To avoid this situation, the first span of this bridge could be widened with precast prestressed AASHTO Type VI girders to eliminate the false requirements within the railroad right-of-way. It is anticipated that a one day closure of the LRT line would be needed to de-energize the catenary lines and erect the AASHTO girders.

The existing bridge includes a hinge located within the third span of the structure. The location of the hinge would preclude the precast concrete girder option for the entire structure. Therefore, it is anticipated that the first span would be widened using precast girders, with the remaining portion of the bridge widening with cast-in-place post-tensioned concrete box girders that would match the existing structure.

An existing bike path is located along Lake View Road. The bike path would be relocated to avoid a conflict with a new column at Pier 5.

There are several overhead 69 kV power lines owned and operated by SRP that pass over the bridge structure. Cast-in-place construction is anticipated at these locations. It is feasible to build the bridge without impacting the overhead high voltage power lines.

Vertical Clearance

The existing vertical clearance over the UPRR is approximately 26'-2. The existing vertical clearance over Mill Avenue is approximately 18'-1".

The final vertical clearances over the UPRR, LRT tracks and Mill Avenue are 23'-9", 17'-10" and 17'-4", respectively. Additional survey data will be required during the next design phase to verify these clearances.

Recommendation

A combination of an AASHTO precast prestressed girder (span 1) and cast-in-place post-tensioned box girder (for the remaining spans) was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.15 West Pedestrian Overpass EB (Structure No. 2259, MP 7.13)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over an existing unimproved pathway, which is currently closed to the public. The span length is 70'.

The bridge is constructed on a sag vertical curve within a tangent horizontal alignment with 90 degree skew. The bridge supports the eastbound roadway with a variable superelevation sloping down to the north.

The existing eastbound clear roadway width on the bridge is 79.71'. The widening of this structure would add one general-purpose lane and an auxiliary lane in the eastbound direction of travel, modifying the clear roadway width on the bridge to 105.71'.

Foundation Type

The existing substructure consists of stub abutments founded on drilled shafts located behind full-height, cast-in-place retaining walls. It is anticipated that the widened substructure would match the existing bridge configuration.

Feasible Structure Types and Traffic Control

It would be feasible to widen the existing bridge by matching the existing structure with a post-tensioned cast-in-place box girder superstructure, with "side-by-side" precast prestressed Type BII concrete box girder scenario, or AASHTO Type III girders.

Precast construction would eliminate the falsework needed for the post-tensioned box girder construction, but either alternative would allow the pedestrian overpass to remain in service during the construction activities.

AASHTO Type III girders can be used for this structure without reducing the existing vertical clearance. However, for the widening of the East Pedestrian Overpass EB (an almost identical structure), the use of the AASHTO Type III girders does reduce the existing vertical clearance.

Site-Specific Issues

The pedestrian crossing is currently rough-graded and does not include an improved pathway. The bridge opening is fenced to preclude pedestrian access at this time.

Vertical Clearance

The westbound side of this structure has an approximate 10'-1" vertical clearance. Similarly, the existing vertical clearance on the eastbound side of the structure is approximately 12'-2".

Since the widened portion of this structure will be on the high side of the superelevated roadway, the vertical clearance for the widened structure would exceed the existing conditions.

Recommendation

The precast box option was selected for cost estimating purposes. A detailed analysis of the other alternatives should be considered during final design.

4.6.4.16 East Pedestrian Overpass EB (Structure No. 2260, MP 7.41)

Existing Bridge Configuration

The general discussion, foundation type, feasible structure types and site specific issues associated with this structure are identical to the West Pedestrian Overpass; with the exception the East Pedestrian Overpass has a 2% cross-slope for the westbound roadway and a variable cross-slope on the eastbound roadway that slopes to the south.

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over an existing unimproved pathway, which is currently closed to the public. The span length is 70'.

Vertical Clearance

The existing vertical clearance for this structure is approximately 12'-2" for the westbound roadway and 12'-6" for the eastbound roadway.

Assuming the use of precast prestressed AASHTO Type BII concrete box girders for the widening of this bridge (with an approximate structural depth of 3'-5"), the cast-in-place box girder and precast box girder alternatives would reduce the vertical clearance below 12', but provide over 10' clearance. Regrading of the pathway area may be necessary in the future to facilitate the multi-use crossing.

AASHTO Type III girders can not be used for this structure without reducing the existing vertical clearance. This option may be further considered if the grade below the bridge or vertical clearance can be reduced.

Recommendation

The precast box option was selected for cost estimating purposes. A detailed analysis of the other options should be considered during final design.

4.6.4.17 College Avenue Overpass EB (Structure No. 2261, MP 7.55)

Existing Bridge Configuration

The existing bridge is a single span cast-in-place post-tensioned concrete box girder bridge passing over College Avenue. The span length of the existing bridge is 122'.

The bridge is located on vertical crest curve within a tangent horizontal alignment with a skew of 9°30'00" to College Avenue. The bridge supports the east and westbound roadways and is superelevated at a variable cross-slope that slopes down towards the south.

Since the Scottsdale Road exit ramp departs the SR 202L mainline at this location, the eastbound roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 113.1" at Abutment 1 to 121.7' at Abutment 2. The widening of this structure would add one general-purpose lane in the eastbound direction of travel. The clear roadway width would be modified to provide 126.7' and 137.2' at Abutment 1 and Abutment 2, respectively.

Foundation Type

The existing substructure consists of partial-height abutments founded on two rows of drilled shafts. It is anticipated that the widened substructure would match the existing substructure configuration.

Feasible Structure Types and Traffic Control

It would be feasible to widen the bridge with a shallower post-tensioned concrete box structure utilizing 6,000 psi concrete. The existing 15'-7" vertical clearance would require the bridge to be constructed on falsework above the final elevation, and then lowered into place with hydraulic jacking. This would allow College Avenue to remain open to traffic during the bridge construction activities.

A second option is a precast prestressed concrete girder (AASHTO Type IV girders) widening. Falsework would not be necessary for this option. The superstructure depth would be comparable to the existing superstructure depth. This option would also reduce the construction duration and impacts to traffic.

Site-Specific Issues

College Avenue is the only access road to the Tempe Town Lake Marina. Bridge widening solutions that minimize the impacts to College Avenue during the bridge construction activities need to be considered.

Vertical Clearance

The existing vertical clearance is approximately 15'-7". The vertical clearance provided with the widened SR 202L overpass would be approximately 15'-1" for the AASHTO Type IV girder option. As previously stated, a shallower post-tensioned alternative is feasible and would retain the existing vertical clearance.

Recommendation

Given the reduced traffic impacts, the AASHTO Type IV girder option was selected for cost estimating purposes. A detailed analysis of the post-tensioned alternative should be considered during final design.

4.6.4.18 Scottsdale Road TI Overpass EB and WB (Structure No. 2263, MP 7.71)

Existing Bridge Configuration

The existing bridges are single span cast-in-place post-tensioned concrete box girder bridges passing over Scottsdale Road. The existing Scottsdale Road TI is a SPUI, with all left-turn movements passing below the overpass. The span length of the existing bridges is 194.5 feet.

The bridge is constructed on a tangent vertical profile within a tangent horizontal alignment with a skew of 0°49'50" and 4°51'05" for Abutments 1 and 2, respectively. The bridges support the east and westbound roadways with a variable superelevation on the westbound roadway sloping toward the median, and a 2% normal cross-slope on the eastbound roadway that slopes to the south.

The eastbound and westbound clear roadway widths on the bridge are 79.71'. The widening of these structures would add one general-purpose lane in the eastbound and westbound directions of travel, modifying the roadway widths on the bridge to 93.71'.

Proposed Bridge Configuration

Per section 3.4.5 of this report, two options for bridge layouts were considered at this location. The first option would modify the existing single span bridge by widening the existing abutment. The widened abutment would be placed in line with the existing abutment with chamfered corners, and would require all of existing ramps to be realigned to avoid the abutments.

The second option would widen the existing bridge abutments by using straddle bents that would span over the existing left-turn ramp roadways, thereby avoiding any realignment of the ramps near the crossroads intersection. This alternative would consist of a simple main span that matches the existing bridge and two short end spans that span between the straddle bents to new abutments placed further back from the intersection to avoid the existing left turn ramp alignments.

Option 2 is recommended as the preferred alternative at the Scottsdale Road TI because it would not require the reconstruction of the existing ramps. Since the ramps would not be reconstructed at the crossroad, this option would be anticipated to reduce traffic impacts during construction. Also, the cost of this option is about the same as Option 1.

Foundation Type

The existing substructure for the Scottsdale Road TI Overpass consists of full-height abutments on triple rows of drilled shafts.

Preliminary substructure calculations and a review of the as-built soil boring logs indicate that there should be sufficient reserve capacity in the existing abutment foundation to handle the contribution of the additional load from a new straddle bent. The other end of the straddle bents would be supported by drilled shaft foundation located within the curbed islands at the crossroad intersections. It is anticipated that the new abutments would be supported on drilled shafts. However, spread footings should be evaluated during final design. However, spread footings may require ramp closures during foundation construction.

Feasible Structure Type and Traffic Control

The span length of the existing bridge (189 feet) would preclude the use of conventional precast, prestressed girder alternatives. A typical CIP post-tensioned box girder superstructure for the bridge widening would require both restricted falsework clearances and would impact the operations of the interchange during the bridge construction activities.

Two additional alternatives were considered including a CIP post-tensioned box girder constructed above the existing structure's finished grade on falsework (to achieve 16'-0" minimum temporary vertical clearance), which would be lowered into final position using hydraulic jacks. A second, spliced girder alternative would construct the bridge using precast segments that are then post-tensioned together to develop a composite superstructure.

Either of these options could be designed and constructed while maintaining the recommended minimum vertical falsework clearance. The temporary interchange configuration would include a minimum of two through-lanes and one left-turn lane in

each direction of travel. One left-turn lane and all right-turn lanes would also be retained on the ramps during the bridge construction activities.

Site-Specific Issues

There are no other site specific issues that would require consideration at this location.

Vertical Clearance

The existing vertical clearance at this structure is approximately 16'-6". The final vertical clearance for the widened superstructure would be approximately over 16'-3" for the superstructure, and 16'-0" for the straddle bents.

Recommendation

Both the hydraulically jacked CIP post-tensioned box girder and spliced girder alternatives are potential options for this location. The hydraulically jacked CIP PT box girder alternative was selected for cost estimating purposes. A detailed analysis of both alternatives should be considered during final design.

4.6.4.19 Indian Bend Wash Bridge EB and WB (Structure No. 2265, MP 8.06)

Existing Bridge Configuration

The existing bridges are eight span precast prestressed standard AASHTO Type VI concrete girder bridge passing over Miller Road and the Indian Bend Wash drop structure. The span lengths of the existing bridges are 123.4', 125.3', 125.3', 125.3', 125.3', 125.3', 125.3' and 123.4'

The bridges are constructed on a crest vertical curve within a tangent horizontal alignment and a skew of 39° 00' 00" to Indian Bend Wash. The bridges support the east and westbound SR 202L roadways. The SR 202L mainline is crowned to the outside at 2%, and the HOV lane and median shoulder is crowned toward the median with a 2% cross-slope.

Since the westbound Scottsdale Road exit ramp departs the SR 202L mainline at this location, the westbound roadway width varies across the bridge. The existing westbound clear roadway width varies from approximately 81.5' at Abutment 1 to 79.7' at Abutment 2. The widening of this structure would add one general-purpose lane in the westbound direction of travel. The clear roadway width would be modified to provide 105.7' on the full length of the bridge.

In the eastbound direction of travel, the Scottsdale Road entrance ramp merges with the SR 202L mainline, and the McClintock Road exit ramp departs the mainline with a tapered exit design. Therefore, the eastbound roadway width varies across the bridge. The existing eastbound clear roadway width varies from approximately 81.5' at

Abutment 1 to 92.2' at Abutment 2. The widening of this structure would add one general-purpose lane in the westbound direction of travel. The clear roadway width would be modified to provide 105.7' on the full length of the bridge. Two general-purpose lanes would be added to the eastbound roadway, modifying the clear roadway width on the bridge to 105.7' at Abutment 1 to 112.7' at Abutment 2.

Foundation Type

The existing substructure for the bridges consist of stub abutments and piers founded on drilled shafts. It is anticipated that the widened substructure would match the configuration of the existing bridges.

Feasible Structure Types and Traffic Control

The existing structure utilizes AASHTO Type VI girders. It is anticipated that the widened structure would match the superstructure configuration of the existing bridge. Stay-in-place deck forms are recommended for the widening of this bridge.

No significant traffic or local agency maintenance access is anticipated for this structure.

Site-Specific Issues

The widening of this structure would require a significant length of the construction to occur over Tempe Town Lake. Some of the drilled shafts and piers would be required to be constructed within the lake.

Several methods of bridge construction and equipment access were considered for the portion of the bridge over the lake including; the use of a trestle (temporary bridge), construction of cofferdams, supporting equipment and materials on barges, and constructing a temporary roadway within the lake.

Construction of a temporary roadway within the lake appears to be the most viable method to provide construction access to widen the existing bridge. The final selection of the means and methods to widen the bridge will be decided by the contractor. However, the development of the construction documents and environmental permitting will be based on the use of the temporary construction access roads within the lake and should not preclude other methods.

The existing bridge passes over the Indian Bend Wash (IBW) Drop Structure, which was constructed by the FCDMC at the interface of the Indian Bend Wash outlet into Tempe Town Lake. This drop structure was constructed of roller compacted concrete (typically 6'-6" thick), and includes several drops along the alignment of the wash. A number of the bridge piers currently penetrate the drop structure, and the widening of the bridge would require additional piers to be placed through the structure.

The existing bridge also passes over soil cement bank protection placed along the north side of the Salt River channel. The bank protection is 8' thick cement stabilized alluvium (CSA). A number of the existing and proposed bridge piers would penetrate the CSA.

The majority of the drop structure is below the water surface of Tempe Town Lake. The slopes of the drop structure and channelization necessitate specialized construction procedures for the construction of the drilled shaft foundation and pier construction.

Since it is difficult for conventional equipment to drill vertically through a sloped concrete structure, a recommended method of construction of the drilled shaft foundations through the drop structure would include jack hammering an oversized opening through the drop structure or CSA, place an oversized casing that extends about a minimum of two feet below the bottom of the structure, and then excavate and place the drilled shaft foundation. A conceptual drawing of this construction method is provided on Figure 21. The use of an outer and inner casing will isolate the drop structure from potentially damaging movements of the bridge substructure.

Vertical Clearance

Miller Road has recently been built underneath the Indian Bend Wash Bridges by the City of Tempe. Based on the Miller Road construction drawings, the existing vertical clearance is approximately 17'-0". The vertical clearance maintained beneath the widened bridge structure would be approximately 16'-9".

It is anticipated that vertical clearances at the existing FCDMC maintenance roads would be over the 15' minimum clearance required by the FCDMC.

Recommendation

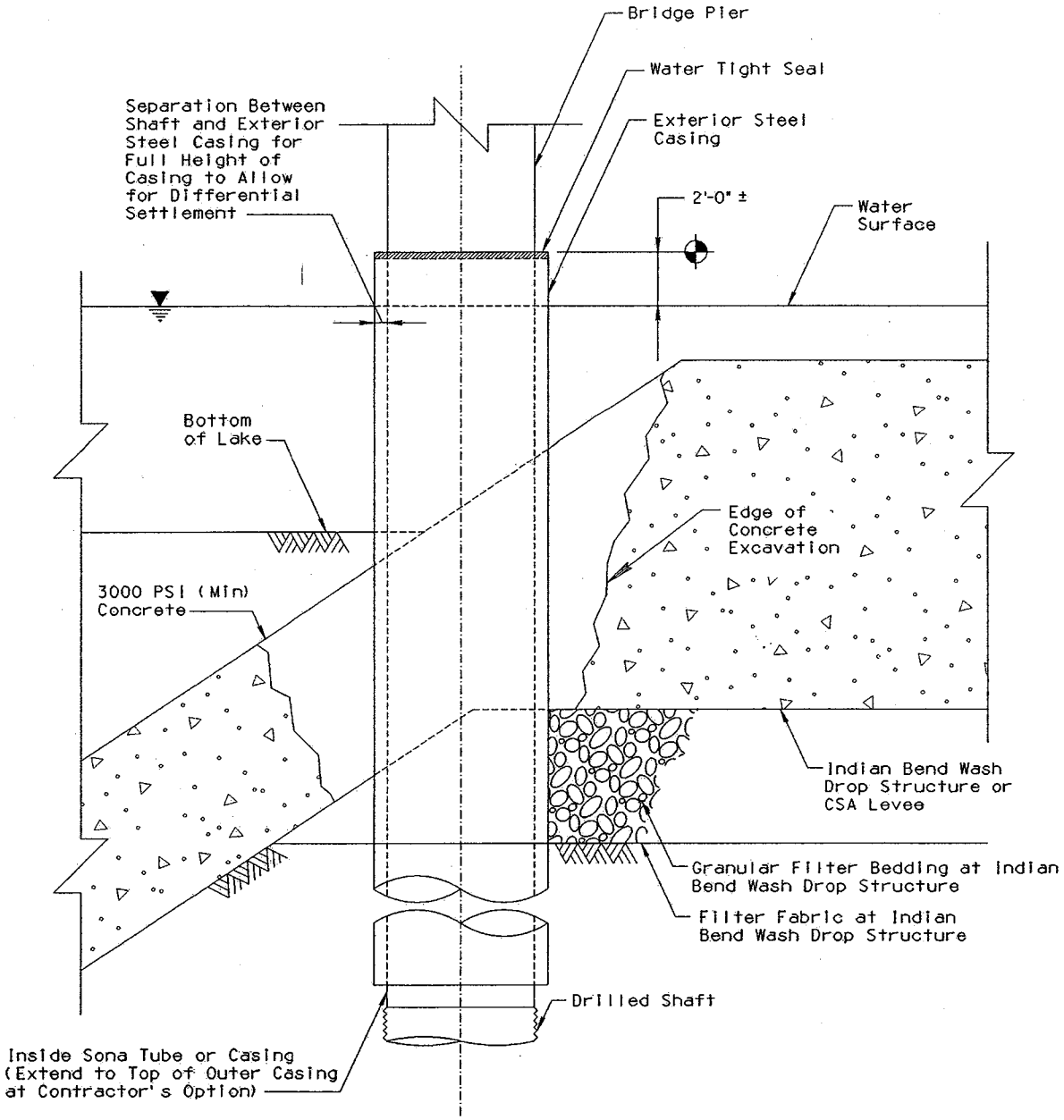
It is recommended the widened structure would match the superstructure configuration of the existing bridge. A detailed analysis of the other options should be considered during final design.

4.6.1.20 Salt River Bridge EB (Structure No. 2268, MP 8.17)

Existing Bridge Configuration

The existing eastbound bridge is a 39 span precast prestressed AASHTO Type VI (Standard and Super) concrete girder bridge passing over McClintock Drive, McClintock Drive Ramp B and the Salt River. The spans vary from 99.4 to 141 feet.

The bridge is not skewed. The vertical profile of the bridge includes numerous crest and sag vertical curves located within a tangent horizontal alignment that transitions into a horizontal curve near the SR101L/SR202L TI. The bridge supports the eastbound roadway and has a 2% normal cross-slope transitioning to a superelevated section near the system TI.



SECTION AT PIER AND
INDIAN BEND WASH DROP STRUCTURE
OR CSA LEVEE

Figure 21 – Conceptual Drilled Shaft Detail at the Indian Bend Wash Drop Structure and CSA Levee

Due to the proximity of off ramps at SR101L on the eastern end, the existing bridge edges are tapered and the structure itself is split into two independent decks to accommodate the through traffic movements on SR202L, and the traffic exiting the freeway to access SR 101L. The clear roadway width for the majority of the eastbound structure is 80'.

Two general purpose lanes would be added in the eastbound direction. The clear roadway width for the widened bridge would be 106' for the majority of the length of the bridge.

Foundation Type:

The existing substructure for the Salt River Bridge includes stub abutments and piers founded on drilled shaft foundations. It is anticipated that the widened substructure would match the configuration of the existing bridges.

Feasible Structure Types and Traffic Control:

The existing structure utilizes a mixture of AASHTO Type VI and Super VI girders. It is anticipated that the widened structure would match the existing superstructure configuration, with an exception for the span over McClintock Road. Girder drops would be utilized to facilitate the roadway tapers, although some "wasted deck" areas may be required in isolated locations.

No significant traffic or maintenance activity impacts are anticipated with this structure.

Site-Specific Issues:

The bridge is built over McClintock Road Ramp B, McClintock Road, and the Salt River. The SR101L/SR202L TI exit ramp (to SR 101L) also departs the SR 202L mainline within the limits of this bridge.

It is anticipated that construction access roads will be constructed along each side of the bridge within the river channel. Drainage pipes will be placed across the construction access roads to provide conveyance of low river flows during the bridge construction activities. The access roads would be designed to "wash out" during significant storm events.

The existing span over McClintock Road has limited vertical clearance. The portion of McClintock Road where the clearance issue occurs is on a bridge structure itself, therefore providing no opportunity to modify the existing roadway profile without incurring significant construction costs and traffic impacts. Therefore, side-by-side AASHTO Type V girders were evaluated and were determined to be a feasible element for this span, which would provide the vertical clearance required at this location.

Existing 69kV and 230kV high voltage power lines cross over the SR 202L mainline near Indian Bend Wash. An initial evaluation indicates sufficient clearance is available between the bridge deck and power lines to allow a crane to erect the girders and excavate the drilled shaft foundations. Continued coordination with representatives of APS and SRP will be conducted during final design to ensure all power line safety guidelines are achieved at this location.

Vertical Clearance:

The McClintock Drive exit ramp will be realigned in support of the mainline widening. The new ramp alignment will consider the vertical clearance requirements below the mainline.

The existing vertical clearance over McClintock Road is 16'-7". By using side-by-side AASHTO Type V girders for the bridge span over the crossroad, vertical clearance would be reduced to approximately 16'-4".

Recommendation:

The McClintock Drive exit ramp will be realigned in support of the mainline widening. It is recommended that the widening would match the superstructure configuration of the existing bridge, with the exception of the span over McClintock Drive. AASHTO Type V girders are recommended for the span over McClintock Drive to maintain the existing 16'-0" foot vertical clearance. A detailed analysis of the other options should be considered during final design.

4.6.4.21 Salt River Bridge WB (Structure No. 2269, MP 8.17)

Existing Bridge Configuration

The existing westbound bridge is a 38-span precast prestressed AASHTO Type VI (Standard and Super) concrete girder bridge passing over McClintock Road, McClintock Road Ramp B, and the Salt River. The spans vary from 106.9' to 141'.

The bridge is not skewed. The vertical profile of the bridge structure consists of crest, sag, and tangent vertical curves with a tangent horizontal alignment transitioning to a horizontal curve at the SR101L/SR202L TI. The bridge supports westbound traffic and has a 2% cross-slope sloping towards the outside edge of the deck, with transitioning superelevated slopes that slope toward the median near the SR101L/SR 202L TI.

Due to the proximity of on ramps at SR101L on the eastern end, the existing bridge edges are tapered and the structure itself is split into two independent decks to accommodate through traffic movements on SR202L and traffic exiting to the SR101L. The clear roadway width for the majority of the eastbound structure is 80'.

Two general purpose lanes would be added in the westbound direction with a median shoulder exception. The clear roadway width for the widened bridge for that majority of the structure would be 100'.

The foundation and feasible structure types and site-specific issues associated with this structure are similar to the Salt River Bridge EB. Vertical clearance of the Salt River Bridge is controlled by the eastbound direction.

Due to the proximity of exit ramps at SR 101L on the eastern end, the existing bridge edges are tapered and the structure itself is split into two independent decks to accommodate through traffic movements on SR 202L and traffic exiting to the SR 101L. The clear roadway width for the majority of the eastbound structure is 80'.

Two general purpose lanes would be added in the westbound direction with an interior shoulder exception. The clear roadway width for the widened bridge for that majority of the structure would be 100'.

The foundation and feasible structure types and site-specific issues associated with this structure are similar to the Salt River Bridge EB.

Vertical clearance of the Salt River Bridge is controlled by the eastbound direction.

Recommendation:

It is recommended the widened structure would match the superstructure configuration of the existing bridge. A detailed analysis of the other options should be considered during final design.

4.6.5 Recommendations

Initial bridge widening recommendations are summarized in Table 18.

Table 18 – Initial Bridge Widening Recommendations Summary

Structure Name	Existing Superstructure Type(s)	Existing Span Configuration	Existing Structure Depth	Assumed Structure Type For Cost Estimating Purposes	Approximate Vertical Clearance After Widening[1]
24th Street TI Overpass (4)	Cast-in-place post-tensioned concrete box girder	243'	12'-0"	Cast-in-place post tensioned concrete box girder; jacked into place	17'-1"
32nd Street TI Overpass	Cast-in-place post-tensioned concrete box girder	189'	8'-0"	Cast-in-place post tensioned concrete box girder; jacked into place	16'-10"

Table 18 – Initial Bridge Widening Recommendations Summary (continued)

Structure Name	Existing Superstructure Type(s)	Existing Span Configuration	Existing Structure Depth	Assumed Structure Type For Cost Estimating Purposes	Approximate Vertical Clearance After Widening[1]
Grand Canal Bridge (4)	Cast-in-place post-tensioned concrete box girder	140'	6'-0"	AASHTO Type VI	Bridge structure is widened on high side of superelevated curve; approximate minimum vertical clearance using AASHTO Type VI girders is 19'-6" (1' deeper than existing post-tensioned bridge)
40th Street TI Overpass (4)	Cast-in-place post-tensioned concrete box girder	153'	6'-9"	Cast-in-place post tensioned concrete box jacked into place	17'-4"
44th Street TI Overpass	Cast-in-place post-tensioned concrete box girder	65', 160', 65'	6'-6"	Cast-in-place post tensioned concrete box jacked into place	15'-10"
East Papago TI Underpass EB	Cast-in-place post-tensioned concrete box girder	42.8', 95', 130', 50'	5'-3" (varies to 5'-10 ⅝" at Abutment 1)	Modified Type BIV box beams (54" deep)	16'-7"
48th Street Overpass EB (4)	Cast-in-place post-tensioned concrete box girder	40', 96', 40'	4'-0"	Standard side-by-side Type BIV box beams	16'-6"
Ramp B Overpass EB	Cast-in-place post-tensioned concrete box girder	40', 70', 40'	3'-6"	Cast-in-place post tensioned concrete box jacked into place	16'-0"[2]
52nd Street Overpass EB (4)	Cast-in-place post-tensioned concrete box girder	75', 140', 75'	5'-0"	Match existing superstructure	17'-8"
Van Buren Street Overpass EB (4)	Cast-in-place post-tensioned concrete box girder	100', 100'	4'-0"	Cast-in-place post tensioned concrete box jacked into place	16'-0"[2]
Washington Street Overpass EB	Cast-in-place post-tensioned concrete box girder	55', 105', 55'	4'-0"	Standard side-by-side Type BIV box beams	16'-8"

Table 18 – Initial Bridge Widening Recommendations Summary (continued)

Structure Name	Existing Superstructure Type(s)	Existing Span Configuration	Existing Structure Depth	Assumed Structure Type For Cost Estimating Purposes	Approximate Vertical Clearance After Widening[1]
SPRR/Grand Canal Bridge EB	Precast prestressed concrete AASHTO Type VI standard and modified girders	130', 90', 120', 70'	6'-10 ½" max.	Match existing superstructure	Existing superstructure clearances over SPRR and SRP maintenance roads control; bridge structure is widened on high side of superelevated curve
Sky Harbor Boulevard WB Overpass (202L EB)	Cast-in-place post-tensioned concrete box girder	70', 120', 70'	5'-0"	AASHTO Type VI	Existing superstructure clearance over Sky Harbor Blvd controls; bridge structure is widened on high side of superelevated curve
Mill Avenue Viaduct EB	Cast-in-place post-tensioned concrete box girder	3 x 141.5', 3 x 159.5', 119.75'	6'-3"	AASHTO Type VI (1st span only); match the existing superstructure for the remaining spans	23'-9" over UPRR; 17'-4" over Mill Avenue
W Pedestrian Overpass EB	Cast-in-place post-tensioned concrete box girder	70'	3'-6"	Standard BII side-by-side box beams	Existing superstructure clearance over W. Pedestrian Access controls; bridge structure is widened on high side of superelevated curve
E Pedestrian Overpass EB	Cast-in-place post-tensioned concrete box girder	70'	3'-6"	Standard BII side-by-side box beams	12' +/- [2]
College Avenue Overpass EB	Cast-in-place post-tensioned concrete box girder	122'	5'-6"	AASHTO Type IV	15'-1"
Scottsdale Road TI Overpass EB & WB	Cast-in-place post-tensioned concrete box girder	194.5'	10'-0"	Cast-in-place post tensioned concrete box jacked into place	16'-3" (16'-0" if straddle bents are used over SPUI ramps[2])
Indian Bend Wash Bridge EB & WB	Precast prestressed concrete AASHTO Type VI standard girders	123.5', 6 x 125.3', 123.5'	7'-0" max.	Match existing superstructure	15' over maintenance road[2]; 16'-9" over Miller Road[3]

Table 18 – Initial Bridge Widening Recommendations Summary (continued)

Structure Name	Existing Superstructure Type(s)	Existing Span Configuration	Existing Structure Depth	Assumed Structure Type For Cost Estimating Purposes	Approximate Vertical Clearance After Widening(1)
Salt River Bridge EB	Precast prestressed concrete AASHTO Type VI standard and super girders	99.4', 127.6', 124.9', 3 x 105.6', 29 x 140', 4 x 141'	Varies 7'-0" to 7'-6" +/-	Match existing superstructure (except at span over McClintock – utilize AASHTO Type V girders)	16'-1" over McClintock Road; 16'-6" over McClintock Ramp B
Salt River Bridge WB	Precast prestressed concrete AASHTO Type VI standard and super girders	106.9', 116.6', 2 x 125.1', 22 x 140', 8 x 137', 140', 4 x 141'	Varies 7'-0" to 7'-6" +/-	Match existing superstructure	Eastbound structure controls

(1) Approximate vertical clearances shown are based on as-builts and ADOT Bridge Maintenance Data, except as noted. Factors impacting vertical clearance during final design include, but are not limited to: results of supplemental survey, actual superstructure depth of the widened structure, the extent of bridge widening, and the superstructure framing plan.
(2) Vertical clearance is based on aerial survey data. Supplemental survey should be utilized to compute actual clearances at these locations.
(3) Vertical clearance is based on as-built data and construction plans for the recently completed Miller Road.
(4) Noise walls will be required on bridge structure in eastbound direction only, except for 52nd Street Overpass and Van Buren (westbound only)

4.7 RETAINING WALLS, NOISE WALLS AND BOX CULVERTS

4.7.1 Retaining Walls

New retaining walls will be required throughout the corridor to accommodate the roadway widening. Wall heights of up to 35' are anticipated with average heights in the 5' to 23' range.

The retaining wall alternatives that could be considered for this project are cantilevered walls on spread footings, cantilevered walls on drilled shafts, mechanically stabilized earth (MSE) walls, soil nailed walls, and soldier/tieback walls.

At the time of this report, it is understood from ADOT Bridge Design Section that retaining and noise walls will be designed in accordance with the latest *LRFD Bridge Design Specifications – Customary U. S. Units,* AASHTO, as superseded by the ADOT *Bridge Practice Guidelines,* if the walls are designed after July 1, 2009. All walls designed prior to this date will utilize the *Standard Specifications for Highway Bridges, 17th Edition (2002)* as superseded by the ADOT *Bridge Practice Guidelines.*

Reviews of the as-built plans indicate the majority of the existing walls were built with spread footing foundations. A few of the taller retaining walls were founded on drilled shaft or driven pile foundations. Mechanically Stabilized Earth (MSE) walls were used along the edge of the eastbound freeway adjacent to each side of the Grand Canal Overpass. Existing wall types and locations are listed in Table 19.

Table 19 – Existing Retaining Walls in Proximity of Freeway Widening

General Location	Retaining Wall Description	Wall Type
24th Street TI Overpass	Edge of EB SR 202L mainline between the following: • Station 993+00 to Station 998+00 • Station 1001+33 to Station 1003+40	Cantilevered wall on spread footing. **Note:** Walls on H-piles adjacent to bridge structure at SW corner.
24th Street to 32nd Street Auxiliary Lane	Edge of EB SR 202L mainline between approximate Station 1024+05 to Station 1037+90	Modified roadway barrier (5' maximum height). **Note:** 32" to 42" standard barriers utilized on each end of the bridge.
32nd Street TI Overpass	Edge of EB SR 202L mainline between the following: • Station 1051+00 to Station 1052+67 • Station 1054+72 to Station 1056+50	Cantilevered wall on spread footing.
Grand Canal Overpass	Edge of EB SR 202L mainline between approximate Station 1068+25 to Station 1076+63	MSE wall.
40th Street TI Overpass	Edge of EB SR 202L mainline – 18' long walls located immediately adjacent to the southeast and southwest corners of the bridge structure	Cantilevered wall on spread footing.
44th Street TI Overpass	Edge of EB SR 202L mainline between the following: • Station 1127+41 to Station 1131+62 • Station 11+59 to Station 13+16	Cantilevered wall on spread footing.
Mill Avenue to West Pedestrian Overpass	Edge of EB SR 202L mainline between Station 199+78 to Station 208+96	Cantilevered wall on spread footing. **Note**: Two-tier wall system exists between Station 201+48 to Station 206+04.
West Pedestrian Overpass to East Pedestrian Overpass	Edge of EB SR 202L mainline between Station 210+35 to Station 223+64	Cantilevered wall on spread footing.
East Pedestrian Overpass to College Avenue	Edge of EB SR 202L mainline between Station 224+36 to Station 231+35	Cantilevered wall on spread footing.
Scottsdale Road Ramp B	Edge of Scottsdale Road Ramp B between Ramp B Station 7+17 to Station 14+98	Cantilevered wall on spread footing.
Scottsdale Road TI Overpass	Edges of EB and WB SR 202L mainlines between the following: • Station 236+73 to Station 244+51 (EB) • Station 247+56 to Station 250+92 (EB) • Station 237+20 to Station 244+54 (WB) • Station 247+70 to Station 253+71 (WB)	Cantilevered wall on spread footing. **Note:** Walls founded on drilled shafts at all four corners adjacent to Scottsdale Road TI Overpass.
McClintock Road Ramp A	Northern edge of Ramp A between Ramp A Station 11+32 to Station 9+82 and southern edge of Ramp A between Station 8+00 to Station 9+00.	Cantilevered wall on spread footing.

Wingwalls adjacent to the 24th Street TI and Scottsdale Road TI overpasses were founded on drilled shafts or H-piles. However, the previous use of drilled shafts and H-piles is not necessarily indicative that the soils are incapable of supporting new retaining walls founded on spread footings. Further geotechnical investigations will be required to determine the adequacy of the in-situ soils to determine if spread footings would be viable in the vicinity of these bridge structures. Drilled shaft foundations were assumed for the cost estimating purposes at these locations.

New retaining walls along the corridor may require special design considerations due to the proximity of the new wall to the existing wall. At these locations, the following alternatives should be evaluated during final design:

- Offset the new wall from the existing wall to provide sufficient area to construct a new spread footing.
- Provide a specialty wall design that could be founded on:
  - an L-shape spread footing.
  - a single or multiple row of drilled shafts utilizing a shaft cap to transfer the loads from the wall to the shafts.
  - tie-back or soil nail walls may be considered. However, the existing roadway embankment may not be suitable for lateral restraint.

An evaluation will be required during final design to evaluate the feasibility of each wall alternative. The evaluation should include technical viability, right-of-way constraints, construction access availability, maintenance of traffic during construction, and estimated construction costs.

Retaining Wall Types:

Any walls not requiring special treatment as noted in the general discussion would be designated as "regular walls." "Regular walls" are anticipated to be either ADOT standard cast-in-place walls or walls founded on normally configured spread footing foundations.

Walls that would require an unusual footing shape, or would be founded on drilled shafts, are designated as "specialty walls."

Other retaining walls along the corridor may require additional height to provide noise mitigation as identified by the preliminary noise analysis. These walls are identified as "combination walls." Unless otherwise specified as a "combination/specialty" wall, "combination walls" are also assumed to be founded on typically standard spread footings.

In some cases, modifying a standard barrier section would eliminate the need for a separate retaining wall. These walls are identified as "barrier walls."

Special Design Considerations:

The City of Tempe (COT) has attached tile murals to the existing retaining walls in the vicinity of the Tempe Town Lake Marina. The COT would remove and store the murals. Upon the completion of the construction of the new walls, the murals would be placed on the new wall by the COT.

Recommendations:

A summary of the retaining and noise walls used for cost estimating purposes is provided in Table 20. A detailed analysis of the other options should be considered during final design.

Table 20 – New Retaining Wall Summary

Roadway	Wall No.	Description	Approximate Station Limits	Approximate Wall Length	Average Wall Height/ Maximum Wall Height(1)	Wall Type(2)
I-10 Ramp S-E	R1	Edge of EB SR 202L mainline, between the mainline and 24th Street Ramp B	Sta 42+04 to Sta 47+99	608'	15'/32' (6' to 10')	Combination/specialty wall; a specialty design is likely required given the proximity of an existing wall. Taller walls may need to be founded on drilled shafts pending further geotechnical investigations.
SR 202L Mainline	R2	Edge of EB SR 202L mainline, between the mainline and 24th Street Ramp D	Sta1001+22 to Sta 1005+00	378'	16'/31' (12' to 14')	Combination/specialty wall; a specialty design is likely required given the proximity of the existing wall. Taller walls may need to be founded on drilled shafts pending further geotechnical investigations.
	R3	Edge of EB SR 202L mainline, between the mainline and 32nd Street Ramp B	Sta 1051+00 to Sta1052+75	175'	16'/28'	Regular wall
	R4	Edge of EB SR 202L mainline, between the mainline and 32nd Street Ramp D	Sta1054+64 to Sta1056+29	165'	20'/28'	Regular wall
	R5	Edge of EB SR 202L mainline	Sta 1060+82 to Sta1066+84	613'	7'/14' (10')	Combination wall
	R6	Edge of EB SR 202L mainline	Sta1068+20 to Sta1086+00	1813'	14'/33' (10')	Combination/specialty wall would be required adjacent to Grand Canal Overpass; the remaining 500 feet would be regular wall
	R7	Edge of EB SR 202L mainline, between the mainline and 40th Street Ramp B	Sta1103+00 to Sta1107+70	466'	10'/13' (10')	Combination wall

Table 20 – New Retaining Wall Summary (continued)

Roadway	Wall No.	Description	Approximate Station Limits	Approximate Wall Length	Average Wall Height/ Maximum Wall Height[1]	Wall Type[2]
SR 202L Mainline	R8	Edge of EB SR 202L mainline, between the mainline and 40th/44th Street Frontage Road	Sta1109+24 to Sta 1116+77	753'	10'/10' (10' to 12')	Combination wall
	R10 (R9 not used)	Edge of EB SR 202L mainline between the mainline and 40th/44th Street Frontage Road	Sta1126+00 to Sta1131+71	571'	20'/26'	Regular wall
	R11	Edge of EB SR 202L mainline between the 44th St mainline and Ramp D	Sta 11+51 to Sta 14+34	283'	17'/25'	Regular wall
44th Street Ramp D	BW2 (BW1 not used)	Southern edge of 44th Street Ramp D	Sta 32+18 to Sta 33+19	101'	5'/5'	Barrier wall
SR 202L Mainline	R12	Edge of EB SR 202L mainline	Sta 25+58 to Sta 25+91	33'	5'/5' (14')	Combination wall
	R13	Edge of EB SR 202L mainline	Sta 32+00 to Sta 36+63	454'	5'/6' (10')	Combination wall
	R14-1	Edge of EB SR 202L mainline	Sta 38+38 to Sta 46+80	843'	6'/7' (12' to 14')	Combination wall for approximately 550'; remainder would be a regular wall
52nd Street Ramp B	R14-2	Southern edge of 52nd Street Ramp B	Sta 14+52 to Sta 21+04	647'	9'/12'	Regular wall
SR 202L Mainline	R19	Edge of EB SR 202L mainline	Sta 94+67 to Sta 107+60	1317'	11'/27'	Regular wall
	R15	Edge of EB SR 202L mainline	Sta 58+35 to Sta 58+80	44'	9'/11'	Regular wall
	R16	Edge of EB SR 202L mainline	Sta 60+36 to Sta 64+00	349'	7'/10'	Regular wall
	R17	Edge of EB SR 202L mainline	Sta 71+50 to Sta 73+55	197'	9'/14'	Regular wall
Van Buren Street Ramp D	R18	Western edge of Van Buren Street Ramp D	Sta 19+85 to Sta 25+00	514'	8'/11'	Regular wall
SR 202L Mainline	R19	Edge of EB SR 202L mainline	Sta 94+67 to Sta 107+60	1317'	11'/27'	Regular wall

Table 20 – New Retaining Wall Summary (continued)

Roadway	Wall No.	Description	Approximate Station Limits	Approximate Wall Length	Average Wall Height/ Maximum Wall Height[1]	Wall Type[2]
SR 202L Mainline	R20	Edge of EB SR 202L mainline	Sta 111+77 to Sta 118+16	672'	14'/22'	Regular wall
	BW3	Edge of EB SR 202L mainline	Sta 138+00 to Sta 143+35	535'	4'/5'	Barrier wall
EB Connector Road	R21	Southern edge of EB connector road	Sta 20+00 to Sta 27+00	703'	5'/5'	Regular wall
SR 202L Mainline	R22	Edge of EB SR 202L mainline	Sta 172+50 to Sta 176+00	350'	7'/10'	Regular wall
	R24 (R23 not used)[3]	Edge of EB SR 202L mainline	Sta 200+03 to Sta 209+65	960'	23'/34'	Specialty or regular wall: New wall could be located between an existing tiered wall system; the remainder of the new wall could be offset to avoid the existing wall that is immediately adjacent to the freeway.
	R25[3]	Edge of EB SR 202L mainline	Sta 210+35 to Sta 223+65	1364'	14'/18'	Regular wall
	R26[3]	Edge of EB SR 202L mainline	Sta 224+35 to Sta 231+40	706'	15'/17'	Regular wall
Scottsdale Road Ramp B	R27	Southern edge of Scottsdale Road Ramp B	Sta 16+30 to Sta 24+29	799'	15'/20'	Regular/specialty wall given its close proximity to an existing retaining wall.
SR 202L Mainline	R28	Edge of EB SR 202L between the mainline and Scottsdale Road Ramp B	Sta 236+00 to Sta 244+62	849'	20'/31'	Regular wall; Specialty wall may be required for the last 100' (+/-) since the existing wall is founded on drilled shafts (see Table 19)
	R29	Edge of EB SR 202L between the mainline and Scottsdale Road Ramp B	Sta 246+50 to Sta 253+00	650'	17'/31'	Regular wall; Specialty wall may be required for the last 100' (+/-) since the existing wall is founded on drilled shafts (see Table 19). A regular wall could potentially be utilized for the remainder of the retained section.
Scottsdale Road Ramp D	R30	Southern edge of Scottsdale Road Ramp D	Sta 9+25 to Sta 11+80	255'	7'/7'	Regular wall

Table 20 – New Retaining Wall Summary Table (continued)

Roadway	Wall No.	Description	Approximate Station Limits	Approximate Wall Length	Average Wall Height/ Maximum Wall Height(1)	Wall Type(2)
SR 202L Mainline	R31	Edge of EB SR 202L mainline	Sta 263+45 to Sta 264+78	136'	7'/9'	Regular wall
	R32	Edge of EB SR 202L mainline between the mainline and McClintock Road Ramp B	Sta 285+75 to Sta 286+25	50'	18'/19'	Regular wall
McClintock Road Ramp B	R33	Southern edge of McClintock Road Ramp B	Sta 15+40 to Sta 22+90	758'	9'/9'	Regular wall
SR 202L Mainline	R34	Edge of WB SR 202L mainline between the mainline and Scottsdale Road Ramp C	Sta 247+00 to Sta 254+00	702'	18'/26'	Specialty wall is likely required for at least the first 100' (+/-) since the existing wall is founded on drilled shafts (see Table 19). A regular wall could potentially be utilized for the remainder of the retained section.
McClintock Road Ramp A	R35	Edge of WB SR 202L mainline between the mainline and Scottsdale Road Ramp C	Sta 251+60 to Sta 266+54	1498'	9'/11'	Regular wall
SR 202L Mainline	R36	Northern edge of McClintock Road Ramp A	Sta 102+00 to Sta 106+70	469'	7'/7'	Regular wall
	R37	Edge of WB SR 202L mainline between the mainline and Scottsdale Road Ramp A	Sta 234+65 to Sta 244+65	1015'	22'/30'	Regular wall. A specialty wall is likely required for at least the last 300' (+/-) since the existing wall is founded on drilled shafts (see Table 19)

(1) For combination walls, the retaining wall height is given. The number in parentheses indicates the height required for noise mitigation; this height may either be an addition to, or part of, the overall wall height.
(2) Wall type may be impacted pending further noise analyses, structural analyses, and/or geotechnical investigations.
(3) Portions of these retaining walls have existing artistic treatments attached to the fascia. The City of Tempe has requested that these treatments be salvaged and placed on the exterior face of the new walls.

4.7.2 Noise Walls

All noise walls shown or discussed in this report may be revised during the project development process.

A preliminary noise study was completed for this project and is documented in a separate report. In selected locations, noise walls will be mounted on retaining walls or bridge structures. A structural analysis will be required to account for the added noise wall requirements for each applicable bridge structure and retaining wall.

Noise walls are currently planned to be included on the following bridges: 24th Street TI Overpass, Grand Canal Overpass, 40th Street TI Overpass, 48th Street Overpass, 52nd Street Overpass and Van Buren Overpass.

4.7.3 Box Culverts

Existing box culverts were investigated to determine if the freeway widening would have any impact on the structural capacity of the existing structures. The box culverts located within the widened freeway section are listed in Table 21. The box culverts have been grouped together according to their original freeway design segments.

Table 21 – Box Culvert Summary

General Location	Box Culvert Description
Near I-10/SR 51 TI to 40th Street	2-cell 8'x6', 1-cell 8'x6', 4-cell 12'x8', 2-cell 10'x3'
SR 143 TI	2-cell 6'x4', 2-cell 10'x4', 1- cell 8'x8', 1-cell 16'x15.21', 1-cell 16'x15.5', 2-cell 6'x4', and 1-cell 6'x2'
Near UPRR/Grand Canal Overpass	2-cell 8'x5' with transitions
SR 202L Station 258+50 (+/-)	2-cell 8'x6'

At all locations, retaining walls appear to mitigate the necessity of extending the existing culverts. Verification that existing box culverts can accommodate increased loadings due to additional embankment fill will need to be performed during final design. No significant structural modifications to the existing box culverts are anticipated.

4.8 DRAINAGE

4.8.1 On-Site Systems

Analysis Criteria

The drainage evaluation was based on the requirements of Chapter 600 of ADOT's *Roadway Design Guidelines*. The minimum catch basin spacing was based on the allowable spread requirements for each roadway classification.

On-Site System Overview

The on-site drainage analysis in this study addresses the required pavement drainage system modifications necessary for the widened freeway mainline and interchange ramp realignment areas. Modifications to the off-site drainage system will not be required with this project, and was therefore not evaluated with this study. The proposed drainage system concept is illustrated in Appendix D.

In developing the modified pavement drainage system, the general approach is to expand the existing storm drain pipe and inlet system to be compatible with the requirements of the additional general purpose-lanes. The existing median and shoulder catch basins will be retrofitted to be compatible with the roadway pavement locations and widths required with the Recommended Alternative.

The existing 30" CIPCP between 24th and 40th Streets was installed in the late 1980's by a unique concrete cast-in-place construction method. The pavement widening associated with the Recommended Alternative will require portions of this pipe to be located beneath the new eastbound travel lanes.

The design of the CIPCP is typical based on load tests performed during the construction of the pipe and bedding material. The construction records were unavailable to determine the type bedding material that was used for the pipe. Load test results were also unavailable. Without this information an accurate structural capacity evaluation could not be preformed.

It is currently anticipated that the existing CIPCP would remain in service for the locations where the new loading conditions will be similar to existing conditions. However, a video analysis of the pipe will be performed during the Stage II final design to evaluate the current condition of this pipe.

At locations where the CIPCP would remain under existing travel lanes special inspection access manholes will be installed along the 30" CIPCP at 500' interval spacing. Special inspection manholes would provide horizontal access from outside the traveled lane.

A deck drainage analysis will be performed as part of the preliminary design. It is anticipated that the proposed deck drainage design will match the existing systems in concept.

Provisions may be needed to accommodate cross drainage at the proposed noise walls locations.

4.8.2 Salt River and Indian Bend Wash

Salt River

Table 22 presents the results of the Corps hydrologic analyses for the Salt River at the Mill Avenue bridge, which is approximately two miles downstream of the SR 202L bridge. These discharges were used to define the peak discharge for various frequency flood events within the project reach. The peak discharge-frequency data presented in Table 22 was developed in the 1982 Corps study.

Table 22 – Salt River Discharges at Mill Avenue Bridge

Return Period (years)	Discharge (cfs)
5	40,000
10	93,000
20	135,000
50	160,000
100	215,000
200	275,000
500	330,000

A digital terrain model (DTM) was generated from aerial photos of the Salt River that were obtained in August 2005. At the time the river was photographed, water was ponded upstream of the Tempe Town Lake east dam. Therefore, the DTM that was developed from these aerial photographs does not provide the channel elevations needed to develop the hydraulic model. As a result, a DTM was obtained from the FCDMC based upon aerial photographs dated December 17, 2000.

Recent aerial mapping provided by Cooper Aerial Surveys in 2005 was used to develop the hydraulic model for Indian Bend Wash.

Two previously adopted HEC-2 hydraulic models for this segment of the Salt River were obtained from the FCDMC. The cross-section locations are the same in both HEC-2 models and are shown in Figure 22. Each hydraulic model begin at Grade Control Structure No. 5 located just downstream of McClintock Drive.

The first hydraulic model was documented in the *Bridge Hydraulics Report for the Pima Freeway Crossing*, Simons Li & Associates (SLA)(1992). The Dobson Road alignment was the upstream limit of the model that was used to estimate the original scour depths for the freeway bridges, and also included the proposed bank protection between McClintock Drive and Dobson Road. The model was based on three different topographic maps, including Kenney Aerial 1986, Cooper Aerial 1990, and ADOT 1990.

A second HEC-2 hydraulic model was developed by SLA after the completion of the construction of the river channelization and freeway bridges. This study was used to evaluate and document the as-built hydraulic conditions of the river. Kenney Aerial Mapping generated the topography in 1994. Figure 22 depicts the HEC-2 cross-section locations, a plan view of the bridge structures, and the locations of the bank-stabilization measures from that hydraulic model.

A new HEC-RAS hydraulic model was developed for this study using the same cross-section locations and alignments from the SLA models. Summary tables of the hydraulic parameters for the 10-year, 100-year and "Superflood" events are shown in Tables 23, 24 and 25, respectively.

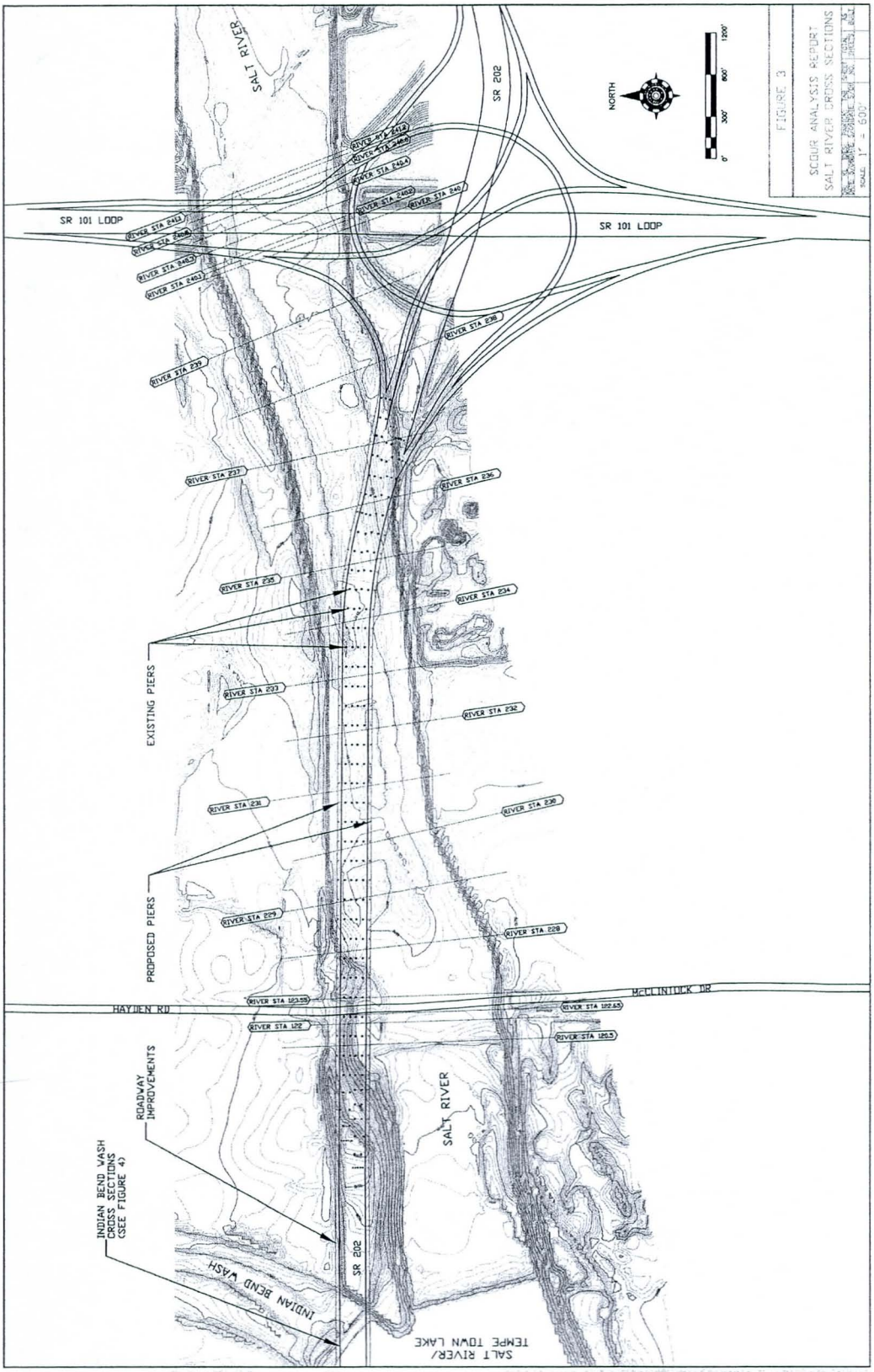


Figure 22 – Salt River Hydraulic Models Cross Section Locations

Table 23 – 10-Year Hydraulic Parameters in Salt River

Cross Section ID	10-year Flow (cfs)	Flow Depth (ft)	Velocity (ft/s)	Froude #
120.50	93,000	9.16	11.39	0.72
122.00	93,000	10.04	9.86	0.56
122.65	93,000	10.22	9.71	0.55
123.55	93,000	11.24	9.35	0.51
228.00	93,000	14.04	7.86	0.40
229.00	93,000	18.10	8.00	0.38
230.00	93,000	17.13	9.20	0.43
231.00	93,000	22.02	9.02	0.40
232.00	93,000	21.40	9.13	0.39
233.00	93,000	20.23	9.73	0.41
234.00	93,000	22.74	9.15	0.38
235.00	93,000	21.34	8.28	0.34
236.00	93,000	22.03	7.52	0.30
237.00	93,000	21.79	6.85	0.27
238.00	93,000	23.23	5.56	0.21
239.00	95,300	23.66	6.14	0.25
240.00	95,300	20.65	5.47	0.22
240.10	95,300	20.76	5.15	0.21
240.20	95,300	20.77	5.09	0.21
240.30	95,300	20.83	5.01	0.21
240.40	95,300	20.85	5.03	0.21
240.50	95,300	20.87	4.93	0.20
240.60	95,300	20.62	5.02	0.21
241.10	95,300	19.88	5.05	0.21
241.20	95,300	19.87	5.05	0.21

* Information in Table provided by AZTEC Engineering

The average velocity and depth through the existing and proposed bridge structures during a 100-year flood is approximately 10.5 feet-per-second (fps) and 27.8', respectively. These average hydraulic conditions were used in the original SLA local scour computations for the 100-year flood as well as these updated computations.

Table 24 – 100-Year Hydraulic Parameters in Salt River

Cross Section ID	100-year Flow (cfs)	Flow Depth (ft)	Velocity (ft/s)	Froude #
120.50	215,000	14.26	15.45	0.76
122.00	215,000	14.84	14.30	0.66
122.65	215,000	15.05	14.50	0.67
123.55	215,000	17.80	12.63	0.54
228.00	215,000	20.87	11.38	0.46
229.00	215,000	24.92	11.88	0.46
230.00	215,000	24.01	14.07	0.54
231.00	215,000	29.20	13.98	0.51
232.00	215,000	28.59	13.86	0.49
233.00	215,000	27.54	14.56	0.52
234.00	215,000	31.15	13.32	0.46
235.00	215,000	30.05	12.15	0.41
236.00	215,000	31.48	10.54	0.35
237.00	215,000	32.28	9.78	0.31
238.00	215,000	34.09	8.18	0.25
239.00	220,000	34.48	8.56	0.28
240.00	220,000	31.72	7.75	0.25
240.10	220,000	31.83	7.24	0.23
240.20	220,000	31.85	7.18	0.23
240.30	220,000	31.96	6.90	0.22
240.40	220,000	31.97	6.84	0.22
240.50	220,000	31.99	6.70	0.22
240.60	220,000	31.73	6.79	0.22
241.10	220,000	30.99	6.87	0.23
241.20	220,000	30.97	6.83	0.23

* Information in Table provided by AZTEC Engineering

The "Superflood" (Q=250,000 cfs) hydraulic parameters for the design conditions were also determined in order to estimate the maximum scour depths for the piers needed to widen the existing bridges. Table 25 of this report presents a summary of the results of the hydraulic analysis for the "Superflood" event.

Table 25 – "Superflood" Hydraulic Parameters in Salt River

Cross Section ID	"Superflood" Flow (cfs)	Flow Depth (ft)	Velocity (ft/s)	Froude #
120.50	250,000	15.26	16.59	0.79
122.00	250,000	15.80	15.46	0.70
122.65	250,000	16.02	15.73	0.70
123.55	250,000	19.00	13.63	0.56
228.00	250,000	22.25	12.29	0.48
229.00	250,000	26.30	12.86	0.49
230.00	250,000	25.41	15.27	0.57
231.00	250,000	30.72	15.10	0.54
232.00	250,000	30.09	14.95	0.52
233.00	250,000	29.07	15.68	0.54
234.00	250,000	33.01	14.24	0.47
235.00	250,000	31.97	13.04	0.43
236.00	250,000	33.65	11.19	0.36
237.00	250,000	34.77	10.40	0.32
238.00	250,000	36.68	8.59	0.26
239.00	250,000	37.07	9.11	0.28
240.00	250,000	34.39	8.03	0.25
240.10	250,000	34.49	7.50	0.23
240.20	250,000	34.52	7.44	0.23
240.30	250,000	34.64	7.16	0.22
240.40	250,000	34.64	7.06	0.22
240.50	250,000	34.67	6.92	0.22
240.60	250,000	34.41	7.02	0.22
241.10	250,000	33.66	7.11	0.22
241.20	250,000	33.65	7.06	0.22

* Information in Table provided by AZTEC Engineering

The average velocity and depth through the proposed bridge structures during a "Superflood", is approximately 11.2 fps and 29.9', respectively.

The water surface elevation (WSEL) and velocity within the river would increase slightly over the existing conditions due to the additional piers required for the bridge widening. A comparison of these hydraulic parameters for the 100-year event is shown in Table 26. The results of the analysis indicated that the construction of the additional piers would have a minimal impact on the hydraulic conditions within the Salt River, and would not impact the available freeboard provided for the river bank protection.

Table 26 – 100-year Hydraulic Analysis Results Comparison

Cross Section ID	100-year Flow Rate (cfs)	Existing WSEL *(1) (ft)	Existing Velocity (ft/s)	Proposed WSEL *(1) (ft)	Proposed Velocity (ft/s)	Difference Between Proposed and Existing WSEL *(1) (ft)
120.50	215,000	1165.17	15.45	1165.17	15.45	0.00
122.00	215,000	1165.84	14.30	1165.84	14.30	0.00
122.65	215,000	1166.05	14.50	1166.10	14.79	0.05
123.55	215,000	1168.8	12.63	1168.17	12.51	-0.63
228.00	215,000	1170.26	11.38	1170.19	11.50	-0.07
229.00	215,000	1170.70	11.88	1170.44	12.44	-0.26
230.00	215,000	1171.23	14.07	1170.6	14.99	-0.63
231.00	215,000	1172.20	13.98	1171.50	14.97	-0.70
232.00	215,000	1172.59	13.86	1171.45	14.82	-1.14
233.00	215,000	1173.15	14.56	1172.04	15.48	-1.11
234.00	215,000	1175.15	13.32	1174.77	13.77	-0.38
235.00	215,000	1176.05	12.15	1175.95	12.23	-0.10
236.00	215,000	1177.48	10.54	1177.88	10.96	0.40
237.00	215,000	1179.28	9.78	1179.51	9.82	0.23
238.00	215,000	1180.09	8.18	1180.39	8.08	0.30
239.00	215,000	1180.08	8.56	1180.37	8.48	0.29
240.00	220,000	1180.80	7.75	1181.07	7.67	0.27
240.10	220,000	1180.83	7.24	1181.09	7.17	0.26
240.20	220,000	1180.85	7.18	1181.12	7.11	0.27
240.30	220,000	1180.96	6.90	1181.23	6.84	0.27
240.40	220,000	1180.97	6.84	1181.23	6.77	0.26
240.50	220,000	1180.99	6.70	1181.25	6.64	0.26
240.60	220,000	1180.98	6.79	1181.25	6.72	0.27
241.10	220,000	1180.99	6.87	1181.25	6.81	0.26
241.20	220,000	1180.97	6.83	1181.24	6.76	0.27

Notes: (1) The water surface and bank protection elevations are NAVD 88 datum.
* Information in Table provided by AZTEC Engineering

Table 27 – 100-year Hydraulic Freeboard Comparison

Cross Section ID	Top of Bank Elevation *(1) (ft)	Existing WSEL *(1) (ft)	Existing Bank Freeboard (ft)	Proposed WSEL *(1) (ft)	Proposed Bank Freeboard (ft)
120.50	1173.72	1165.17	8.55	1165.17	8.55
122.00	1172.22	1165.84	6.38	1165.84	6.38
122.65	1171.32	1166.05	5.27	1166.10	5.22
123.55	1172.12	1168.8	3.32	1168.17	3.95
228.00	1174.32	1170.26	4.06	1170.19	4.13
229.00	1174.92	1170.70	4.22	1170.44	4.48
230.00	1174.72	1171.23	3.49	1170.6	4.12
231.00	1174.52	1172.20	2.32	1171.50	3.02
232.00	1175.72	1172.59	3.13	1171.45	4.27
233.00	1175.92	1173.15	2.77	1172.04	3.88
234.00	1178.92	1175.15	3.77	1174.77	4.15
235.00	1179.82	1176.05	3.77	1175.95	3.87
236.00	1180.92	1177.48	3.44	1177.88	3.04
237.00	1182.92	1179.28	3.64	1179.51	3.41
238.00	1183.42	1180.09	3.33	1180.39	3.03
239.00	1182.52	1180.08	2.44	1180.37	2.15
240.00	1184.92	1180.80	4.12	1181.07	3.85
240.10	--	1181.83	--	1181.09	--
240.20	--	1181.85	--	1181.12	--
240.30	--	1180.96	--	1181.23	--
240.40	--	1180.97	--	1181.23	--
240.50	--	1180.99	--	1181.25	--
240.60	--	1180.98	--	1181.25	--
241.10	1184.52	1180.99	3.53	1181.25	3.27
241.20	--	1180.97	--	1181.24	--

Notes: (1) The water surface and bank protection elevations are NAVD 88 datum.
100-year WSEL for the proposed condition increases, but is contained within the existing bank protection. The bank protection elevations were obtained from the SLA report, but were on NAVD 29 datum. The conversion factor (+1.92') was added to the elevations to adjust to the NGVD 1988 datum.
* Information in Table provided by AZTEC Engineering

Temporary construction access road may be constructed within the Salt River and Tempe Town Lake to build portions of the Indian Bend Wash and Salt River bridges. The access roads would be designed with culverts to pass a low frequency storm event, and to erode for flow events greater than the 2-year event.

A preliminary hydraulic analysis was performed to ensure flow would be contained within the watercourses during minor flow events in the river. The analysis indicated the access roads would not impact the river hydraulic conditions. The contractor should

provide a more detailed hydraulic analysis for the final access road configuration prior to construction.

A bridge scour analysis was conducted for the Salt River bridges. The scour analysis consisted of estimating the various scour components associated with the SR 202L bridge structures crossing the Salt River. The analysis considered the effects of long-term degradation, general scour, low-flow incisement, bed-form scour, and pier scour.

The previous scour analysis was developed in 1992 by SLA. The total scour was estimated using average hydraulic parameters. The average hydraulic parameters were selected because the flows used in the scour calculations are very conservative. The modifications to Theordore Roosevelt Dam greatly reduce the discharges in this reach of the Salt River. The modifications to the dam were not completed before the Salt River bridge was designed, so the higher flows were used during final design and construction. This scour analysis used the same pre-Roosevelt Dam modification flows as the original design criteria.

The total estimated scour depth is 37.1' for the 100-year event and of 38.5' for the "Superflood" event as shown in Table 28. These calculated scour depths are similar to the scour depths shown in the 1992 SLA report, which recommended total scour depths of 37.9' for the 100-year event and 39.4' for the "Superflood" event.

Table 28 – Total Scour Depths for the SR 202L Bridge over the Salt River

Flood Event	Flow (cfs)	Long-term Scour (ft)	Low-flow Channel (ft)	General Scour (ft)	Pier Scour (ft)	30% Factor of Safety (ft)	Total Scour (ft)
100-year	215,000	1.7	2.0	0.9	23.9	8.6	37.1
"Superflood"	250,000	1.7	2.0	1.1	24.8	8.9	38.5

* Information in Table provided by AZTEC Engineering

Indian Bend Wash

The hydrology from the Indian Bend Wash Flood Insurance Study (FIS) was used for the hydraulic analysis. The hydraulics from the FIS did not accurately reflect the IBW drop structure, so a new hydraulic model was developed for this study. The new model incorporates the drop structure from as-built drawings and the existing topographic conditions provided with recent aerial mapping provided by Cooper Aerial Surveys. The hydraulic analysis results indicate the proposed improvements would not impact the existing hydraulic characteristics of Indian Bend Wash.

The original Scour Report for the SR 202 Indian Bend Wash bridge was completed by SLA in 1990, and included the IBW drop structure. The Indian Bend Wash design discharge was higher than the discharges resulting from the 1997 FIS, resulting in calculated scour depths that are higher than the design scour depths calculated herein.

The new hydraulic model as developed for the 100-year and SPF flood events based on the as-built drawings for the IBW Drop Structure. The bridge piers that are located within the drop structure are adequately protected from scour since the drop structure is not anticipated to fail during the Standard Project Flood (SPF). For the piers that are not located within the drop structure, total calculated scour depth is estimated to be 21.5' for the 100-year event and of 30.2' for the SPF as shown in Table 29.

These values are lower than the original scour depths from the 1990 SLA Report, which included a total scour depth of 34.0' for the 100-year event and 41.0' for the SPF.

Table 29 – Total Scour Depths for the SR 202L Bridge Over the Indian Bend Wash

Flood Event	Flow (cfs)	Long-term Scour (ft)	Bed-Form Scour (ft)	Low-flow Channel (ft)	General Scour (ft)	Pier Scour (ft)	30% FOS (ft)	Total Scour (ft)
100-year	20,000	0.1	0.2	2.0	2.1	12.1	5.0	21.5
SPF	39,000	0.1	0.9	2.0	3.9	16.3	7.0	30.2

* Information in Table provided by AZTEC Engineering

Flood Control Permits at Indian Bend Wash and Salt River

The City of Tempe (COT) has primary responsibility to regulate the 100-year floodplain within their City limits, which includes Indian Bend Wash and the portion of the Salt River within Tempe Town Lake. Therefore, the COT will review and approve the project features located within the 100-year floodplain. Any flood control permits and design details required for construction of the proposed improvements within Tempe Town Lake must be obtained by the COT.

The IBW Drop Structure and Salt River bank protection is owned and maintained by FCDMC. The FCDMC will review and approve the design of any of their features that would be impacted by the project including the IBW drop structure penetrations, bank protection penetrations, and temporary construction access roads proposed within the river. The FCDMC will also be the agency responsible to regulate the 100-year floodplain outside the limits of the COT.

A FCDMC Right-of-Way Use Permit will be required to construct any of the proposed improvements within their right-of-way. A Right-of-Way Use Permit will also be required during final design to obtain temporary access for geotechnical investigations.

4.9 EARTHWORK

The earthwork required for the construction of this project would include approximately 45,000 cubic yards of excavation and 175,000 cubic yards of embankment. An additional 100,000 cubic yards of embankment will be required to be placed within Tempe Town Lake and the Salt River for the temporary construction access roads.

4.10 TRAFFIC DESIGN

4.10.1 Signing and Pavement Marking

A guide sign concept was prepared to ensure an effective guide signing plan could be developed for the preferred alternative. The goal of the signing concept is to provide clear advance guide signing for the route, while maintaining the integrity of the signing schemes on the SR 202L freeway corridor. A preliminary guide signing plan is provided in Appendix D.

The existing signs and sign structures would be relocated or replaced in accordance with the proposed freeway widening. The final sign locations will be determined during the development of the final design plans and will consider existing and new locations of utilities, bridge structures, retaining and noise walls, drainage features, lighting standards, and other appurtenances.

The modified pavement marking concept would be developed to incorporate the existing and new lane configurations for the mainline, auxiliary lanes, service interchange ramps and system interchange ramps.

The preliminary pavement marking concept has been developed in accordance with the ADOT *Signing and Marking Standard Drawings* 2002 (and recent updates) that reference the requirements for lane lines, edge lines, and gore striping.

4.10.2 Lighting

Full freeway lighting is currently provided on the SR 202L within the study limits. An evaluation was conducted to determine if the existing median lighting (on the mainline) and high mast lighting (at the system interchanges) could accommodate the additional travel lanes associated with the recommended alternative.

The modifications to the existing lighting systems were evaluated in accordance with the criteria established in the *American National Standard Practice for Roadway Lighting, ANSI/IES RP-8-00* (2000). This publication identifies nationally recognized design criteria for roadway lighting and has been adopted by ADOT. In addition, the following criteria listed in the ADOT *Urban Highways Design Procedures Manual* was used in the lighting analysis criteria:

- Average maintained horizontal illuminance for freeway lighting: 0.6 to 0.8 foot-candles (Fc) on the roadway
- Minimum illuminance: 0.2 foot-candles
- Average to minimum uniformity ratio: 3:1 to 4:1
- Light loss factor (LLF): 0.81

Based on these criteria, illuminance lighting levels were calculated every six feet along the traveled roadway. Based on the initial lighting evaluation, the existing median and high mast lighting systems would need to be modified at certain locations by adding light fixtures to the existing assemblies.

Typically, the transition between the mainline lighting and the service interchange ramp lighting occurs at the back of the gore. As required, the existing light poles located along the ramps would be relocated in accordance with the new ramp alignment(s).

Additional lighting analysis will be required during final design including a lighting analysis for the crossroads that include the shadow effects off the freeway overpasses and underpasses, along with the use of underdeck lighting to enhance the lighting beneath the bridge structures.

4.10.3 Freeway Management System

The existing Freeway Management System (FMS) includes an integrated system of Dynamic Message Signs (VMS), pull boxes, system detectors, CCTV cameras and ramp meters placed throughout this segment of the SR 202L corridor. These FMS features are connected to the ADOT Traffic Control Center by three 3" conduits that are located along the eastbound and westbound roadways. These existing FMS features will be required to be relocated within the limits of the freeway widening.

New FMS Design Guidelines will be adopted in the near future. The new guidelines will allow the FMS communication system to be provided with three 3" conduits placed along one side of the freeway. Therefore, the initial recommendation for the FMS system is to abandon the conduits and communication lines that currently parallel the eastbound roadway, and retain the existing system along the westbound roadway. The relocated FMS elements along the eastbound roadway would be connected to the north fiber optic cable trunk line by boring new conduit beneath the mainline pavement.

Due to the age of the existing equipment, some items may need to be replaced with new equipment. The existing fiber optic cable is anticipated to be removed and replaced with new fiber optic cable. The system detectors would also be abandoned and

replaced with new Passive Acoustic Detectors (PAD's), and placed approximately every mile in each direction of travel in advance of each entrance ramp. New DMS sign structures will also be required in conformance with the new sign support requirements.

The FMS system must remain operational at all times during the construction of this project.

4.11 CONSTRUCTION PHASING AND TRAFFIC CONTROL

Traffic will be managed by detailed traffic control plans and by procedures and guidelines specified in Part VI of the *Manual of Uniform Traffic Control Devices* (MUTCD), 2003 Version, and by the Arizona Supplement to Part VI of the MUTCD.

Freeway traffic will be carried through the construction work zone at all times during this project. The conceptual construction phasing plan for the mainline widening would include the following:

- The HOV and general-purpose lanes would be shifted toward the median utilizing a portion of the median shoulder. Temporary concrete barrier would be placed adjacent to the existing SR 202L outside shoulders. All grading, drainage, pavement widening, bridge widening, retaining wall demolition and construction, sign structure foundations, and other items would be constructed in this phase.
- The HOV and general-purpose lanes would be shifted to the right utilizing a portion of the right shoulder for the outside lane. Temporary concrete barrier would be placed adjacent to the median shoulder. All median construction activities would occur during this phase.
- Bridge girder and superstructure erection will likely require intermittent freeway closures. A detailed traffic control plan should be developed for each bridge location to define the detour route at each location.

The system and service interchange ramp connections within the limits of the pavement widening would be reconstructed to match the widened mainline roadway. These ramp connections would remain open to traffic wherever feasible. Where the new ramp horizontal and vertical alignments are modified a sufficient amount to preclude leaving the ramp open to traffic, the ramp would be closed for the reconstruction activities.

The ramp closure would coincide with the widening of the bridge on the same interchange crossroad. Successive entrance and exit ramps should not be closed to traffic at the same time.

The construction of the widened bridges would impact the traveling public on the crossroads. Feasible bridge widening solutions are available to allow the crossroads to remain open to traffic during the bridge construction activities. However, a number of the bridges that would be widened will require falsework and/or towers for support. At these locations, the number of crossroad lanes would be required to be reduced to one

left-turn lane and two through lanes in each direction of travel during bridge widening activities.

Coordination will be required with the local agencies to determine the project phasing restrictions that will be used for this project. These restrictions could include limits in the number of crossroads and ramp connections that would be under construction at the same time. For example, it may not be desirable to widen the freeway overpasses and realign the ramps for the 32nd Street TI and 40th Street TI at the same time due to local agency concerns about arterial street capacity, freeway access, and emergency vehicle access.

The final construction phasing and traffic control plans will be developed during the final design.

4.12 CITY OF TEMPE FACILITIES AT TEMPE TOWN LAKE

The City of Tempe (COT) has parking and building facilities located below the Mill Avenue Viaduct. This project is not anticipated to significantly impact these existing facilities.

The City of Tempe (COT) has existing landscaping, pathways, pathway lighting, parking lots and decorative wall features that are located within and adjacent to the ADOT right-of-way between Mill Avenue and College Avenue. In locations where the existing Tempe improvements are located within the ADOT right-of-way, these facilities were constructed within the right-of-way with a lease agreement or encroachment permit. The City of Tempe facilities that are within the freeway right-of-way would be relocated by the City of Tempe.

Coordination will be required with the COT to relocate the existing facilities that would conflict with the proposed roadway improvements.

4.13 UTILITY, RAILROAD AND VALLEY METRO RAIL COORDINATION

Utility Coordination

During final design, each utility company will receive and review the preliminary design for this project and develop plans for any relocations and/or adjustments.

Using the as-built plans and the conceptual plans developed for the recommended alternative, it is anticipated that minimal utility impacts would occur with this project. A summary of the potential utility impact locations are as follows:

- Noise wall and retaining wall construction may impact the City of Phoenix 8" sanitary sewer line at 26th Street, a 10" sanitary sewer at 28th Street, a 16" RCP water line at 29th Street, and the 21" sanitary sewer line at 30th Street.

- The widening of the SR 202L grade separation structure at Washington Street should be feasible without de-energizing the APS 69kV power line across the freeway corridor.
- The widening of the SR 202L overpass over the Mill Avenue Viaduct should be feasible without de-energizing the SRP overhead 69kV power lines across the freeway corridor.
- The widening of the Salt River Bridge EB and WB at McClintock Drive should be feasible without de-energizing the 12kV, 69kV and 230kV power lines owned by APS and SRP. However, one of the bridge piers is near an existing City of Tempe 36" water line near SR 202L Station 295+25. The new drilled shaft for the bridge widening should avoid direct conflict with the water line.

The Grand Canal is owned and operated by Salt River Project (SRP). The Grand Canal crosses the SR 202L corridor just east of 32nd Street and just south of Washington Street. Coordination will be required with SRP to maintain their canal maintenance roads open during the construction of the freeway overpasses.

UPRR Coordination

The SR 202L mainline passes over the Union Pacific Railroad (UPRR) one half mile south of Washington Street, and again west of Mill Avenue. The crossing near Washington Street is at UPRR milepost 912.30 (SR 202L MP 4.83), UPRR Federal Project Number 7048184W. The crossing west of Mill Avenue is at UPRR milepost 913.86 (SR 202L MP 6.34), UPRR Federal Project Number 753711Y.

It is anticipated that precast girder construction would be used to span the UPRR at each freeway overpass. The use of precast girders would eliminate the need for falsework towers and crash walls for the construction of these spans. It also reduces the duration and potential impacts to railroad traffic.

The proposed widenings of the SR202L may occur within the current limits of the existing railroad agreements. Coordination with representatives of the UPRR will be necessary to confirm the necessary design details, permit requirements, construction requirements, and agreement requirements for the two crossings.

Valley Metro Rail Coordination

The SR 202L also passes over the "METRO" LRT tracks at Washington Street (SR 202L MP 4.52), and again west of Mill Avenue (SR 202L MP 6.34).

Reconstruction/relocation costs for the relocation of the catenary lines are anticipated to be incurred by the Valley Metro Rail. Coordination will be needed with Valley Metro Rail during the design of this project to obtain their concurrence of the construction features for the relocation of their facilities

4.14 GEOTECHNICAL AND PAVEMENT DESIGN

4.14.1 Modification of Bridge Structures

The site soils are generally considered to be well suited for the use of either shallow spread foundations or drilled shafts at relatively shallow depths. Though several of the existing bridges are supported either partially or solely by steel H-piles, the common practice today for widening projects (or new construction) in Arizona, is to utilize drilled shafts. Spread footings should provide adequate support for widened structure elements which are currently supported on shallow footings. Allowable bearing pressures from 2 to 5 ksf are anticipated for finer grained surficial soils, from 10 to 20 ksf within the SGC and from about 8 to 20 ksf within the weathered, upper contacts of the underlying granite and Tempe Formation sedimentary bedrock. Table 30 provides a listing of the structures to be widened, the existing foundation conditions and expectations for foundations required for the widened structures.

Drilled shafts derive significant support (both in shear and end bearing) from the dense GGC deposit that underlies much of the study area. More heavily loaded shafts which support the Indian Bend Wash and Salt River Bridge structures extend also within the underlying variably firm to hard basin fill materials. In 1990, load tests of the underlying finer grained basin fill was performed as part of the Drilled Shaft Load Test Research Program (Thomas Hartig and Associates, Inc., 1990). The study investigated the applicability of constructing large (10' diameter) drilled shafts through the SGC and into the basin fill. Shafts of this size and depth were required to handle axial loads in excess of 3,500 kips with a scour condition of about 40'. The load test results indicated that initial assumptions of shaft-soil shear stress within the undrained basin fill soils were roughly 60% of what could actually be utilized.

Table 30 – Summary of Existing and Recommended Foundation Types

Bridge	Existing Foundation Type	Recommended Foundation Type	Comments
24th Street OP (Single Span)	Abutments on Driven Piles	Drilled Shafts	Shafts to be Founded in SGC Soils Below Approx. 20'
32nd Street TIOP (Single Span)	Abutments on Driven Piles	Drilled Shafts	Shafts to be Founded in SGC Soils Below Approx. 15'
Grand Canal Bridge (Single Span)	Abutments on Driven Piles	Drilled Shafts	Shafts to be Founded in SGC Soils Below Approx. 20'
40th Street TIOP (Two Span)	Abutments and Piers On Drilled Shafts	Drilled Shafts	Shafts to be Founded in Hard Soils (and Possible Sandstone Below Approx. 60')
44th Street TIOP (Three Span)	Abutments and Piers on Spread Footings	Spread Footings	Footings to be Founded on Hard Soils at Shallow Depth
East Papago TIUP (Four Span)	Abutments and Piers on Spread Footings	Spread Footings	Footings to be Founded on Hard Soils at Shallow Depth

Table 30 – Summary of Existing and Recommended Foundation Types (continued)

Bridge	Existing Foundation Type	Recommended Foundation Type	Comments
48th Street OP (Three Span)	Abutments on Shafts, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Firm to Hard Soils Below Approx. 10'
52nd Street Ramp B OP (Three Span)	Abutments on Driven Piles, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Firm to Hard Soils Below Approx. 5'
52nd Street OP (Three Span)	Abutments on Driven Piles, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Firm to Hard Soils Below Approx. 10'
Sky Harbor WB OP (Three Span)	Abutments on Drilled Shafts, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded on SGC or Underlying Granite
Van Buren Street OP (Two Span)	Abutments on Driven Piles, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Shallow Granite Bedrock
Washington Street OP (Three Span)	Abutments on Driven Piles, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Shallow Granite Bedrock
SPRR Grand Canal Viaduct (Four Span)	Abutments on Driven Piles, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded in Shallow Granite Bedrock
Sky Harbor WB OP (Three Span)	Abutments on Drilled Shafts, Piers on Spread Footings	Abutments on Drilled Shafts, Piers on Spread Footings	Shafts and Footings to be Founded on SGC or Underlying Granite
Mill Avenue Viaduct (Seven Span)	Abutments and Piers on Drilled Shafts	Abutments and Piers on Drilled Shafts	Abutment Shafts May be Founded on SGC or Granite with Piers Likely Extending to Granite
West Pedestrian OP (Single Span)	Abutments on Drilled Shafts	Abutments on Drilled Shafts	Shafts to extend to Shallow SGC or to Underlying Tempe Formation Rock Depending on Loads
East Pedestrian OP (Single Span)	Abutments on Drilled Shafts	Abutments on Drilled Shafts	Shafts to extend to Shallow SGC or to Underlying Tempe Formation Rock Depending on Loads
College Avenue OP (Single Span)	Abutments on Dual Row of Drilled Shafts	Abutments on Drilled Shafts	Shafts Founded in SGC or Underlying Tempe Formation
Scottsdale Road TI (Single Span)	Abutments on Dual Row of Drilled Shafts	Abutments on Drilled Shafts	Shafts Founded in SGC
Indian Bend Wash (EB/WB) (8 Span)	Abutments and Piers on Drilled Shafts	Abutments and Piers on Drilled Shafts	Shafts Founded in SGC and Underlying Basin Fill
Salt River Bridge (EB/WB) (39 Spans EB/ 38 Spans WB)	Abutments and Piers on Drilled Shafts	Abutments and Piers on Drilled Shafts	Shafts Founded in SGC and Underlying Basin Fill

4.14.2 Retaining Walls

Approximately 38 new retaining or barrier walls will be required to accommodate the widened mainline pavement sections and modifications to some of the existing ramps. The number of, and locations of walls will vary depending on the roadway alternative that is selected. Wall heights of up to 35' are anticipated with average heights in the 5' to 23' range. Conceptual locations at this time indicate the majority of walls to be founded on existing roadway embankment with less than five or six walls founded at grade or within cut conditions.

The majority of walls can likely be constructed as standard cast-in-place concrete walls with spread footings at relatively low to moderate allowable soil bearing pressures. Standard wall footings will be constructible provided the new walls are located a sufficient distance from existing walls (laterally and vertically). The use of drilled shafts may be preferred in some locations depending on proximity to existing structures and in some areas as dictated by poor subgrade conditions. Drilled shaft walls currently exist in the vicinity of Scottsdale Road to penetrate thru softer soils. Other special design walls, such as L-shaped footing walls, may be needed due to the proximity of new walls to existing structures.

4.14.3 Recommended Pavement Structural Sections

From a preliminary basis, it is recommended that the widening of the SR 202L mainline pavements at minimum match the adjacent existing structural pavement section. However, it is further recommended based on discussions with ADOT Materials Pavement Design Section that the new PCCP pavements have a minimum thickness of 12.5". Table 31 provides the recommended pavement structural sections:

Table 31 – Preliminary Pavement Structural Sections

Location	AB-2 (inches)	AC (Base Mix) (inches)	Plain PCCP (inches)	AR-ACFC (inches)	Total Thickness (inches)
SR 51 to 24th Street	-	4	12.5	1	17.5
24th Street to Washington	4	-	13.5	1	18.5
Washington to Mile Long Bridge	4	-	12.5	1	17.5
Mile Long Bridge to Red Mtn TI	4	-	13.5	1	18.5

Though much of the SR 202L alignment is founded on relatively good quality soils and/or bedrock, portions of the alignment east of Scottsdale Road overlie what was previously Salt River related sand and gravel mined pits that were subsequently infilled with a variety of materials. Though it is generally believed that municipal wastes which were identified within the existing roadway limits (and likely beyond to some extent) were removed and that the overexcavated areas were backfilled with compacted materials, widening of the SR 202L mainline roadway embankment would result in a widened footprint that likely will infringe on materials which have not been previously

modified to support the elevated sections of roadway. Overexcavation depths of 3' to 20' are indicated by the as-built plans along this portion of the project, with little or no modification required beyond the toe of existing slope. In areas where construction debris or otherwise unsuitable fill materials were present, it is understood that up to 20' of these materials were removed and replaced with acceptable fill material within the limits of the mainline roadway and ramps. Further investigation of these soils to determine what treatment is needed to support the widened embankments will be required.

4.15 PHOENIX SKY HARBOR INTERNATIONAL AIRPORT COORDINATION

This project is located beneath the Federal Aviation Regulation (FAR) Part 77 Navigable Airspace for the north runway at Phoenix Sky Harbor International Airport. An initial evaluation indicates all of the proposed freeway improvements would occur below the Part 77 Surface. This surface is approximately 73' above the UPRR/Grand Canal Overpass, which should be sufficient for the freeway lighting and construction equipment to erect the girders at this bridge as shown on Figure 23.

Federal Aviation Administration (FAA) Form 7460-1 must be submitted to the FAA for their evaluation of any permanent or temporary penetrations of the Part 77 surface. All potential permanent and temporary encroachments into the Part 77 navigable airspace should be evaluated during the final design and construction phases of this project.

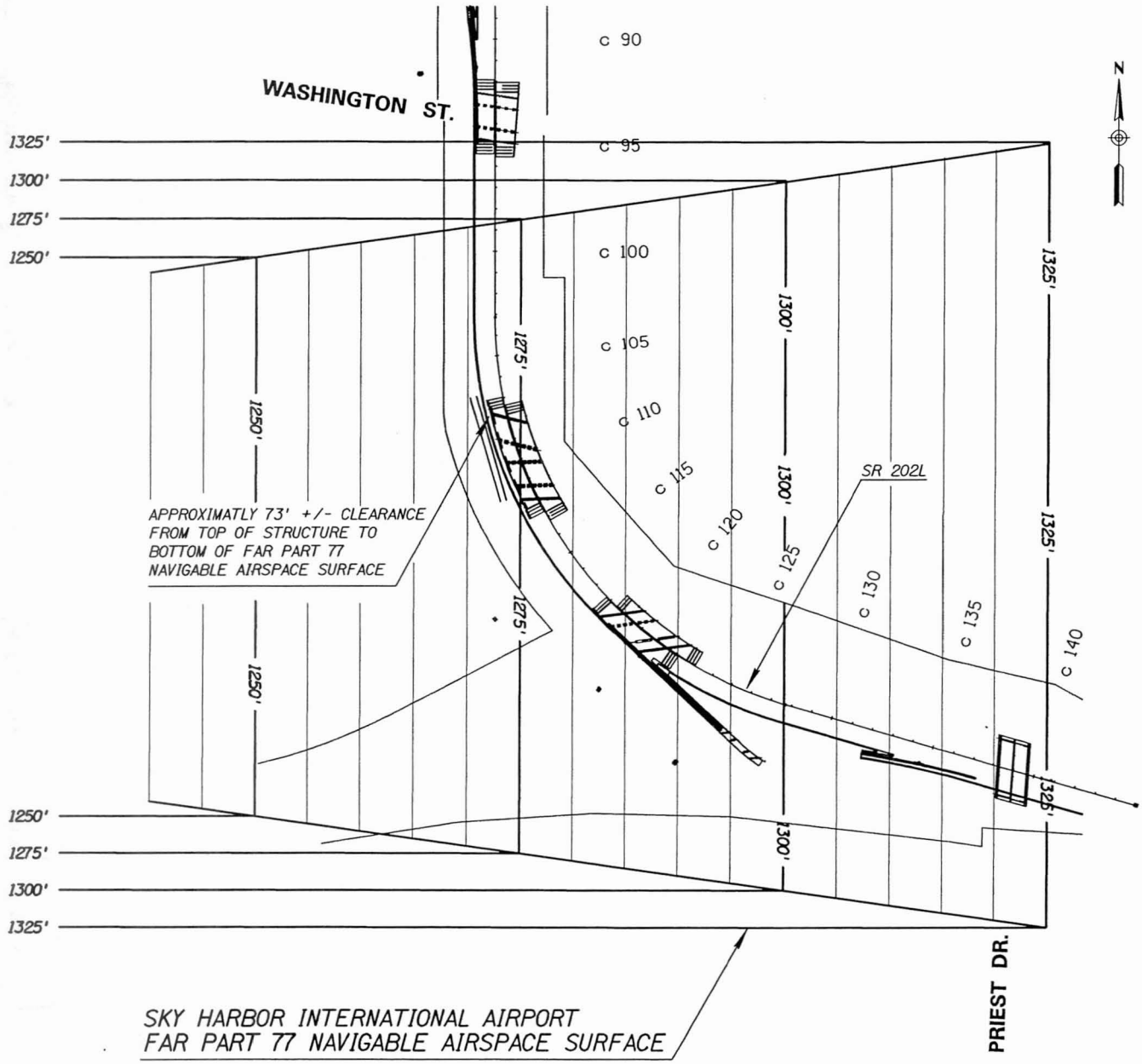


FIGURE 23

SKY HARBOR INTERNATIONAL AIRPORT
FEDERAL AVIATION REGULATION (FAR)
PART 77 NAVIGABLE AIRSPACE CLEARANCE
(APPROXIMATE)

ON THE MOVE
PARTNERS IN PROGRESS

5.0 ORDER OF MAGNITUDE ITEMIZED ESTIMATE

The order of magnitude estimates of project cost for the Recommended Alternative is $184,000,000, which includes $148,800,000 for the eastbound roadway and $35,200,000 for the westbound roadway. The total budgeted amount for this project is $105,030,000. The order of magnitude itemized estimates for the alternatives are shown on the following pages. The estimated unit costs are based on unit prices obtained from recent ADOT bid results.

Pavement structural sections used for this estimate are provided in Section 4.14.3 of this report.

The following is a list of assumptions that are reflected in the cost estimates:

- No new right-of-way is anticipated for this project.
- Costs for landscaping are only for the restoration of disturbed areas.
- New freeway lighting would consist of providing additional illuminaires to the existing median light poles. Relocation of light poles would be required within the ramp realignment areas.
- The costs shown reflect construction of all project elements in one bid package. No phasing costs are included in the estimate.
- Drainage modifications would be limited to adjusting or replacing the existing drainage elements to match the pavement widening and ramp realignments.
- Relocation of the existing FMS improvements is included in the cost estimates.
- The earthwork factor applied to the project excavation is estimated to be 15% shrink. No additional earthwork quantities were included in anticipation of hazardous materials or unsuitable material sites.
- Environmental mitigation costs are not included in this cost estimate.
- Retaining and noise wall costs reflect single vertical walls with standard surface treatments/rustications and do not include potential aesthetic treatments.
- The financial responsibility for the relocation of existing improvements at Tempe Town Lake is not defined at this time. A total cost of $100,000 has been included in the cost estimates to address this item.

Table 32 – Alternative 1 Eastbound Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	23,040	$6.00	$139,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	3,351	25.00	85,000
Removal of Concrete Half Barrier	L.Ft.	34,044	16.00	546,000
Removal of PCCP Pavement	Sq.Yd.	65,043	15.00	977,000
Roadway Excavation	Cu.Yd.	42,738	6.00	258,000
Roadway Embankment (Borrow)	Cu.Yd.	146,426	8.00	1,174,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	37,380	45.00	1,683,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	89,080	50.00	4,456,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	126,460	5.00	634,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	154	60.00	10,000
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	1,832	70.00	130,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	747	90.00	68,000
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	157	170.00	27,000
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	3,155	140.00	443,000
Concrete Pipe Collar	Each	274	500.00	138,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	50	3,000.00	150,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	13	3,000.00	39,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	11	3,500.00	40,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	28	3,000.00	84,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	28	3,500.00	99,000
Concrete Catch Basin (C-15.80) (Median)	Each	4	3,000.00	12,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	10	4,000.00	40,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	6	5,500.00	33,000
Junction Box	Each	6	2,000.00	12,000
Strom Drain Outlet	Each	2	500.00	2,000
Removal of Pipe	L.Ft.	772	30.00	25,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	2,000	10.00	20,000
Concrete Catch Basin (Modify Existing)	Each	141	750.00	107,000
Fill Abandoned Manhole & Plug Pipe	Each	5	1,200.00	8,000
Removal of Miscellaneous Concrete	L.Sum	1	50,000.00	49,000
Removal of Structural Concrete	Cu.Yd.	42	750.00	33,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	11	80,000.00	880,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	14	7,500.00	106,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	3	30,000.00	90,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	17	7,000.00	119,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	14	5,000.00	70,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	15	200.00	4,000
Sign Post (Perforated) (2 S)	L.Ft.	3	12.00	1,000
Sign Post (Perforated) (2 1/2 S)	L.Ft.	69	12.00	2,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	190	18.00	5,000
Foundation For Sign Post (Concrete)	Each	21	150.00	4,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	80	20.00	3,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	4,900	25.00	124,000
Relocate Signs	Each	26	1,000.00	26,000
Relocate Signs (VMS)	Each	2	50,000.00	100,000
Milepost Marker (S-10)	Each	8	250.00	3,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	113	50.00	8,000
Temporary Painted Marking (Stripe)	L.Ft.	458,260	0.15	72,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	370,009	0.25	94,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	88,251	0.25	24,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	180	0.75	3,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	101	150.00	17,000
Pavement Marker, Raised, Type C	Each	7,022	3.50	27,000
Impact Attenuation Device	Each	14	25,000.00	350,000
Electrical Conduit (3-3")(PVC)	L.Ft.	20,000	20.00	400,000
Flagging Services	L.Sum	2	125,000.00	250,000
Pull Box (No. 7)	Each	40	600.00	25,000

Table 32 – Alternative 1 Eastbound Order of Magnitude Itemized Estimate (Continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 9)	Each	20	$2,500.00	$51,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	60,000	5.00	300,000
Loop Detector For Traffic Surveillance (6'x6')	Each	40	500.00	20,000
Luminaire (Vertical Mount) (400 Watt)	Each	260	750.00	196,000
Relocate Ramp Metering Equipment	Each	9	15,000.00	135,000
Landscaping	Mile	7	200,000.00	1,400,000
Concrete Curb And Gutter	L.Ft.	20,974	20.00	422,000
Concrete Half Barrier	L.Ft.	37,479	70.00	2,625,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	3,748	100.00	377,000
24th Street TI Overpass	L.Sum	1	1,081,000.00	1,081,000
32nd Street TI Overpass	L.Sum	1	853,000.00	853,000
Grand Canal Bridge	L.Sum	1	595,000.00	595,000
40th Street TI Overpass	L.Sum	1	724,000.00	724,000
44th Street TI Overpass	L.Sum	1	1,353,000.00	1,353,000
East Papago TI Underpass EB	L.Sum	1	1,703,000.00	1,703,000
48th Street Overpass EB	L.Sum	1	903,000.00	903,000
Ramp B Overpass EB	L.Sum	1	580,000.00	580,000
52nd Street Overpass EB	L.Sum	1	754,000.00	754,000
Van Buren Street Overpass EB	L.Sum	1	533,000.00	533,000
Washington Street Overpass EB	L.Sum	1	651,000.00	651,000
SPRR/Grand Canal Bridge EB	L.Sum	1	1,873,000.00	1,873,000
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	1	651,000.00	651,000
Mill Avenue Viaduct EB	L.Sum	1	3,175,000.00	3,175,000
W Pedestrian Overpass EB	L.Sum	1	259,000.00	259,000
E Pedestrian Overpass EB	L.Sum	1	255,000.00	255,000
College Avenue Overpass	L.Sum	1	560,000.00	560,000
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Scottsdale Road TI Overpass	L.Sum	0	1,108,000.00	0
Indian Bend Wash Bridge EB	L.Sum	1	2,744,000.00	2,744,000
Indian Bend Wash Bridge WB	L.Sum	0	2,754,000.00	0
Salt River Bridge EB	L.Sum	1	11,457,000.00	11,457,000
Salt River Bridge WB	L.Sum	0	10,082,000.00	0
Noise Wall	L.Sum	1	9,701,300.00	9,702,000
Retaining Wall (Type: Regular)	Sq. Ft.	179,700	50.00	8,985,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	15,100	75.00	1,133,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	43,000	60.00	2,580,000
Retaining Wall (Type: Barrier)	Sq. Ft.	2,600	25.00	65,000
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$74,700,000**
Maintenance And Protection of Traffic		10%		7,470,000
Dust And Water Palliative		0.75%		570,000
Quality Control		2%		1,500,000
Construction Surveying		2%		1,500,000
Erosion Control		0.3%		230,000
Mobilization (8% of Total Construction Items)				9,134,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$95,100,000**
Unidentified Items		20%		19,020,000
TOTAL CONSTRUCTION COST:				**$114,120,000**
Construction Engineering		9%		10,280,000
Construction Contingencies		5%		5,710,000
Engineering Design (Includes Surveying And Geotechnical)		8%		9,130,000
Right-of-Way				0
Utility Relocation		1%		1,150,000
Relocation of Existing Facilities at Tempe Town Lake (unknown at this time)				100,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$140,600,000**

Table 33 – Alternative 1 Westbound Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	1,344	$6.00	$9,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	421	25.00	11,000
Removal of Concrete Half Barrier	L.Ft.	4,210	16.00	68,000
Removal of PCCP Pavement	Sq.Yd.	8,262	15.00	124,000
Roadway Excavation	Cu.Yd.	2,492	6.00	15,000
Roadway Embankment (Borrow)	Cu.Yd.	17,078	8.00	137,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	5,563	45.00	251,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	8,245	50.00	413,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	13,808	5.00	70,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	292	70.00	21,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	385	140.00	54,000
Concrete Pipe Collar	Each	26	500.00	13,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	14	750.00	11,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	2,000.00	2,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	48	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1005	25.00	26,000
Relocate Signs (Including VMS)	Each	4	1,000.00	4,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	128	50.00	7,000
Temporary Painted Marking (Stripe)	L.Ft.	550,983	0.15	83,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	447,364	0.25	112,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	103,619	0.25	26,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	180	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	125	150.00	19,000
Pavement Marker, Raised, Type C	Each	8,773	3.50	31,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	4,000	20.00	80,000
Flagging Services	L.Sum	0	0.00	0
Pull Box (No. 7)	Each	8	600.00	5,000

Table 33 – Alternative 1 Westbound Order of Magnitude Itemized Estimate (Continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 9)	Each	4	$2,500.00	$10,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	12,000	5.00	60,000
Loop Detector For Traffic Surveillance (6'x6')	Each	8	500.00	4,000
Luminaire (Vertical Mount) (400 Watt)	Each	52	750.00	39,000
Relocate Ramp Metering Equipment	Each	1	15,000.00	15,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	1,674	20.00	34,000
Concrete Half Barrier	L.Ft.	3,833	70.00	269,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	383	100.00	39,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct(EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	1	2,754,000.00	2,754,000
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	1	10,082,000.00	10,082,000
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	21,200	50.00	1,060,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	2,400	75.00	180,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	2,200	60.00	132,000
Retaining Wall (Type: Barrier)	Sq. Ft.	0	0.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$18,300,000**
Maintenance And Protection of Traffic		10%		1,830,000
Dust And Water Palliative		0.75%		140,000
Quality Control		2%		370,000
Construction Surveying		2%		370,000
Erosion Control		0.3%		60,000
Mobilization (8% of Total Construction Items)				2,238,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$23,310,000**
Unidentified Items		20%		4,670,000
TOTAL CONSTRUCTION COST:				**$27,980,000**
Construction Engineering		9%		2,520,000
Construction Contingencies		5%		1,400,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,240,000
Right-of-Way				0
Utility Relocation		1%		280,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$34,400,000**

Table 34 – Alternative 2 Eastbound Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	23,780	$6.00	$144,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	3,404	25.00	86,000
Removal of Concrete Half Barrier	L.Ft.	34,044	16.00	546,000
Removal of PCCP Pavement	Sq.Yd.	65,044	15.00	977,000
Roadway Excavation	Cu.Yd.	43,251	6.00	261,000
Roadway Embankment (Borrow)	Cu.Yd.	165,839	8.00	1,328,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	37,886	45.00	1,706,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	92,851	50.00	4,644,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	130,737	5.00	656,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	154	60.00	10,000
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	1,952	70.00	138,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	747	90.00	68,000
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	157	170.00	27,000
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	3,155	140.00	443,000
Concrete Pipe Collar	Each	274	500.00	138,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	50	3,000.00	150,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	15	3,000.00	45,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	13	3,500.00	47,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	28	3,000.00	84,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	28	3,500.00	99,000
Concrete Catch Basin (C-15.80) (Median)	Each	4	3,000.00	12,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	10	4,000.00	40,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	6	5,500.00	33,000
Junction Box	Each	6	2,000.00	12,000
Strom Drain Outlet	Each	2	500.00	2,000
Removal of Pipe	L.Ft.	772	30.00	25,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	2,000	10.00	20,000
Concrete Catch Basin (Modify Existing)	Each	145	750.00	110,000
Fill Abandoned Manhole & Plug Pipe	Each	5	1,200.00	8,000
Removal of Miscellaneous Concrete	L.Sum	1	50,000.00	49,000
Removal of Structural Concrete	Cu.Yd.	42	750.00	33,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	11	80,000.00	880,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	14	7,500.00	106,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	3	30,000.00	90,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	17	7,000.00	119,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	14	5,000.00	70,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	17	200.00	4,000
Sign Post (Perforated) (2 S)	L.Ft.	3	12.00	1,000
Sign Post (Perforated) (2 1/2 S)	L.Ft.	92	12.00	3,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	190	18.00	5,000
Foundation For Sign Post (Concrete)	Each	23	150.00	5,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	80	20.00	4,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	4,922	25.00	124,000
Relocate Signs (Including VMS)	Each	26	1,000.00	26,000
Relocate Signs (VMS)	Each	2	50,000.00	100,000
Milepost Marker (S-10)	Each	8	250.00	3,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	101	50.00	7,000
Temporary Painted Marking (Stripe)	L.Ft.	458,757	0.15	71,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	373,067	0.25	95,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	85,690	0.25	23,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	180	0.75	3,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	98	150.00	16,000
Pavement Marker, Raised, Type C	Each	7,503	3.50	29,000
Impact Attenuation Device	Each	14	25,000.00	350,000
Electrical Conduit (3-3")(PVC)	L.Ft.	22,000	20.00	440,000
Flagging Services	L.Sum	2	125,000.00	250,000
Pull Box (No. 7)	Each	44	600.00	28,000

Table 34 – Alternative 2 Eastbound Order of Magnitude Itemized Estimate (Continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 9)	Each	22	$2,500.00	$56,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	66,000	5.00	330,000
Loop Detector For Traffic Surveillance (6'x6')	Each	44	500.00	22,000
Luminaire (Vertical Mount) (400 Watt)	Each	286	750.00	216,000
Relocate Ramp Metering Equipment	Each	10	15,000.00	150,000
Landscaping	Mile	7	200,000.00	1,400,000
Concrete Curb And Gutter	L.Ft.	20,974	20.00	422,000
Concrete Half Barrier	L.Ft.	37,474	70.00	2,625,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	3,747	100.00	377,000
24th Street TI Overpass	L.Sum	1	1,081,000.00	1,081,000
32nd Street TI Overpass	L.Sum	1	853,000.00	853,000
Grand Canal Bridge	L.Sum	1	595,000.00	595,000
40th Street TI Overpass	L.Sum	1	724,000.00	724,000
44th Street TI Overpass	L.Sum	1	1,353,000.00	1,353,000
East Papago TI Underpass EB	L.Sum	1	1,703,000.00	1,703,000
48th Street Overpass EB	L.Sum	1	903,000.00	903,000
Ramp B Overpass EB	L.Sum	1	580,000.00	580,000
52nd Street Overpass EB	L.Sum	1	754,000.00	754,000
Van Buren Street Overpass EB	L.Sum	1	533,000.00	533,000
Washington Street Overpass EB	L.Sum	1	651,000.00	651,000
SPRR/Grand Canal Bridge EB	L.Sum	1	1,873,000.00	1,873,000
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	1	651,000.00	651,000
Mill Avenue Viaduct EB	L.Sum	1	3,175,000.00	3,175,000
W Pedestrian Overpass EB	L.Sum	1	471,000.00	471,000
E Pedestrian Overpass EB	L.Sum	1	464,000.00	464,000
College Avenue Overpass	L.Sum	1	560,000.00	560,000
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Scottsdale Road TI Overpass	L.Sum	0	890,000.00	0
Indian Bend Wash Bridge EB	L.Sum	1	2,801,000.00	2,801,000
Indian Bend Wash Bridge WB	L.Sum	0	2,304,000.00	0
Salt River Bridge EB	L.Sum	1	15,014,000.00	15,014,000
Salt River Bridge WB	L.Sum	0	11,385,000.00	0
Noise Wall	L.Sum	1	9,701,300.00	9,702,000
Retaining Wall (Type: Regular)	Sq. Ft.	175,900	50.00	8,795,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	15,000	75.00	1,125,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	42,900	60.00	2,575,000
Retaining Wall (Type: Barrier)	Sq. Ft.	2,600	25.00	65,000
Access Road Embankment	L.Sum	1	500,000.00	500,000

SUBTOTAL OF ABOVE ITEMS:		**$79,100,000**
Maintenance And Protection of Traffic	10%	7,910,000
Dust And Water Palliative	0.75%	600,000
Quality Control	2%	1,590,000
Construction Surveying	2%	1,590,000
Erosion Control	0.3%	240,000
Mobilization (8% of Total Construction Items)		9,671,000
SUBTOTAL - CONSTRUCTION COST:		**$100,700,000**
Unidentified Items	20%	20,140,000
TOTAL CONSTRUCTION COST:		**$120,840,000**
Construction Engineering	9%	10,880,000
Construction Contingencies	5%	6,050,000
Engineering Design (Includes Surveying And Geotechnical)	8%	9,670,000
Right-of-Way		0
Utility Relocation	1%	1,210,000
Relocation of Existing Facilities at Tempe Town Lake (Unknown at this time)		100,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)		0
TOTAL PROJECT COST:		**$148,800,000**

Table 35 – Alternative 2 Westbound Order of Magnitude itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	1,344	$6.00	$9,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	421	25.00	11,000
Removal of Concrete Half Barrier	L.Ft.	4,210	16.00	68,000
Removal of PCCP Pavement	Sq.Yd.	8,261	15.00	124,000
Roadway Excavation	Cu.Yd.	1,422	6.00	9,000
Roadway Embankment (Borrow)	Cu.Yd.	9,965	8.00	80,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	6,105	45.00	275,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	6,069	50.00	304,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	12,174	5.00	61,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	268	70.00	19,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	385	140.00	54,000
Concrete Pipe Collar	Each	26	500.00	13,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	14	750.00	11,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	2,000.00	2,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	48	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1,005	25.00	26,000
Relocate Signs	Each	4	1,000.00	4,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	27	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	81,075	0.15	13,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	58,570	0.25	15,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	22,505	0.25	6,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	0	0.75	0
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	33	150.00	5,000
Pavement Marker, Raised, Type C	Each	2,033	3.50	8,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	4,000	20.00	80,000
Flagging Services	L.Sum	0	0.00	0
Pull Box (No. 7)	Each	8	600.00	5,000

Table 35 – Alternative 2 Westbound Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 9)	Each	4	$2,500.00	$10,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	12,000	5.00	60,000
Loop Detector For Traffic Surveillance (6'x6')	Each	8	500.00	4,000
Luminaire (Vertical Mount) (400 Watt)	Each	52	750.00	39,000
Relocate Ramp Metering Equipment	Each	0	15,000.00	0
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	2,037	20.00	41,000
Concrete Half Barrier	L.Ft.	3,694	70.00	259,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	369	100.00	37,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	1	890,000.00	890,000
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	1	2,304,000.00	2,304,000
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	1	11,385,000.00	11,385,000
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq.Ft.	23,900	50.00	1,195,000
Retaining Wall (Type: Specialty 1)	Sq.Ft.	2,400	75.00	180,000
Retaining Wall (Type: Specialty 2)	Sq.Ft.	2,100	60.00	126,000
Retaining Wall (Type: Barrier)	Sq.Ft.	0	0.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$18,700,000**
Maintenance And Protection of Traffic		10%		1,870,000
Dust And Water Palliative		0.75%		150,000
Quality Control		2%		380,000
Construction Surveying		2%		380,000
Erosion Control		0.3%		60,000
Mobilization (8% of Total Construction Items)				2,288,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$23,830,000**
Unidentified Items		20%		4,770,000
TOTAL CONSTRUCTION COST:				**$28,600,000**
Construction Engineering		9%		2,580,000
Construction Contingencies		5%		1,430,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,290,000
Right-of-Way				0
Utility Relocation		1%		290,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$35,200,000**

6.0 AASHTO CONTROLLING DESIGN CRITERIA

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This section will be provided with the Final Design Concept Report.

7.0 SOCIAL, ECONOMIC AND ENVIRONMENTAL CONCERNS

7.1 INTRODUCTION

No significant environmental impacts are anticipated as a result of this project. Therefore, ADOT and FHWA have recommended the preparation of a Group 2, Non-Programmatic Categorical Exclusion (CE) as the appropriate level of National Environmental Policy Act (NEPA) documentation. As stipulated in the *Arizona Programmatic Categorical Exclusion Approval* (dated August 2000), this CE will be submitted by the ADOT Environmental Planning Group (EPG) to FHWA for final approval.

The CE will evaluate the potential environmental impacts resulting from the construction of this project and will include provisions to mitigate the severity of anticipated impacts. The following summary of social, economic, and environmental considerations reflects the data gathered during the preliminary stages of the CE preparation. The final CE is scheduled for completion in early 2007.

7.2 LAND USE AND OWNERSHIP

Land ownership in the project area includes State Trust, Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), municipal, and private lands. State Trust lands are administered by the Arizona State Land Department (ASLD). The SR 202L borders portions of the Salt River Pima-Maricopa Indian Community (SRPMIC), north of the freeway between McClintock Drive and SR 101L. The SR 202L right-of-way is owned by ADOT, except where the freeway traverses BLM lands through an easement. No changes to the current land use and ownership of the project area are anticipated.

Adjacent land uses along this segment of SR 202L are residential, commercial, industrial, transportation, vacant, and public uses such as schools and parks. From I-10/SR 51 to 52nd Street, residential development is mostly single family homes with some multi-story apartment buildings. From 52nd Street to SR 101L, there are few single unit dwellings but several apartment complexes clustered near Center Parkway and Scottsdale Road.

Commercial development is generally clustered along the major arterial streets and traffic interchanges. There are several medium-rise hotel and office buildings in the vicinity of 44th Street. Industrial areas include warehouse and distribution facilities between 52nd Street and Priest Drive, and a block of mixed industrial properties occurring north of SR 202L between Scottsdale Road and McClintock Drive. Transportation uses other than the freeway and city streets include the Union Pacific Railroad (UPRR) and the Valley Metro Light Rail (METRO) line.

Vacant land includes State Trust parcels between 32nd and 40th Streets. The Arizona State Land Department has no immediate plans to auction this property for

development. Vacant land is also located adjacent to the freeway between McClintock Drive and SR 101L. Vacant land in this area are lands on the SRPMIC and ADOT-owned parcels located at the SR 202L/SR 101L TI.

Schools located in the study area are the Excelencia Elementary School located north of the I-10/SR 51/SR 202L TI, the Gateway Elementary School located north of SR 202L at 35th Street, and Balsz Elementary School located north of SR 202L at 44th Street.

The Carraro Cactus Garden, a City of Phoenix park, includes the historic Tovrea Castle. This property is located at the southwest corner of SR 202L and Washington Street and is undergoing renovation and will not be open to the public until 2008. The Moeur, Papago, and Tempe Town Lake/Rio Salado Parks are City of Tempe parks that are located in the project area. The Tempe Town Lake Marina, a component of the Tempe Town Lake/Rio Salado Park, is located south of the freeway near Scottsdale Road.

There is a publicly accessible riparian habitat restoration project located within the Indian Bend Wash channel. Similar projects sponsored by the US Army Corps of Engineers (Corps) are planned for the Salt River both upstream and downstream of the Tempe Town Lake. The City of Tempe maintains a nature preserve adjacent to Mouer Park, known as the Lopiano Bosque.

7.3 SUMMARY OF HAZARDOUS MATERIALS REVIEW

SR 202L crosses two Superfund sites that are listed on the National Priority List including the 52nd Street Motorola site and the Indian Bend Wash site. These sites encompass areas of organic solvent-contaminated groundwater. Both sites are currently undergoing remediation through soil vapor extraction. Geotechnical investigations and construction within the boundaries of these sites will require an Aquifer Protection Permit (APP) from the Arizona Department of Water Resources (ADWR). Provisions will be necessary to prevent the spread of contaminated groundwater and soil during geotechnical investigations and construction excavation. The design consultant shall contact the ADOT Environmental Planning Group during final design to complete the environmental clearance process for geotechnical investigations.

Records indicate that a variety of other hazardous material concerns are located in the study area. These include sites documented in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), Resource Conservation and Recovery Information System, and Toxic Chemical Release Inventory System (TRIS). There are also 2 solid waste facility/landfill sites, 57 leaking underground storage tanks, 65 underground storage tanks, and 4 above ground storage tanks. These facilities are located outside of the SR 202L right-of-way and will not be impacted or displaced by the project. Therefore, hazardous materials concerns associated with these facilities will not require any action.

7.4 SUMMARY OF AIR QUALITY ANALYSIS

An air quality analysis was performed to assess impacts from the proposed project. The analysis focused on vehicle emissions of carbon monoxide (CO). Other pollutants, such as particulate matter and oxides of nitrogen are also components of vehicular emissions. However, carbon monoxide is the primary pollutant of vehicular emissions and is the only pollutant for which the Environmental Protection Agency (EPA) has developed guidelines for evaluating impacts. Ozone, nitrogen oxides, and hydrocarbons are pollutants that are regional in nature, and as such, meaningful evaluation at the project level is not possible. The EPA is currently developing procedures for analyzing micro-scale particulate pollution impacts, but guidance is not available at this time. Until the EPA provides guidelines for the analysis for particulate matter, the analysis will concentrate on the local impact of carbon monoxide emissions.

A micro-scale analysis of this proposed action was performed and utilized the EPA air quality models MOBILE6.2 and CAL3QHC Version 2. MOBILE6.2 was used to compute composite emission factors from various vehicle types at various speeds. These emission factors were input into CAL3QHC. CAL3QHC was then used to estimate maximum one-hour concentrations of CO at various locations (receptors) such as sensitive land use areas or any location of anticipated maximum concentrations.

Predicted maximum one-hour and eight-hour concentrations of CO were calculated for the current traffic conditions and roadway configurations (2006), for the estimated traffic conditions on the existing roadway configuration in 2030 (No-Build), and for the estimated traffic conditions and future roadway configurations of the improved freeway in 2030 (Build). These concentrations are not expected to exceed the Federal or State air quality standards.

Short-term impacts of CO may occur during construction due to the interruption of normal traffic flow. Efforts should be made to reduce traffic queuing, especially during the peak hours of travel. Impacts to CO associated with the proposed facility may be considered very minor. Short-term impacts to particulate matter ($PM_{10}/PM_{2.5}$) may also occur during the construction phase, but these may be reduced through the use of watering or other dust-control measures in accordance with county and local rules or ordinances.

This proposed project is listed in the Tentative 2007 – 2011 Maricopa Association of Governments (MAG) Area Life Cycle Construction Program, indicating that the MAG conformity analysis has been adopted for Maricopa County.

In accordance with Maricopa County Rule 310, Fugitive Dust Ordinance, before beginning construction, an approved Application for Earth Moving Permit, Demolition, and Dust Control Plan shall be obtained from the Maricopa County Environmental Services Department. The permit describes measures to control and regulate air pollutant emissions during construction.

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are National Ambient Air Quality Standards (NAAQS), the EPA also regulates air toxic emissions. Most air toxics originate from human-made sources including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act (CAA). The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes unburned through the engine. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the CAA and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources 66 FR 17229 (March 29, 2001). This rule was issued under the authority in Section 202 of the CAA. In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, the FHWA projects that even with a 64 percent increase in vehicle miles traveled (VMT), these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent and will reduce on-highway diesel particulate matter emissions by 87 percent.

As a result, EPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. The agency is preparing another rule under authority of CAA Section 202(l) that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

Unavailable Information for Project Specific MSAT Impact Analysis

A basic analysis of the likely MSAT emission impacts of this project will be included in the CE document. However, available technical tools do not enable the prediction of project-specific health impacts of the emission changes associated with the No Build and Build conditions in this CE document. Due to these limitations, the following discussion is included in accordance with Council on Environmental Quality regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

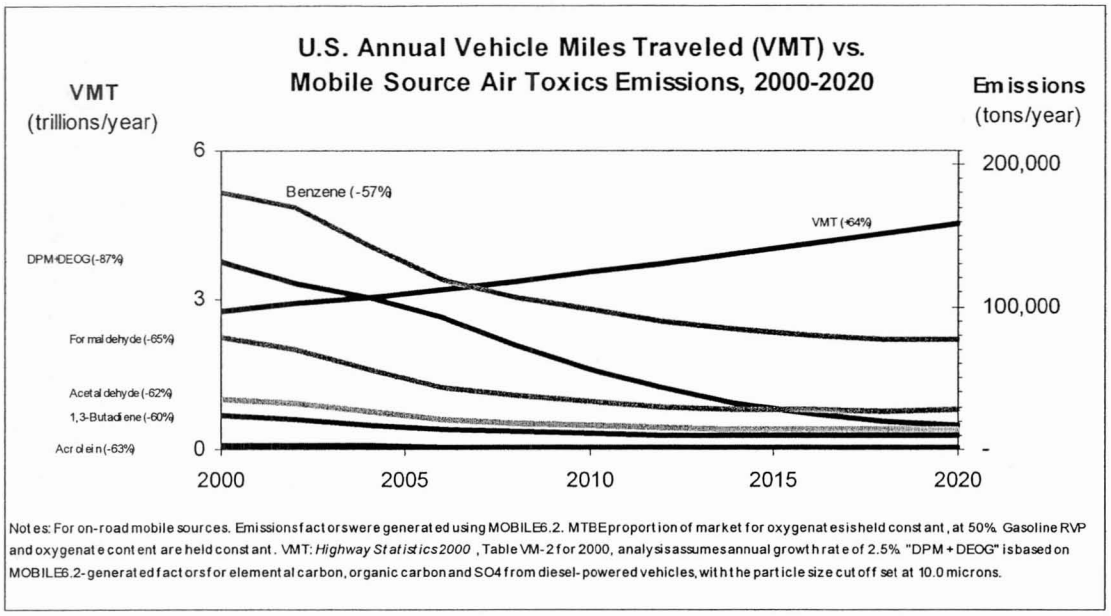


Figure 24 – Vehicle Miles Traveled versus Mobile Source Air Toxics Emissions

Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements including emissions modeling, dispersion modeling (in order to estimate ambient concentrations resulting from the estimated emissions), exposure modeling (in order to estimate human exposure to the estimated concentrations), and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project that are provided in the following paragraphs.

- Emissions: The EPA tools used to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model and emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of particulate matter under the

conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- Dispersion: The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The National Cooperative Highway Research Program is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the *National Environmental Policy Act* process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

- Exposure Levels and Health Effects: Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates

of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, between the no build and build conditions. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*, found at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm.

For the Build condition, the amount of MSATs emitted would be proportional to the VMT assuming that other variables such as fleet mix are the same for the No-Build and Build conditions. The VMT estimated for the Build condition is slightly higher than that for the No-Build condition, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the build condition along the highway corridor, along with a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to EPA's MOBILE6.2 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Table 36 – Travel Characteristics

Annual Average Daily Traffic (Vehicles Per Day)						
Condition	Year					
	2006			2030		
	SR 202L	Arterials	Total	SR 202L	Arterials	Total
No-Build	231,000	60,000	299,000	238,000	89,000	327,000
Build	--	--	--	260,000	91,000	351,000
Daily Vehicle Miles of Travel (VMT Per day)						
Condition	Year					
	2006			2030		
	SR 202L	Arterials	Total	SR 202L	Arterials	Total
No-Build	2,264,000	666,000	2,930,000	2,332,000	872,000	3,204,000
Build	--	--	--	2,548,000	892,000	3,440,000

Emissions will likely be lower than present levels in the design year because of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the build condition will have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher under the build condition than the No-Build condition. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections. However, as discussed above, the magnitude and the duration of these potential increases compared to the no-build condition cannot be accurately quantified due to the inherent deficiencies of current models. In sum, when a highway is widened and, as a result, moves closer to receptors, the localized level of MSAT emissions for the build condition could be higher relative to the No-Build condition, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions, except for diesel particulate matter). However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Construction activity may generate a temporary increase in MSAT emissions. Project-level assessments that render a decision to pursue construction emission mitigation will benefit from a number of technologies and operational practices that should help lower short-term MSATs. In addition, the SAFETEA-LU[1] has emphasized a host of diesel retrofit technologies in the law's CMAQ[2] provisions; technologies that are designed to lessen a number of MSATs.

Construction mitigation includes strategies that reduce engine activity or reduce emissions per unit of operating time. Operational agreements that reduce or redirect work or shift times to avoid community exposures can have positive benefits when sites are near vulnerable populations. For example, agreements that stress work activity outside normal hours of an adjacent school campus would be operations-oriented mitigation. Also on the construction emissions front, technological adjustments to equipment, such as off-road dump trucks and bulldozers, could be appropriate strategies. These technological fixes could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions. The

[1] The acronym, SAFETEA-LU, refers to Public Law 109-59, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, signed by President George W. Bush on August 10, 2005. SAFETEA-LU authorizes the Federal surface transportation programs for highways, highway safety, and transit for the 5-year period between 2005 and 2009.

[2] The acronym, CMAQ, refers to the Congestion Mitigation and Air Quality Program, enacted into law in 1991 through the Intermodal Surface Transportation Efficiency Act. The program provides funds for surface transportation and other related projects that contribute to air quality improvements and reduce congestion.

use of clean fuels, such as ultra-low sulfur diesel, also can be a very cost-beneficial strategy.

The EPA has listed a number of approved diesel retrofit technologies. Many of these can be deployed as emissions mitigation measures for equipment used in construction and can be found at www.epa.gov/otaq/retrofit/retroverifiedlist.htm.

In summary, as demonstrated in this analysis, the project is not likely to contribute to the severity or number of violations of the NAAQS. Some deterioration of air quality may be expected due to the operation of construction equipment and the slower traffic speeds associated with a construction zone. However, this will be a localized condition that will cease when this project is completed. Fugitive dust generated from construction activities must be controlled in accordance with the *Arizona Department of Transportation Standard Specifications for Road and Bridge Construction*, Section 104.08 (2000 Edition), special provisions, and local rules or ordinances.

7.5 NOISE

A traffic noise analysis was performed based on the preliminary design concepts to determine if substantial changes in traffic noise would occur from this project. Noise barrier locations and heights were analyzed for noise attenuation (mitigation) in accordance with 23 USC Section 109(h) and (i), of the FHWA guidelines for the assessment of highway traffic-generated noise. These regulations, published as Part 772 of Title 23 of the Code of Federal Regulations, provide procedures to be followed in conducting noise analyses that will protect the public health and welfare. Additionally, the analysis was performed in accordance with the ADOT's Noise Abatement Policy (NAP), dated December 5, 2005, and all subsequent updates. These findings are documented in the report entitled *Draft Noise Study Technical Report, Red Mountain Freeway (I-10/SR 51/SR 202L TI – SR 101L)*.

Noise level monitoring was conducted at 16 sites to determine the current noise level conditions in the project area. The FHWA-approved Traffic Noise Model 2.5 (TNM 2.5) was used to predict the future (year 2030) traffic noise levels and conduct the mitigation analyses. Due to the length and complexity of the roadway, the noise model for the project was divided into 11 geographical sections as defined in Table 37.

Table 37 – Noise Model Section Locations

Section	Number of Modeled Locations	Description of Section
01	23	I-10/SR 51 to 24th Street
02	51	24th Street to 32nd Street
03	65	32nd Street to 40th Street
04	29	40th Street to SR 143
05	19	SR 143 to 48th Street
06	25	48th Street to Washington Street

Table 37 – Noise Model Section Locations (continued)

Section	Number of Modeled Locations	Description of Section
07	6	Washington Street to Priest Drive
08	15	Priest Drive to Center Parkway
09	39	Center Parkway to Scottsdale Road
10	24	Scottsdale Road to McClintock Road
11	3	McClintock Road to SR 101L
Total Number of Modeled Locations: 299		

Customers represent locations where future noise levels are predicted and are typically outdoor use areas such as residential front and back yards, patios, and playgrounds. Non-customer locations are also incorporated into the noise model to provide data for areas that ordinarily would not qualify as customers, such as outdoor use areas including parks. A total of 299 customers and the 16 monitored locations were incorporated into the noise model to predict the future noise conditions. Table 38 summarizes the results of the noise analysis.

Table 38 – Predicted Traffic Noise Levels

Location Type	Minimum dBA[1]	Maximum dBA
Monitored Locations	55	73
Modeled Locations *without* mitigation in year 2030	49	80
Modeled Locations *with* mitigation in year 2030	50	67

1 The "A" -weighted noise level, annotated as dBA, response is similar to the typical human hearing capability

Noise barriers have been recommended for customers if the following three ADOT NAP criteria are met:

- A barrier would result in a noise reduction of 5 dBA,
- A barrier would result in a noise level of less than 64 dBA, and
- The cost of the barrier would not exceed $43,000 per benefited customer.

Mitigation is not recommended for customers in cases where one or more of the following exceptions exist:

- The predicted noise level is below the thresholds that warrant mitigation per FHWA policy,
- Construction of noise mitigation structures to a maximum feasible height of 20 feet would not achieve a minimum reduction of 5 dBA,
- The estimated cost of the nose mitigation structure would exceed the maximum cost per benefited customer of $43,000,
- The customer would be considered an isolated customer,

- The predicted traffic noise levels are predicted to be less than the existing noise levels, or
- The cost per benefited customer cannot be calculated because the number of customers cannot be determined.

Based on the these criteria, the recommended noise barriers for this project have been identified at following locations along SR 202L:

- I-10/SR 51 TI to 24th Street; along the eastbound and westbound sides ,
- 24th Street to 32nd Street; along the eastbound and westbound sides,
- 32nd Street to 40th Street; along the eastbound side,
- 40th Street to SR 143; along the eastbound side,
- SR 143 to 48th Street; along the eastbound and westbound sides,
- 52nd Street to Van Buren Street; along the westbound side.

See Appendix D for locations of the recommended noise barriers. The noise barrier locations are approximate. The ultimate location and height of the barriers will be determined during final design. All noise walls shown or discussed in this report are subject to significant changes during the project development process. Construction feasibility, cost, changes to the project improvements, and changes to the NAP may affect the noise barrier locations and design. The ADOT Project Manager and the ADOT EPG environmental planner will coordinate during final design to review and verify noise analysis results and abatement considerations.

7.6 VISUAL QUALITY

Most of the project is area is in a highly developed urban setting with the foreground views consisting primarily of the features associated with the SR 202L corridor and commercial and residential development. Portions of the project are adjacent to the landscapes of Papago Park and Tempe Town Lake. Depending on the location along this segment of the SR 202L, some natural landforms may be visible from the project area including Piestawa Peak, the Papago Buttes, Camelback Mountain, South Mountain, and the McDowell Mountains.

Construction of the additional lanes within the existing freeway corridor will not impact the visual quality or character of the project area because travel lanes would be built using similar materials to those lanes currently in operation and would be constructed on the same vertical alignment. ADOT will coordinate with the cities of Phoenix and Tempe to discuss the aesthetics of landscaping, retaining walls, and other structural features during final design.

7.7 WATER RESOURCES

Two major watercourses are within the project area: the Salt River and Indian Bend Wash. These water resources are described in more detail in the following sections.

Because this project will result in one or more acres of ground disturbance, an Arizona Pollutant Discharge Elimination System (APDES) general permit will be required. The ADOT Roadside Development Section will determine who will prepare the Stormwater Pollution Prevention Plan. The ADOT Phoenix District Construction Office and the contractor will submit the Notice of Intent and the Notice of Termination to the Arizona Department of Environmental Quality.

7.8 CLEAN WATER ACT – SECTION 401, 402, AND 404 PERMITS

The SR 202L freeway spans the Salt River and Indian Bend Wash. These resources have been previously determined by the Corp of Engineering (Corps) to be jurisdictional waters of the U.S. A Section 404 Jurisdictional Delineation (JD) was prepared for the project area and approved by the Corps on June 26, 2006. The results of this jurisdictional delineation included the identification of approximately 20.03 acres of wetlands within the jurisdictional limits of the Salt River.

Since the freeway widening will require bridge columns to be placed within the delineated "Waters of the US" and wetlands, a Clean Water Act Section 404 permit will be required for this project. Based on preliminary plans, it is anticipated that the total permanent loss of jurisdictional area would be less than 0.10 acres. There will also be temporary construction access roads constructed within the Salt River channel. These roads will be considered temporary impacts, and because they will be removed after construction is complete, the disturbance would not contribute to the calculation of permanent loss. The type of Section 404 permit necessary for this action will be confirmed between ADOT and the Corps at the completion of Stage II plans during final design.

If the construction activities cannot avoid impacts to the jurisdictional wetlands within the Salt River Channel, a Section 404 Individual Permit would be necessary. The Arizona Department of Environmental Quality would also require a Section 401 water quality certification.

7.9 FLOODPLAINS

Portions of the project area are located within the Federal Emergency Management Agency (FEMA) designated 100-year floodplain. Impacts to floodplains typically occur when the topography within a floodplain is substantially modified either by placement or removal of materials within the floodplain. Since this is a widening project on the existing alignment and pass-through drainage will be maintained, this project will not substantially modify the topography in the project area. Floodplain encroachment permits may be necessary for the construction of temporary access roads within the Salt River. Coordination with the City of Tempe floodplain administrator, as well as the Flood Control District of Maricopa County, will be necessary for approvals and permits during final design.

7.10 BIOTIC COMMUNITIES

The majority of the project area is heavily urbanized and does not support habitat for a diversity of native wildlife and plant species. Vegetation in the urbanized areas of the project limits consists mostly of non-native ornamentals and native species in landscaped settings. In Papago Park north of the project area, native vegetation is present, consisting mostly of creosotebush, scattered paloverde and mesquite, and some cacti, including cholla and saguaro. Although most of the project limits do not support wildlife habitat, a human-induced wetland area supporting wildlife habitat has become established in the Salt River channel upstream of the Tempe Town Lake eastern dam, near the SR101L/SR202L T.I.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) list of threatened, endangered, proposed, and candidate species potentially occurring in Maricopa County was reviewed. A biological evaluation (BE) of the following species has been prepared:

- Bald eagle
- California Brown pelican
- Southwestern willow flycatcher
- Yuma clapper rail

The BE concluded that the project may affect these species, but is not likely to adversely affect these species. Because ground-disturbing activities in the Salt River bed would be subject to federal Clean Water Act Section 404 permitting, the project would also be subject to Section 7 consultation with the USFWS. The ADOT EPG regional biologist will determine the need for Section 7 consultation during final design.

Arizona Special Status Species

Coordination with the Arizona Game and Fish Department (AGFD) was completed during the agency coordination process. The AGFD provided a list of special status species that have been documented as occurring within 2 miles of the project area including the lowland leopard frog and Arizona chuckwalla. ADOT maintains a list of state sensitive species that they routinely make accommodations for and none of these species were listed as potentially present by the AGFD. Based upon the lack of specific concerns from the AGFD, and the absence of typical ADOT species to address, no protection of these species is necessary for this project.

Arizona Protected Native Plants

Mesquite trees (*Prosopis* spp.) were observed within the project area. If these protected native plants will be impacted by this project, the ADOT Roadside Development Section will notify the Arizona Department of Agriculture at least 60 days prior to the start of

construction so that the Arizona Department of Agriculture can determine the disposition of these plants.

Other Special Status Species

The project may impact cliff swallow nests that may be attached to SR 202L bridges in the project area. Cliff swallows are protected under the Migratory Bird Treaty Act. During final design, the Arizona Department of Transportation will develop measures to avoid impacting cliff swallows nesting on bridges in the project area. These measures may include removal of cliff swallow nests during the non-breeding season prior to construction and employing deterrents to prevent cliff swallows from re-building nests before construction begins.

Coordination with the Arizona Game and Fish Department (AGFD) was completed during the agency coordination process. The AGFD provided a list of special status species that have been documented as occurring within 2 miles of the project area, including the lowland leopard frog and Arizona chuckwalla. ADOT maintains a list of state sensitive species that they routinely make accommodations for and none of these species were listed as potentially present by the AGFD. Based upon the lack of specific concerns from the AGFD, and the absence of typical ADOT species to address, no protection of these species is necessary for this project.

7.11 CULTURAL RESOURCES

Six archaeological sites have been identified in the project area. Portions of these sites that occur in the ADOT right-of-way were excavated prior to the original construction of SR 202L. Since the project will be confined to the existing ADOT right-of-way at the locations where these sites were excavated, any remains of these archaeological resources outside the freeway right-of-way will not be impacted.

In addition to archeological sites, the following historic properties that are eligible for or listed on the National Register of Historic Places that are located in the project area include the following:

- Grand Canal
- Old Crosscut Canal
- Tovrea Castle and Carraro Cactus Garden
- Historic US Highway 60/70/80/89
- Southern Pacific Railroad
- Mill Avenue Bridge
- Indian Bend Pump Ditch

Linear historic properties (Grand Canal, Old Crosscut Canal, Historic US Highway 60/70/80/89, and the Southern Pacific Railroad) that cross the ADOT right-of-way are spanned by existing bridge structures. This project would involve widening the bridge structures over these sites. Temporary falsework may be placed adjacent to these

properties for the construction of additional bridge columns. Since the falsework would be temporary and would not result in modification of these historic properties, it would not represent an impact. The new columns would be constructed on the same alignment as the existing columns and would appear similar. The new columns and widened bridges would not diminish the integrity of location, design, materials, workmanship, feeling, or association of the historic properties, and would only have a subtle affect on their setting.

The Tovrea Castle and Carraro Cactus Garden, the Mill Avenue Bridge, and the Indian Bend Pump Ditch are located outside of the ADOT right-of-way and will be avoided because no temporary construction easements or new right-of-way will be acquired from these properties. Since SR 202L is an existing facility, the roadway widening will only minimally affect the setting of these properties. "No adverse effect" is an appropriate recommendation for this project because prior mitigation of archaeological resources in the SR 202L right-of-way has occurred and historic properties will be avoided.

Response letters from the City of Phoenix (dated June 21, 2006) and Arizona State Land Department (dated June 22, 2006) have concurred with the findings of "no adverse effect". Consultation with the State Historic Preservation Office, Bureau of Reclamation, City of Tempe, and Salt River Project is currently pending.

7.12 SUMMARY OF SECTION 4(f) AND 6(f) RESOURCES

Section 4(f), of the US Department of Transportation Act of 1966, states that the FHWA "...may approve a transportation program or project...requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if...there is no prudent and feasible alternative to using that land; and...the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use." (49 U.S.C. 303[c])

A use of a Section 4(f) resource, as defined in "Title 23, Code of Federal Regulations, Part 771.135(p)," occurs: 1) when land is permanently incorporated into a transportation facility; 2) when there is a temporary occupancy of land that is adverse in terms of the statute's preservationist purposes; or 3) when there is a constructive use of land. A constructive use of a Section 4(f) resource occurs when the transportation project does not incorporate land from a Section 4(f) resource, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. For example, a constructive use can occur when:

a) the projected noise level increase, attributable to the project, substantially interferes with the use and enjoyment of a noise-sensitive facility of a resource protected by Section 4(f);

b) the proximity of the project substantially impairs aesthetic features or attributes of a resource protected by Section 4(f), where such features or attributes are considered important contributing elements to the value of the resource. An example of such an effect would be the location of a transportation facility in such proximity that it obstructs or eliminates the primary views of an architecturally significant historical building, or substantially detracts from the setting of a park or historic site which derives its value in substantial part due to its setting; and/or

c) the project results in a restriction on access, which substantially diminishes the utility of a significant publicly owned park, recreation area, or historic site.

There are no wildlife and waterfowl refuges within the study area. The athletic fields associated with the adjacent public schools are not open to the general public and are used for the structured physical education of children; therefore, these properties are not protected under Section 4(f).

There are publicly owned park and recreation areas, park and recreation areas that are also used for habitat preservation, and historic properties located in the project study area. There are a total of 13 Section 4(f) properties adjacent to SR 202L within the study area that are listed in Table 39. The following public parks are located in the study area:

- City of Tempe Moeur Park
- City of Tempe Papago Park
- City of Tempe Rio Salado Park/Tempe Town Lake

The following public recreation areas that also serve as habitat preservation and habitat restoration areas are located in the study area:

- Lopiano Bosque
- Indian Bend Wash Habitat Restoration
- Salt River Habitat Restoration (Rio Salado) Project (two future phases)

The following historic properties that are eligible for or listed on the National Register of Historic Places (NRHP) are located in the study area:

- Grand Canal
- Old Crosscut Canal
- Tovrea Castle and Carraro Cactus Garden
- Historic US Highway 60/70/80/89
- Southern Pacific Railroad
- Mill Avenue Bridge
- Indian Bend Pump Ditch

An analysis for each Section 4(f) resource follows the map and table.

Table 39 – Summary of Section 4(f) Properties for the Red Mountain Freeway (I-10/SR 51 TI – SR 101L)

Property Name	Location	Ownership/ Jurisdiction	Existing and Planned Facilities	Acreage[1]	Access	Provisions affecting ownership/use	Notes
Grand Canal	Passes under SR 202L at MP 2.15 & 5.20	Bureau of Reclamation/Salt River Project	Existing multi-use/recreation trails	-	Multiple points of access at arterial street crossings; connected with MAG trail system	Facilities primary use for conveyance of irrigation water	The State Historic Preservation Office (SHPO) concurred with a determination of "no adverse effect" for this property
Old Crosscut Canal	Passes under SR 202L at MP 3.56	Bureau of Reclamation/Salt River Project	Existing historic property	-	None	Portion of facility within study area closed to public	Portions of facility within study area have been recently reconstructed and no longer retain historic character; SHPO concurred with a determination of "no adverse effect" for this property
Historic US Highway 60/70/80/89	Crosses SR 202L at MP 4.54 & 6.78	City of Phoenix and City of Tempe	Existing historic property	-	Multiple points of access; connected with surface street system and sidewalks	None	SHPO concurred with a determination of "no adverse effect" for this property
Tovrea Castle and Carraro Cactus Garden	5041 E. Van Buren Street, Phoenix	City of Phoenix	Existing historic buildings; planned picnic/public gathering areas, interpretive trail, and restored gardens	45	Points of access from Van Buren and Washington Streets	None	Facility listed on the NRHP; SHPO concurred with a determination of "no adverse effect" for this property
Southern Pacific Railroad	Adjacent to SR 202L at MP 5.15-6.65	Union Pacific Corporation	Existing historic property	-	None	Facility within study area closed to public	SHPO concurred with a determination of "no adverse effect" for this property
Salt River Habitat Restoration (Rio Salado) Project (two future phases)	Salt River bed adjacent to Tempe Town Lake	US Army Corps of Engineers	Planned hiking trails and pedestrian amenities	111	Planned facility, no public access currently exists	Facilities primary use is for the conveyance of floodwater	Facilities will be subject to flooding once completed
Moeur Park	715 N. Mill Avenue	City of Tempe	Existing picnic areas and Frisbee golf course	97	Points of access from Mill Avenue and Curry Rd., connected with Rio Salado Park /Tempe Town Lake	None	n/a

Table 39 – Summary of Section 4(f) Properties for the Red Mountain Freeway (I-10/SR 51 TI – SR 101L) (continued)

Property Name	Location	Ownership/ Jurisdiction	Existing and Planned Facilities	Acreage[1]	Access	Provisions affecting ownership/use	Notes
Papago Park	1000 N. College Avenue	City of Tempe	Existing picnic areas, athletic facilities, playgrounds, hiking trails	296	Access point at College Avenue; connected with City of Phoenix portion of Papago Park	None	n/a
Rio Salado Park/Tempe Town Lake	620 N. Mill Avenue	City of Tempe	Existing picnic areas, athletic facilities, playgrounds, hiking trails, boating, fishing	637	Multiple points of access from arterial streets and sidewalks	Portions of Rio Salado Park occupy ADOT R/W through an encroachment agreement	Tempe Town Lake occupies land primarily used to convey floodwater and releases from upstream reservoirs
Mill Avenue Bridge	Adjacent to SR 202L at MP 6.78	City of Tempe	Existing historic property	-	Access points from Rio Salado Park/Tempe Town Lake and Mill Avenue	None	Property listed on the NRHP; SHPO concurred with a determination of "no adverse effect" for this property
Lopiano Bosque	Adjacent to SR 202L between Mill and College Avenues	City of Tempe	Existing hiking and equestrian trails	15	Points or access from Mill and College Avenues	None	n/a
Indian Bend Pump Ditch	Adjacent to SR 202L between Mill and College Avenues	Bureau of Reclamation/Salt River Project	Existing historic property with hiking/equestrian facility	-	Access from both Lopiano Bosque and Moeur Park	Facilities primary use for conveyance of irrigation water	SHPO concurred with a determination of "no adverse effect" for this property
Indian Bend Wash Habitat Restoration	1701 E. McKellips Road	US Army Corps of Engineers	Existing hiking trails and lookout ramada	21	Access points at Curry and Miller Roads	Facility occupies land primarily used to convey floodwater	Facility subject to flooding during storm events

7.12.1 Public Parks

Moeur and Papago Park

Moeur Park and portions of Papago Park are located in Tempe and are situated between Curry Road and SR 202L. There will be no use of these properties because no new right-of-way or permanent easements will be acquired from these parks, and no portion of the parks will be incorporated into a transportation facility. The widening of SR 202L will not represent a constructive use of these parks because a) noise modeling predicts noise levels ranging from 65 to 72 decibels (dBA) that are not higher than the current noise level measured at 71 dBA; b) the existing landscape in these parks will not

be changed and views of the surrounding features such as Tempe Town Lake and the Papago Buttes will not be blocked; and c) the existing points of access to these facilities from Curry Road, Mill Avenue, Gilbert Drive, and access provided by the City of Tempe pedestrian and multi-use paths will not be affected by this project.

Rio Salado Park and Tempe Town Lake

Rio Salado Park and Tempe Town Lake are located south of SR 202L between Priest Drive and Scottsdale Road. The Tempe Town Lake Marina, a component of these facilities, is adjacent to the freeway between Mill Avenue and Scottsdale Road. Portions of the Tempe Town Lake are located under the SR 202L Indian Bend Wash Bridge within the right-of-way. The portions of Tempe Town Lake that is within the ADOT right-of-way are not protected under Section 4(f) because the primary use land within the ADOT right-of-way is for the construction and continued operation of the freeway and for the Flood Control District of Maricopa County to construct and maintain flood control structures.

No new right-of-way permanent easements will be acquired from Rio Salado Park, Tempe Town Lake, or the Tempe Town Lake Marina. There will be no use of these properties because they will not be incorporated into a transportation facility. These facilities are located in an urban environment that includes noise sources such as the existing freeway and arterial street traffic, commercial airline aircraft, and the UPRR. The predicted changes to noise levels are expected to not substantially impair the properties as a result of the project and are not expected to deter the public from continued use of these facilities or interfere with their use and enjoyment.

The Tempe Town Lake Marina includes an area identified as an amphitheatre that was constructed after the original construction of SR 202L. The amphitheater provides public seating within the marina but also functions as a water feature that circulates and aerates water from the marina lagoon. The water circulation feature is quasi-interactive, as park visitors can come in contact with the water.

Since the opening of the Marina in 2004, the Marina has been used for launching of watercraft, watercraft storage, parking, public access to other portions of the Tempe Town Lake Park, and has been used to host activities associated with triathlon competitions. This facility also has been used for public viewing of the fireworks display during 4th of July celebrations. Future noise levels resulting from widening SR 202L are expected to increase at the Tempe Town Lake Marina but will not constitute a constructive use of the amphitheatre because this facility was constructed in an area of ambient highway traffic noise and was never intended to host noise-sensitive activities.

The aesthetic qualities of Rio Salado Park, Tempe Town Lake, and the Tempe Town Lake Marina will not be impacted by widening SR 202L because improvements will be limited to the freeway and bridge structures and the parks' landscape appearance will remain similar to existing conditions. The existing viewsheds from these parks will not

be affected because the project will not block or prevent park patrons from seeing the lake and other prominent landmarks such as the historic flourmill and Hayden Butte.

The project will not result in restricted access to Rio Salado Park, Tempe Town Lake, or the Tempe Town Lake Marina because the existing points of access to these facilities will be maintained during construction and will not change as a result of the project. In summary, there will be no constructive use of Rio Salado Park, Tempe Town Lake, or the Tempe Town Lake Marina because a) predicted noise levels will not substantially impair the properties or its uses; b) the aesthetic qualities of these parks and the views they afford will not be affected; and c) the project will not result in restricted public access to the parks or lake.

7.12.2 Public Recreation Areas that also Function as Habitat Preservation and Habitat Restoration Areas

The Lopiano Bosque is bounded on the north by the Indian Bend Pump Ditch, on the south by SR 202L, and on the east and west by College and Mill Avenues. This area was designated by the City of Tempe as a nature preserve but also serves a recreation function for hikers, equestrianship, and mountain bikers. The project will not represent a use of this preserve because no new right-of-way permanent easements will be acquired from this property. There will be no constructive use of this property because a) widening will take place on the opposite side of the freeway and future noise levels are expected to remain similar to current levels; b) the aesthetic qualities of this property will not be affected because changes to the freeway and landscape will be confined to the eastbound side and will not be evident to patrons within the Lopiano Bosque; and c) the Lopiano Bosque is currently accessed from Moeur Park or the trailhead at College Avenue, and these points of access will not change as a result of the project.

The Indian Bend Wash Habitat Restoration is located within the Indian Bend Wash channel between Curry Road and the Salt River. This Corps project includes the reestablishment of native riparian vegetation and recreation facilities for hiking and bicycling. The widening of SR 202L will not represent a use of this property because no new right-of-way or permanent easements will be acquired from this property and no portion of the habitat area will be incorporated into a transportation facility. There will be no constructive use of this property because a) increases of noise levels from current conditions to predicted levels are not expected to substantially impair the habitat area or its uses as a result of the widening, b) the aesthetic qualities of this property will not be affected because changes to the freeway will use similar workmanship/materials to the existing freeway, and c) the existing points of access to the Indian Bend Wash Habitat for pedestrians and motorists at Miller and Curry roads will not change as a result of the project.

Two phases of the Corps sponsored Salt River Habitat Restoration (Rio Salado) Project are planned for the segments of Salt River east and west of Tempe Town Lake. The phases of the Corps' Rio Salado Project have been adopted into the City of Tempe's General Plan. Therefore, areas designated for the development of the future habitat

restoration project phases are protected under Section 4(f). These phases will be similar to the existing Indian Bend Wash Habitat and include planting native riparian vegetation, creating open water, and providing recreational opportunities to the public such as hiking and bird watching. Both phases will be constructed outside of the existing ADOT SR 202L right-of-way, and ADOT has no plans to acquire new right-of-way or easements from these proposed habitat project areas. The widening of the freeway will not represent a use of these future habitat areas, as no portion of their land will be incorporated into a transportation facility.

Constructive use of the future Rio Salado Habitat Restoration Phases will not result from the freeway widening because a) noise levels in these future habitat areas are predicted to remain under 68 dBA and are not expected to impair the property or its uses; b) widening of the existing freeway and bridge structures and will not change the appearance of the existing landscape; and c) the freeway widening will not make changes to the pedestrian, multi-use, or motorized access routes that may potentially be incorporated into the access plan for the future habitat restoration areas.

7.12.3 Historic Properties

The following historic properties in the project area are protected under Section 4(f):

- Grand Canal
- Old Crosscut Canal
- Tovrea Castle and Carraro Cactus Garden (NRHP-listed)
- Historic US Highway 60/70/80/89
- Southern Pacific Railroad
- Mill Avenue Bridge (NRHP-listed)
- Indian Bend Pump Ditch

The Grand Canal, Old Crosscut Canal, Historic US Highway 60/70/80/89, the Southern Pacific Railroad, and the Indian Bend Pump Ditch are important historical resources and are eligible for the NRHP. The proposed project will not affect the characteristics of these properties that potentially qualify them for the NRHP. The Carraro Cactus Garden (including the Tovrea Castle) and the Mill Avenue Bridge are listed on the NRHP. The proposed project will not affect the characteristics of these properties that qualify them for the NRHP. The Arizona State Land Department, City of Phoenix, Salt River Project (SRP), and the State Historic Preservation Office have concurred with the determination of "no adverse effect" for all seven historic properties in the project area (letters attached).

The project will not affect these properties because most improvements will span these properties and no new right-of-way or permanent easements will be acquired from historic properties. Therefore, no use of historic properties will result from this project.

A "no adverse effect" determination has been made for all seven historic properties. Therefore the constructive use does not apply. The following historic properties also

function as recreation areas: Grand Canal, Carraro Cactus Garden, and the Indian Bend Pump Ditch. The Grand Canal serves as a segment of the Maricopa Association of Government Bikeway System and provides transportation and recreation opportunities for non-motorized travelers. Carraro Cactus Garden is being renovated and will open as a public park in 2008. The Indian Bend Pump Ditch is located in the City of Tempe Lopiano Bosque and the maintenance road for the ditch provides a hiking, bicycle, and equestrian path through the bosque.

The project is expected to increase noise levels at locations along the Grand Canal by up to 11 decibels (dBA) over current conditions. However, a proposed noise barrier will benefit some portions of the Grand Canal and post-construction noise levels are expected to remain unchanged from current conditions at these locations. Overall, changes in noise levels along the Grand Canal are not expected to deter the use of this facility for non-motorized and recreational transportation because travelers on the path will only briefly be exposed to increased noise levels as they pass under the freeway.

Noise levels at the Carraro Cactus Garden are anticipated to increase by 6 dBA as a result of the project, resulting in noises levels ranging from 67 to 73 dBA. This increase is not expected to impact the use of this property as a public park. The predicted noise levels are not excessive for park patrons to enjoy hiking through the gardens, which is the primary recreation activity based on the proposed park plan.

The project is expected to reduce noise levels by 2 dBA at locations along the Indian Bend Pump Ditch. Therefore, the project will not result in noise levels that affect the use or enjoyment of recreational aspects of this facility.

7.12.4 Park Facilities within the ADOT Right-of-Way

The City of Tempe, through an agreement with ADOT, has developed park facilities in the SR 202L right-of-way under the freeway viaduct spanning Mill Avenue. These park facilities include parking lots, a boathouse, an administrative office, and access ways for park patrons to reach portions of Moeur, Papago, and Tempe Town Lake/Rio Salado parks. Through similar agreements, the City of Tempe has constructed a concrete multi-use pathway, landscaping, and public art that encroaches into the ADOT right-of-way near the Tempe Town Lake Marina. Although fences currently block them, there are two existing SR 202L pedestrian overpasses that provide connectivity between Tempe Town Lake/Rio Salado Park and parks located north of the freeway.

Although there are park and recreation facilities within the SR 202L right-of-way, ADOT maintains the primary rights to the existing right-of-way to construct and operate the freeway. Therefore, the park and recreation facilities within the freeway right-of-way are not protected under Section 4(f). According to the FHWA 4(f) Policy Paper dated March 2005, *the requirements of Section 4(f) to not apply to the subsequent use of the reserved area for its intended highway purpose. This is because the land used for the highway project was reserved from and, therefore, has never been part of the protected 4(f) area.* However, ADOT acknowledges the public benefit that these facilities provide

and will take measures during the design of the project to minimize use of park facilities within the right-of-way. These measures will include but are not limited to: minimizing the loss of parking spaces, maintaining pedestrian connectivity through the two overpasses, providing the opportunity for public art to be removed during construction and replaced after the freeway is widened, and reinstalling landscaping in areas within the right-of-way disturbed during construction.

There are publicly owned parks, recreation areas (including habitat restoration - preservation areas), and historic properties in the project study area. No new right-of-way or permanent easements will be acquired from these properties. Therefore, no portion of these properties will be permanently incorporated into a transportation facility. Constructive use was also analyzed for each property and the use and enjoyment, aesthetic value, and public access to these properties will not be substantially impacted or diminished as a result of the widening of SR 202L. In summary, no use of Section 4(f) properties is expected as a result of the widening and related project activities for SR 202L.

7.12.5 Section 6(f) Resources

The Land and Water Conservation Fund (LWCF) Act was signed into law on September 3, 1964, as Public Law 88- 578, 16 United States Code 460l-4. The Act was established to provide a funding source for the acquisition of park and recreation lands by federal, state, and local governments. As a part of the Act, the provisions under 88-578, 16 United States Code 460l-4, Section 6(f)(3) mandates that these resources are protected, but realize that changes in land use, especially in growing communities, can impact these protected areas. As detailed in the following excerpt from the Act, the LWCF Act contains a clear and common sense provision to protect these areas from conversions.

> *SEC. 6(f)(3) - No property acquired or developed with assistance under this section shall, without the approval of the Secretary (of the U.S. Department of Interior), be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide outdoor recreation plan and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.*

Records from the Arizona State Parks Department indicate that landscape, irrigation, playground equipment, and other park amenities were constructed in the Tempe portion of Papago Park using LWCF Act funds. There are no other Section 6(f) resources in the project area. No new R/W or permanent easements will be acquired from Papago Park. No portion of this park will be converted to a use other than public outdoor recreation. Therefore, no impacts to Section 6(f) resources will result from the widening of SR 202L.

7.12.6 Conclusions

There are publicly owned parks, recreation areas (including habitat restoration - preservation areas), and historic properties in the project study area. No new right-of-way or easements will be acquired from these properties; thus, no portion of these properties will be permanently incorporated into a transportation facility. Constructive use was also analyzed for each property and the use and enjoyment, aesthetic value, and public access to these properties will not be substantially impacted or diminished as a result of the widening of SR 202L. In summary, no use of Section 4(f) properties is expected as a result of the widening and related project activities for SR 202L. Because no portion of any Section 6(f) resource will be converted to a use other than public outdoor recreation, there will be no Section 6(f) impacts as result of this project.

7.13 PUBLIC AND AGENCY INVOLVEMENT PROCESS

As part of the NEPA process, an agency scoping meeting and two public scoping meetings were conducted for the proposed freeway-widening project. Agency scoping letters were sent to 62 federal, state, and local agencies on September 8, 2005. The scoping letters identified the project boundary limits, provided a brief description of the proposed undertaking, and announced the date, time and location of the agency-scoping meeting. On October 5, 2005, an email was also sent to the invitees reminding them of this meeting and provided a map of the meeting location. In addition, public meeting announcements were placed in the Arizona Republic on November 12, 2005.

7.13.1 Agency Scoping Meeting

An agency scoping meeting was held on October 11, 2005 from 1:00 to 3:00 p.m. at the ADOT Human Resource Development Center. The purpose of this meeting was to solicit comments and concerns from the applicable agency stakeholders that may be affected by this project. Twenty-three people signed the attendance sheet at the agency scoping meeting. Representatives from ADOT, FHWA, Corps, MAG, City of Phoenix, City of Mesa, City of Tempe, City of Scottsdale, Valley Metro Regional Public Transportation Authority (RPTA), and project consultant team members were present at this meeting. Attendees were provided an agenda, including a one-page comment form and handouts, and were requested to submit any comments about the proposed project by October 21, 2005. Project team representatives provided a project and environmental overview, followed by a facilitated questions and answers session that is summarized below:

First facilitated question: *"What are the issues that need to be addressed during the study?"*

- The representative from Tempe had the following issues/subjects of concern:
  - Stated that the entire surface area of the Tempe Town Lake is a designated park

- Tempe hosts frequent special events, and is concerned with event traffic during construction of this project
- The City of Tempe is concerned with impacts to an enhancement project in the Papago Park area that was recently completed by the City of Tempe. This project was funded through donations from private citizens that reside in the area.
- Potential impacts to the SRP Grand Canal that is considered historic
- Potential impacts to the light rail will need to be addressed in this study
- Additional R/W needs
- Impacts to neighborhoods including noise impacts
- Noise impacts to adjacent parks should be evaluated
- No potential issues were identified by Tempe that would specifically concern Arizona State University (ASU)
- Tempe is aware that the RPTA is expanding express service to ASU and wishes for impacts to the service be minimized during construction
- Concerned how lighting would affect the surrounding areas; discouraged the use of high mast lighting in Tempe
- Loss of highway landscaping as a result of this project
- Tempe requested that ADOT Freeway Management System camera(s) be installed to have a better perspective on traffic at certain locations
- Tempe has public art on some of the ADOT retaining walls along the south side of the freeway—it can be unbolted, removed and reattached to the new walls
- The representative from Tempe requested a separated one-on-one meeting with ADOT and the Tempe City Council

- The representative from Sky Harbor Airport made the following points:
  - There is an East Access Study underway that will examine ways of improving/optimizing ingress/egress to the airport. The draft report is scheduled to be out the beginning of 2006.
  - Adopted improvements from this access study may or may not affect the proposed project or traffic on SR 202L.
  - There may be future impacts on SR 202L traffic from the proposed new terminal. These future impacts will be addressed in a draft EIS being prepared by the City of Phoenix for Sky Harbor International Airport.
  - Signage on SR 202L that directs rental car traffic through the airport is causing traffic congestion.
  - The design team may want to consider future traffic from the new rental car area based on the inclusion of the facility in the MAG study.
  - There are plans to connect Terminal 4 to the light rail. The City of Phoenix is planning to construct an Automated People Mover (APM) that connects Sky Harbor to the light rail at the intersection of Washington Street and 48th Street.
  - The main contact for Sky Harbor is Jane Morris (Planning Administrator).

- The representative from the City of Scottsdale expressed the following concern:
  - The capacity of the southbound SR 101L to the westbound SR 202L ramp is inadequate. The Representative requested an additional ramp lane at this location.

- The representative from MAG made the following comments:
  - Requested the project team to conduct the air quality studies in conjunction with MAG.
  - Requested the project team look at future traffic volumes and consider double-lane ramps at the SR 202L/SR 202L TI. It was added that the "no build" model for air quality would be provided by MAG.

- The representative from the City of Phoenix requested that landscape rehabilitation be included in the proposed project.
  - FHWA suggested that ADOT consider constructing landscape improvements as part of the proposed project.

The project team asked the representatives from the cities of Scottsdale and Phoenix if they would be interested in private briefings. The representatives did not comment, and were asked to make contact with the Project Manager if they are interested in such meetings.

Second facilitated question: *"Are there any other projects or plans for this area that need to be considered?"*

- The City of Tempe mentioned the Miller Road extension project, which is being constructed by permit within ADOT R/W. The Tempe representative confirmed that this project would be done in two months and that the structure associated with the extension was constructed as wide as ADOT required at the time it was designed. The City of Tempe will provide the project team with construction drawings of this extension.
- An access road to the Light Rail Maintenance and Storage facility is under construction. This project includes a ramp and bridge over the Grand Canal and UPRR within ADOT R/W on the west side of SR 202L, just south of the Washington Street.

Third facilitated question: *"Are there any potential barriers that may impact the implementation of this project?"*

- The representative from the City of Tempe had the following comments and concerns:
  - Tempe Town Lake is a designated city park; the project team should get the limits of the park.
  - Maintaining traffic to the Tempe Town Lake Marina, the only access is at the SR 202L overpass just west of College Avenue.
  - Conflicts with the pump station west of McClintock Drive and just east of the Indian Bend Wash on the north bank of Tempe Town Lake.
  - Impacts to the light rail; it is anticipated that it will be in service by 2008.
  - North of Tempe Town Lake, avoid freight conflicts and clearance issues.
  - Possible restrictions to RPTA bus route at the Scottsdale Road TI.

- The representative wish to know how the ramps will remain lined up at the Priest Drive Bridge.
- Stated that there are major events planned in Tempe, asked for coordination to minimize construction related impacts to these events.

Attendees expressed additional issues, comments, questions and concerns that are summarized below:

- ADOT traffic wants to be kept appraised of what signage changes will be necessary as a result of the proposed project.
- 2015 & 2017 future commuter rail projects should be a consideration of the project team.
- When will construction begin?
- Will no-build modeling for air quality be conducted as well?
- The project team should consider future development along the south side of SR 202L, between Scottsdale Road and Indian Bend Wash.
- MAG noted that from a traffic perspective, the RTP brings us to a certain limit. Traffic interchanges should be considered, especially the SR 101L TI, regarding double lane ramps. These issues should be pointed out to MAG for use beyond the 2025 horizon.
- If additional R/W is needed from the railroad, need to plan on an 18-24 month lead-time. If there is a change in a railroad crossing, approval from the Arizona Corporation Commission is required, this takes 90-120 days for approval.

7.13.2 Agency Scoping Letter Comments

Responses were received from various agencies from the letters that were sent out and below is a summary of agency comments received by October 26, 2005:

Arizona Game and Fish Department

- The AGFD sent a response letter with a list of special status species occurring in the project vicinity. The AGFD stated that this project does not occur in the vicinity of any Proposed or Designated Critical Habitats.

City of Phoenix

- The City of Phoenix sent a response letter identifying their concerns with the following issues:
  - Their environmental concerns consists of noise, dust, landscaping, impacts to adjacent neighborhoods and traffic restrictions on SR 51 that could impact the City's streets.
  - Asked that noise mitigation for residential development adjacent to the project be addressed in the environmental document.
  - Landscaping along SR 202L in the project area may need to be rehabilitated and/or restored to its intended level and, if so, should be included in the project.

- Asked that impacts to the adjacent neighborhoods during construction including noise, dust, and stray lighting should be avoided, minimized or mitigated as appropriate.
- Asked that the project team notify the Street Transportation Department as far in advance as possible of any significant traffic restrictions on SR 202L during the construction of this project.
- Stated that the City is not aware of any projects that would be impacted by this project.
- The City of Phoenix wants to be involved in the development process for this project and provided contact information for future correspondence on this project.

Environmental Protection Agency

- A representative of the Environmental Protection Agency (EPA) responded via telephone and wanted additional information regarding the project. Below is a list of comments and questions:
  - Inquired about the level of NEPA documentation. It was explained that a detailed categorical exclusion is appropriate (at this time) since the widening is planned to occur within ADOT R/W. It was also explained that the project is still in the preliminary stages of the design and environmental process.
  - Concerned about any impoundments to waters of the U.S., mainly the Salt River and Indian Bend Wash. Stated that it is the EPA's preference to avoid these areas, but understands that it may be difficult. Also asked that the project team look for any opportunities to improve drainage, if possible.
  - Wanted to ensure that the project team is coordinating with the Salt River - Pima Maricopa Indian Community for this project.
  - Concerns about both direct and indirect impacts to residents in the area. It was explained that there are residential areas in the project area that are adjacent to the freeway and air and noise analyses will be conducted to determine the level of impacts. It is anticipated that no additional R/W will be needed to construct the freeway improvements, and there will be no residential displacements. Land use and socioeconomic impacts will be evaluated.
  - Wanted to ensure that the project team is conducting analyses for both existing and future impacts, and that this information would be communicated to the public.
  - Mentioned that the EPA has some construction mitigation recommendations related to air quality that they might provide.
  - Regarding the superfund site, the EPA did not have any specifics to add, but that the project team should follow-up with their Superfund Site Office for further discussions, as necessary.
- The EPA followed up with an email with the contact information for an EPA representative in Tucson, AZ, in regards to air quality analyses.
- The EPA also sent a response letter thanking the project team for involving the EPA early in the environmental review process for this project, and asked for continued involvement by reviewing applicable documents. The letter also contained additional environmental concerns:

- If widening of the Salt River Bridge and Indian Bend Wash Bridge occurs, the EPA asked ADOT to identify measures for avoiding and minimizing impacts to these aquatic resources and describe environmental benefits achieved by incorporating specific design features.
- Since the project is in a non-attainment area and maintenance area for Carbon Dioxide, it was asked of ADOT to implement measures to reduce impacts to air quality during construction.
- Recommended working with the Salt River Pima - Maricopa Indian Community in developing design features, construction schedule and mitigation measures for the project.

The Salt River Pima - Maricopa Indian Community

- The representative from the SRPMIC responded via email and stated that the community is considering development and an extension of Pima Road in this area and would be interested in an off ramp at Hayden Road (McClintock) on the WB SR 202L.
- Inquired if there were any issues with water and a possible wetland area under the interchange.

The City of Tempe

- The City of Tempe sent a response letter and identified a number of issues and concerns regarding this project. The following is a summary of the issues that were identified:
  - The City is concerned that ADOT is only considering a CE and not an EIS regarding the environmental impacts the proposed project could pose on the City of Tempe.
  - The City identified a possible utilities conflict that may occur at the McClintock overpass and possible additional locations.
  - The City has a number of concerns regarding the Rio Salado Town Lake and Park, including parkland that could possibly be reduced, as well as landscaping adjacent to the freeway; the multi-use transportation system may also be potentially impacted.
  - The City is also concerned with the construction that will occur over the existing Town Lake and would require extra care to keep construction materials from falling into the lake; public safety is a concern for the City.
  - The City identified areas where private development has begun adjacent to the SR 202L, which includes the area east of Rural Road and the Town Lake Marina Boathouse, and west of Rural Road and College Avenue. The project would have a direct impact on parking and access for these developments. In addition, the Indian Bend Wash Habitat Restoration, which was federally funded, would be impacted.
  - The City would like assurance that during construction their Park Rangers will have access to all the different portions of the park and lake areas to maintain security. The city also wants to maintain access to the path along the north side

of the lake, the marina, boat storage and the boat beach area and have uninterrupted use of the Papago Park recreation areas for the public.
- The City also identified that the Rio Salado Operations Center and offices are located beneath the SR 202L freeway, west of Mil Avenue.
- The City identified that at the time of the proposed construction the Valley Metro Rail System would be in operation and is concerned for public safety, rail and operation safety during construction.
- The City identified their three major intersections and three grade separation crossings that occur in the project area that would be affected, traffic control and maintaining access will need to be addressed at these locations.
- The City is also concerned with noise at the park and adjacent residential areas.

7.13.3 Summary of Agency Comment Forms Received

One comment form was returned at the conclusion of the meeting from the representative of MAG:

- Requested coordination with the air quality report with Lindy Baur at MAG to confirm "buy-in" with regional air quality monitoring.
- Look at the traffic interchanges (SR 101L, SR 51/I-10, SR 143, Sky Harbor in particular) and identify whether additional capacity may be needed in future years.

7.13.4 Public Scoping Meeting

Two public scoping meetings were held on the evenings of November 29, 2005 and November 30, 2005. The first public scoping meeting was held at Tempe High School, located at 1730 S. Mill Avenue, Tempe, AZ, from 6:00 to 8:00 p.m. The second public meeting was held at Balsz Elementary School, located at 4309 E. Belleview Street, Phoenix, AZ from 6:00 to 8:00 p.m. The purpose of these meetings was to solicit comments and concerns from the public that may be affected by this project. Attendees were provided a one-page comment form and handout of the project newsletter.

Public Scoping Meeting at Tempe High School

Twenty-two people signed the attendance sheet at the first public meeting. The meeting was conducted as an open-house type format with a brief presentation that included a project overview. Following the presentation, general questions and comments were requested from the audience and is summarized below:

- An inquiry was made asking if there would be simultaneous construction with this project and the project that is adding HOV lanes to the SR 101L/SR 202L TI to Gilbert Road.
- An inquiry was made asking when the next widening for this area would be; the attendee did not think the additional lanes would solve the problem.
- An inquiry was made asking about the composition of the rubberized asphalt that makes the roadways quieter.

- An inquiry was made regarding the need to add pavement to the existing footprint, especially from Priest Road to McClintock Road.
- An inquiry was made asking if there are plans for noise walls. The attendee informed the project team that they have monitoring noise equipment in their yard.

Public Scoping Meeting at Balsz Elementary

Twenty people signed the attendance sheet at the second public meeting. The meeting was conducted as an Open-House type format with a brief presentation that included a project overview. Following the presentation, general questions and comments were requested from the audience and is summarized below:

- An inquiry was made regarding how the project team will treat the south side of the right-of-way regarding walls and the slope.
- An inquiry was made regarding when the westbound lane will be added, especially at the curve. Inquired about the demand for this in 2040.
- An inquiry was made asking why the existing problems with the ramps will not be fixed.
- An inquiry was made regarding the estimated cost of the project and what is the cost for each mile of the project. Also inquired if the project team considered making the lanes narrower.
- A comment was made regarding the use of the right-of-way such as landscaping and infrastructure that enhances the communities. Inquired what happens when the footprint changes and what are the baselines for communities.
- An inquiry was made asking if there is money in this project for a noise study.

7.13.5 Summary of Public Scoping Comment Forms Received

Comment forms were received from a number of individuals. The following is a summary of comments and questions received:

Meeting at Tempe High School

- A comment was received expressing their gratitude for studying the bottlenecks on the westbound SR 202L approaching SR 101L and eastbound from SR 51. The couple travels on SR 202L daily commuting to and from work and wishes the improvements could be built before 2009. They also thanked the project team for the opportunity to provide input.
- A comment was received regarding future transit uses with the expansion. The HOV lanes accommodate express buses, however buses entering and existing at Scottsdale Road might be difficult. The situation currently exists on Express Routes 520/521 entering and exiting US 60 at Mill Avenue.
- A comment was made regarding maintaining access to all Town Lake activities on the north side during construction. Not only for vehicles but pedestrians and cyclists as well. There are a lot of activities as well as classes that are held at the lake.

Meeting at Balsz Elementary

- A comment was received regarding the southbound SR 51 ramp to the eastbound SR 202L need to complete the second ramp lane. The southbound SR 51 ramp to westbound I-10 should also be two lanes.
- A comment was received regarding the noise levels, noise walls and landscaping. Currently, there is only sparse vegetation between the respondent's neighborhood and the freeway. This individual commented that there was no communication or input with neighbors when the original freeway was constructed; and they would like their concerns be taken seriously. The individual also commented that the quiet asphalt is not as quiet as when it was first applied.
- A comment was received regarding taking care of the neighborhood and the respondent requested that they be notified about what is going on.

All comments received were provided to the project team and will be considered as part of the project development process and the evaluation of environmental issues for this project.

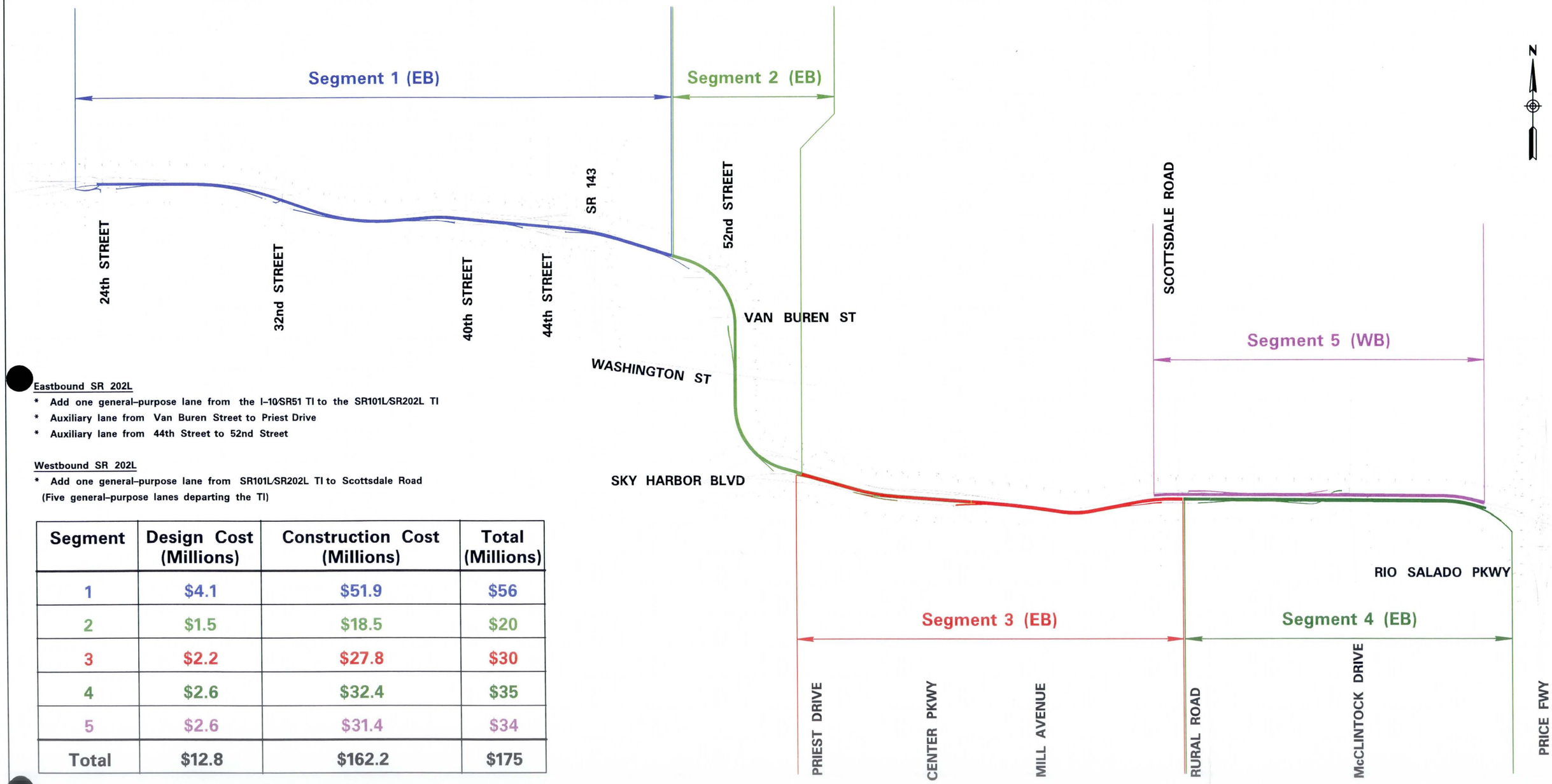
8.0 IMPLEMENTATION PLAN

The RTPFP includes a total budget of $105,030,000 to complete the freeway widening within the study limits. The order of magnitude estimate for the Recommended Alternative is $184,000,000, which includes $170,500,000 for construction and $13,500,000 for design.

Order of magnitude itemized estimates were prepared for five individual segments of the study area for Alternatives 1 and 2, which are included in this section of the report. These estimates were prepared to provide the information necessary to allow the Department to evaluate potential near term projects to systematically build the Recommended Alternative to provide additional capacity and improved level-of-service within the corridor within the fiscal restraints of the RTPFP.

Recommendations for phased construction of the improvements included with the Recommended Alternative will be included in the Final Design Concept Report.

ALTERNATIVE 1 SEGMENT ESTIMATE
SEPTEMBER 2006



Eastbound SR 202L

* Add one general-purpose lane from the I-10/SR51 TI to the SR101L/SR202L TI
* Auxiliary lane from Van Buren Street to Priest Drive
* Auxiliary lane from 44th Street to 52nd Street

Westbound SR 202L

* Add one general-purpose lane from SR101L/SR202L TI to Scottsdale Road
(Five general-purpose lanes departing the TI)

Segment	Design Cost (Millions)	Construction Cost (Millions)	Total (Millions)
1	$4.1	$51.9	$56
2	$1.5	$18.5	$20
3	$2.2	$27.8	$30
4	$2.6	$32.4	$35
5	$2.6	$31.4	$34
Total	$12.8	$162.2	$175

Footnote:
* Right-of-Way acquisition is not anticipated for this project
* Utility Relocation included in Construction Estimate
* Environmental Mitigation cost are not known and are not included in estimate
* Estimates in the tables may not match estimate sheets due to rounding

FIGURE 25

ON THE MOVE
PARTNERS IN PROGRESS

Table 40 – Alternative 1, Segment 1 (EB) Order of Magnitude itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	9,649	$6.00	$58,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	1,717	25.00	43,000
Removal of Concrete Half Barrier	L.Ft.	17,165	16.00	275,000
Removal of PCCP Pavement	Sq.Yd.	24,465	15.00	367,000
Roadway Excavation	Cu.Yd.	30,990	6.00	186,000
Roadway Embankment (Borrow)	Cu.Yd.	73,220	8.00	586,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	17,133	45.00	771,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	40,248	50.00	2,013,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	57,381	5.00	287,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	154	60.00	10,000
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	1,014	70.00	71,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	747	90.00	68,000
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	157	170.00	27,000
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	1,225	140.00	172,000
Concrete Pipe Collar	Each	128	500.00	64,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	42	3,000.00	126,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	1	3,500.00	4,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	11	3,000.00	33,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	11	3,500.00	39,000
Concrete Catch Basin (C-15.80) (Median)	Each	1	3,000.00	3,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	6	5,500.00	33,000
Junction Box	Each	6	2,000.00	12,000
Strom Drain Outlet	Each	1	500.00	1,000
Removal of Pipe	L.Ft.	208	30.00	7,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	2,000	10.00	20,000
Concrete Catch Basin (Modify Existing)	Each	65	750.00	49,000
Fill Abandoned Manhole & Plug Pipe	Each	2	1,200.00	3,000
Removal of Miscellaneous Concrete	L.Sum	1	17,000.00	17,000
Removal of Structural Concrete	Cu.Yd.	15	750.00	12,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	5	80,000.00	400,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	5	7,500.00	38,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	8	7,000.00	56,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	7	5,000.00	35,000
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	4	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	3	12.00	1,000
Sign Post (Perforated) (2 1/2 S)	L.Ft.	46	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	76	18.00	2,000
Foundation For Sign Post (Concrete)	Each	10	150.00	2,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	32	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1259	25.00	32,000
Relocate Signs (Including VMS)	Each	15	1,000.00	15,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	3	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	36	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	174,567	0.15	27,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	142,196	0.25	36,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	32,371	0.25	9,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	72	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	36	150.00	6,000
Pavement Marker, Raised, Type C	Each	2,788	3.50	10,000
Impact Attenuation Device	Each	7	25,000.00	175,000
Electrical Conduit (3-3")(PVC)	L.Ft.	10,000	20.00	200,000
Flagging Services	L.Sum	0	0.00	0
Pull Box (No. 7)	Each	20	600.00	12,000

Table 40 – Alternative 1, Segment 1 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 9)	Each	$10	$2,500.00	$25,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	30,000	5.00	150,000
Loop Detector For Traffic Surveillance (6'x6')	Each	20	500.00	10,000
Luminaire (Vertical Mount) (400 Watt)	Each	130	750.00	98,000
Relocate Ramp Metering Equipment	Each	5	15,000.00	75,000
Landscaping	Mile	3.00	200,000.00	600,000
Concrete Curb And Gutter	L.Ft.	7,928	20.00	159,000
Concrete Half Barrier	L.Ft.	18,363	70.00	1,286,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	1,836	100.00	184,000
24th Street TI Overpass	L.Sum	1	1,081,000.00	1,081,000
32nd Street TI Overpass	L.Sum	1	853,000.00	853,000
Grand Canal Bridge	L.Sum	1	595,000.00	595,000
40th Street TI Overpass	L.Sum	1	724,000.00	724,000
44th Street TI Overpass	L.Sum	1	1,353,000.00	1,353,000
East Papago TI Underpass EB	L.Sum	1	1,703,000.00	1,703,000
48th Street Overpass EB	L.Sum	1	903,000.00	903,000
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	1	9,154,500.00	9,155,000
Retaining Wall (Type: Regular)	Sq. Ft.	45,800	50.00	2,290,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	3,800	75.00	285,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	29,700	60.00	1,782,000
Retaining Wall (Type: Barrier)	Sq. Ft.	400	25.00	10,000
Access Road Embankment	L.Sum	0	0.00	0
SUBTOTAL OF ABOVE ITEMS:				**$29,800,000**
Maintenance And Protection of Traffic		10%		2,980,000
Dust And Water Palliative		0.75%		230,000
Quality Control		2%		600,000
Construction Surveying		2%		600,000
Erosion Control		0.3%		90,000
Mobilization (8% of Total Construction Items)				3,642,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$37,940,000**
Unidentified Items		20%		7,590,000
TOTAL CONSTRUCTION COST:				**$45,530,000**
Construction Engineering		9%		4,100,000
Construction Contingencies		5%		2,280,000
Engineering Design (Includes Surveying And Geotechnical)		8%		3,650,000
Right-of-Way				0
Utility Relocation		1%		460,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$56,000,000**

Table 41 – Alternative 1, Segment 2 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	2,282	$6.00	$14,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	593	25.00	15,000
Removal of Concrete Half Barrier	L.Ft.	5,931	16.00	95,000
Removal of PCCP Pavement	Sq.Yd.	6,170	15.00	93,000
Roadway Excavation	Cu.Yd.	7,770	6.00	47,000
Roadway Embankment (Borrow)	Cu.Yd.	36,533	8.00	293,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	4,597	45.00	207,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	11,814	50.00	591,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	16,411	5.00	83,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	238	70.00	17,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	500	140.00	70,000
Concrete Pipe Collar	Each	91	500.00	46,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	3	3,000.00	9,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	2	3,500.00	7,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	8	3,000.00	24,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	8	3,500.00	28,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	1	500.00	1,000
Removal of Pipe	L.Ft.	240	30.00	8,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	21	750.00	16,000
Fill Abandoned Manhole & Plug Pipe	Each	2	1,200.00	3,000
Removal of Miscellaneous Concrete	L.Sum	1	13,000.00	13,000
Removal of Structural Concrete	Cu.Yd.	12	750.00	9,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	16	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	717	25.00	18,000
Relocate Signs (Including VMS)	Each	2	1,000.00	2,000
Relocate Signs (VMS)	Each	1	50,000.00	50,000
Milepost Marker (S-10)	Each	0	250.00	0
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	28	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	101,173	0.15	16,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	78,905	0.25	20,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	22,268	0.25	6,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	24	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	18	150.00	3,000
Pavement Marker, Raised, Type C	Each	1,170	3.50	5,000
Impact Attenuation Device	Each	2	25,000.00	50,000
Electrical Conduit (3-3")(PVC)	L.Ft.	1,000	20.00	20,000
Flagging Services	L.Sum	1	125,000.00	125,000

Table 41 – Alternative 1, Segment 2 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	2	$600.00	$2,000
Pull Box (No. 9)	Each	1	2,500.00	3,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	3,000	5.00	15,000
Loop Detector For Traffic Surveillance (6'x6')	Each	2	500.00	1,000
Luminaire (Vertical Mount) (400 Watt)	Each	13	750.00	10,000
Relocate Ramp Metering Equipment	Each	1	15,000.00	15,000
Landscaping	Mile	2.00	200,000.00	400,000
Concrete Curb And Gutter	L.Ft.	2,312	20.00	47,000
Concrete Half Barrier	L.Ft.	5,942	70.00	416,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	594	100.00	60,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	1	580,000.00	580,000
52nd Street Overpass EB	L.Sum	1	754,000.00	754,000
Van Buren Street Overpass EB	L.Sum	1	533,000.00	533,000
Washington Street Overpass EB	L.Sum	1	651,000.00	651,000
SPRR/Grand Canal Bridge EB	L.Sum	1	1,873,000.00	1,873,000
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	1	651,000.00	651,000
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	1	546,800.00	547,000
Retaining Wall (Type: Regular)	Sq. Ft.	34,500	50.00	1,725,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	0	75.00	0
Retaining Wall (Type: Specialty 2)	Sq. Ft.	0	60.00	0
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	0	0.00	0

SUBTOTAL OF ABOVE ITEMS:		**$10,500,000**
Maintenance And Protection of Traffic	10%	1,050,000
Dust And Water Palliative	0.75%	80,000
Quality Control	2%	210,000
Construction Surveying	2%	210,000
Erosion Control	0.3%	40,000
Mobilization (8% of Total Construction Items)		1,284,000
SUBTOTAL - CONSTRUCTION ITEMS:		**$13,370,000**
Unidentified Items	20%	2,680,000
TOTAL CONSTRUCTION COST:		**$16,050,000**
Construction Engineering	9%	1,450,000
Construction Contingencies	5%	810,000
Engineering Design (Includes Surveying And Geotechnical)	8%	1,290,000
Right-of-Way		0
Utility Relocation	1%	170,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)		0
TOTAL PROJECT COST:		**$19,800,000**

Table 42 – Alternative 1, Segment 3 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	8,951	$6.00	$54,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	586	25.00	15,000
Removal of Concrete Half Barrier	L.Ft.	6,397	16.00	103,000
Removal of PCCP Pavement	Sq.Yd.	25,418	15.00	382,000
Roadway Excavation	Cu.Yd.	729	6.00	5,000
Roadway Embankment (Borrow)	Cu.Yd.	24,026	8.00	193,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	9,650	45.00	435,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	30,534	50.00	1,527,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	40,184	5.00	201,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	76	70.00	6,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	310	140.00	44,000
Concrete Pipe Collar	Each	20	500.00	10,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	1	3,000.00	3,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	2	3,000.00	6,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	1	3,500.00	4,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	0	3,500.00	0
Concrete Catch Basin (C-15.80) (Median)	Each	3	3,000.00	9,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	4	4,000.00	16,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	296	30.00	9,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	9	750.00	7,000
Fill Abandoned Manhole & Plug Pipe	Each	1	1,200.00	2,000
Removal of Miscellaneous Concrete	L.Sum	1	16,000.00	16,000
Removal of Structural Concrete	Cu.Yd.	12	750.00	9,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	0	80,000.00	0
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	0	7,500.00	0
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	0	200.00	0
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 T)	L.Ft.	0	18.00	0
Foundation For Sign Post (Concrete)	Each	0	150.00	0
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	0	20.00	0
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	632	25.00	16,000
Relocate Signs (Including VMS)	Each	9	1,000.00	9,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	3	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	22	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	82,457	0.15	13,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	67,562	0.25	17,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	14,895	0.25	4,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	84	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	20	150.00	3,000
Pavement Marker, Raised, Type C	Each	1,481	3.50	6,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	5,000	20.00	100,000
Flagging Services	L.Sum	1	125,000.00	125,000

Table 42 – Alternative 1, Segment 3 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	10	$600.00	$6,000
Pull Box (No. 9)	Each	5	2,500.00	13,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	15,000	5.00	75,000
Loop Detector For Traffic Surveillance (6'x6')	Each	10	500.00	5,000
Luminaire (Vertical Mount) (400 Watt)	Each	65	750.00	49,000
Relocate Ramp Metering Equipment	Each	2	15,000.00	30,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	8,824	20.00	177,000
Concrete Half Barrier	L.Ft.	7,869	70.00	551,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	787	100.00	79,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	1	3,175,000.00	3,175,000
W Pedestrian Overpass EB	L.Sum	1	259,000.00	259,000
E Pedestrian Overpass EB	L.Sum	1	255,000.00	255,000
College Avenue Overpass	L.Sum	1	560,000.00	560,000
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	85,600	50.00	4,280,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	9,800	75.00	735,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	10,700	60.00	642,000
Retaining Wall (Type: Barrier)	Sq. Ft.	2,200	25.00	55,000
Access Road Embankment	L.Sum	0	0.00	0
SUBTOTAL OF ABOVE ITEMS:				**$15,700,000**
Maintenance And Protection of Traffic		10%		1,570,000
Dust And Water Palliative		0.75%		120,000
Quality Control		2%		320,000
Construction Surveying		2%		320,000
Erosion Control		0.3%		50,000
Mobilization (8% of Total Construction Items)				1,920,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$20,000,000**
Unidentified Items		20%		4,000,000
TOTAL CONSTRUCTION COST:				**$24,000,000**
Construction Engineering		9%		2,160,000
Construction Contingencies		5%		1,200,000
Engineering Design (Includes Surveying And Geotechnical)		8%		1,920,000
Right-of-Way				0
Utility Relocation		1%		240,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$29,500,000**

Table 43 – Alternative 1, Segment 4 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	2,158	$6.00	$13,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	455	25.00	12,000
Removal of Concrete Half Barrier	L.Ft.	4,551	16.00	73,000
Removal of PCCP Pavement	Sq.Yd.	8,990	15.00	135,000
Roadway Excavation	Cu.Yd.	3,249	6.00	20,000
Roadway Embankment (Borrow)	Cu.Yd.	12,647	8.00	102,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	6,000	45.00	270,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	6,484	50.00	325,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	12,484	5.00	63,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	504	70.00	36,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	1,120	140.00	157,000
Concrete Pipe Collar	Each	35	500.00	18,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	7	3,000.00	21,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	8	3,000.00	24,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	7	3,500.00	25,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	9	3,000.00	27,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	9	3,500.00	32,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	6	4,000.00	24,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	46	750.00	35,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	3,000.00	3,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	5	80,000.00	400,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	8	7,500.00	60,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	0	30,000.00	0
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	7,000.00	7,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	1	5,000.00	5,000
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	6	200.00	2,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 T)	L.Ft.	76	18.00	2,000
Foundation For Sign Post (Concrete)	Each	6	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	32	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	2292	25.00	58,000
Relocate Signs (Including VMS)	Each	0	1,000.00	0
Relocate Signs (VMS)	Each	1	50,000.00	50,000
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	27	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	100,063	0.15	16,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	81,346	0.25	21,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	18,717	0.25	5,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	0	0.75	0
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	27	150.00	5,000
Pavement Marker, Raised, Type C	Each	1,583	3.50	6,000
Impact Attenuation Device	Each	4	25,000.00	100,000
Electrical Conduit (3-3")(PVC)	L.Ft.	4,000	20.00	80,000
Flagging Services	L.Sum	0	0.00	0

Table 43 – Alternative 1, Segment 4 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	8	$600.00	$5,000
Pull Box (No. 9)	Each	4	2,500.00	10,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	12,000	5.00	60,000
Loop Detector For Traffic Surveillance (6'x6')	Each	8	500.00	4,000
Luminaire (Vertical Mount) (400 Watt)	Each	52	750.00	39,000
Relocate Ramp Metering Equipment	Each	1	15,000.00	15,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	1,910	20.00	39,000
Concrete Half Barrier	L.Ft.	5,305	70.00	372,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	531	100.00	54,000
24th Street Ti Overpass	L.Sum	0	0.00	0
32nd Street Ti Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	1	2,744,000.00	2,744,000
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	1	11,457,000.00	11,457,000
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	13,800	50.00	690,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	1,500	75.00	113,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	2,600	60.00	156,000
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$18,700,000**
Maintenance And Protection of Traffic		10%		1,870,000
Dust And Water Palliative		0.75%		150,000
Quality Control		2%		380,000
Construction Surveying		2%		380,000
Erosion Control		0.3%		60,000
Mobilization (8% of Total Construction Items)				2,288,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$23,830,000**
Unidentified Items		20%		4,770,000
TOTAL CONSTRUCTION COST:				**$28,600,000**
Construction Engineering		9%		2,580,000
Construction Contingencies		5%		1,430,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,290,000
Right-of-Way				0
Utility Relocation		1%		290,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$35,200,000**

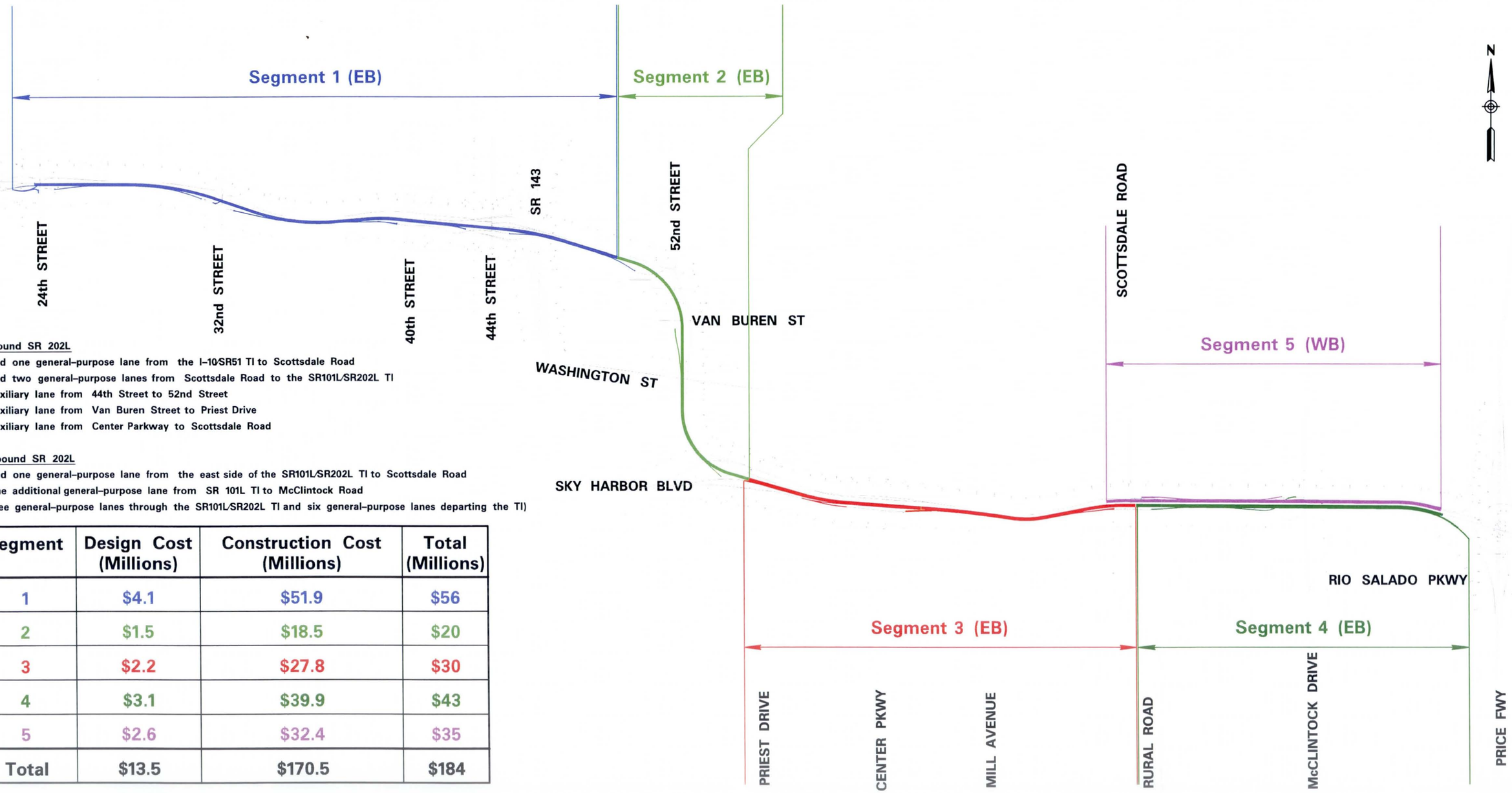
Table 44 – Alternative 1, Segment 5 (WB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	1,344	$6.00	$9,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	421	25.00	11,000
Removal of Concrete Half Barrier	L.Ft.	4,210	16.00	68,000
Removal of PCCP Pavement	Sq.Yd.	8,262	15.00	124,000
Roadway Excavation	Cu.Yd.	2,492	6.00	15,000
Roadway Embankment (Borrow)	Cu.Yd.	17,078	8.00	137,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	5,563	45.00	251,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	8,245	50.00	413,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	13,808	5.00	70,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	292	70.00	21,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	385	140.00	54,000
Concrete Pipe Collar	Each	26	500.00	13,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	14	750.00	11,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	2,000.00	2,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	48	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1005	25.00	26,000
Relocate Signs (Including VMS)	Each	4	1,000.00	4,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	128	50.00	7,000
Temporary Painted Marking (Stripe)	L.Ft.	550,983	0.15	83,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	447,364	0.25	112,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	103,619	0.25	26,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	180	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	125	150.00	19,000
Pavement Marker, Raised, Type C	Each	8,773	3.50	31,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	4,000	20.00	80,000
Flagging Services	L.Sum	0	0.00	0

Table 44 – Alternative 1, Segment 5 (WB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	8	$600.00	$5,000
Pull Box (No. 9)	Each	4	2,500.00	10,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	12,000	5.00	60,000
Loop Detector For Traffic Surveillance (6'x6')	Each	8	500.00	4,000
Luminaire (Vertical Mount) (400 Watt)	Each	52	750.00	39,000
Relocate Ramp Metering Equipment	Each	1	15,000.00	15,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	1,674	20.00	34,000
Concrete Half Barrier	L.Ft.	3,833	70.00	269,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	383	100.00	39,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	1	2,754,000.00	2,754,000
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	1	10,082,000.00	10,082,000
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	21,200	50.00	1,060,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	2,400	75.00	180,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	2,200	60.00	132,000
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$18,300,000**
Maintenance And Protection of Traffic		10%		1,830,000
Dust And Water Palliative		0.75%		140,000
Quality Control		2%		370,000
Construction Surveying		2%		370,000
Erosion Control		0.3%		60,000
Mobilization (8% of Total Construction Items)				2,238,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$23,310,000**
Unidentified Items		20%		4,670,000
TOTAL CONSTRUCTION COST:				**$27,980,000**
Construction Engineering		9%		2,520,000
Construction Contingencies		5%		1,400,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,240,000
Right-of-Way				0
Utility Relocation		1%		280,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$34,400,000**

ALTERNATIVE 2 SEGMENT ESTIMATE
SEPTEMBER 2006



Eastbound SR 202L

* Add one general-purpose lane from the I-10/SR51 TI to Scottsdale Road
* Add two general-purpose lanes from Scottsdale Road to the SR101L/SR202L TI
* Auxiliary lane from 44th Street to 52nd Street
* Auxiliary lane from Van Buren Street to Priest Drive
* Auxiliary lane from Center Parkway to Scottsdale Road

Westbound SR 202L

* Add one general-purpose lane from the east side of the SR101L/SR202L TI to Scottsdale Road
* One additional general-purpose lane from SR 101L TI to McClintock Road

(Three general-purpose lanes through the SR101L/SR202L TI and six general-purpose lanes departing the TI)

Segment	Design Cost (Millions)	Construction Cost (Millions)	Total (Millions)
1	$4.1	$51.9	$56
2	$1.5	$18.5	$20
3	$2.2	$27.8	$30
4	$3.1	$39.9	$43
5	$2.6	$32.4	$35
Total	$13.5	$170.5	$184

Footnote:

* Right-of-Way acquisition is not anticipated for this project
* Utility Relocation included in Construction Estimate
* Environmental Mitigation cost are not known and are not included in estimate
* Estimates in the tables may not match estimate sheets due to rounding

FIGURE 26

ON THE MOVE
PARTNERS IN PROGRESS

Table 45 – Alternative 2, Segment 1 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	9,649	$6.00	$58,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	1,717	25.00	43,000
Removal of Concrete Half Barrier	L.Ft.	17,165	16.00	275,000
Removal of PCCP Pavement	Sq.Yd.	24,465	15.00	367,000
Roadway Excavation	Cu.Yd.	30,990	6.00	186,000
Roadway Embankment (Borrow)	Cu.Yd.	73,220	8.00	586,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	17,133	45.00	771,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	40,248	50.00	2,013,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	57,381	5.00	287,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	154	60.00	10,000
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	1,014	70.00	71,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	747	90.00	68,000
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	157	170.00	27,000
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	1,225	140.00	172,000
Concrete Pipe Collar	Each	128	500.00	64,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	42	3,000.00	126,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	1	3,500.00	4,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	11	3,000.00	33,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	11	3,500.00	39,000
Concrete Catch Basin (C-15.80) (Median)	Each	1	3,000.00	3,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	6	5,500.00	33,000
Junction Box	Each	6	2,000.00	12,000
Strom Drain Outlet	Each	1	500.00	1,000
Removal of Pipe	L.Ft.	208	30.00	7,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	2,000	10.00	20,000
Concrete Catch Basin (Modify Existing)	Each	65	750.00	49,000
Fill Abandoned Manhole & Plug Pipe	Each	2	1,200.00	3,000
Removal of Miscellaneous Concrete	L.Sum	1	17,000.00	17,000
Removal of Structural Concrete	Cu.Yd.	15	750.00	12,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	5	80,000.00	400,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	5	7,500.00	38,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	8	7,000.00	56,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	7	5,000.00	35,000
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	4	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	3	12.00	1,000
Sign Post (Perforated) (2 1/2 S)	L.Ft.	46	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	76	18.00	2,000
Foundation For Sign Post (Concrete)	Each	10	150.00	2,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	32	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1259	25.00	32,000
Relocate Signs (Including VMS)	Each	15	1,000.00	15,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	3	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	36	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	174,567	0.15	27,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	142,196	0.25	36,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	32,371	0.25	9,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	72	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	36	150.00	6,000
Pavement Marker, Raised, Type C	Each	2,788	3.50	10,000
Impact Attenuation Device	Each	7	25,000.00	175,000
Electrical Conduit (3-3")(PVC)	L.Ft.	10,000	20.00	200,000
Flagging Services	L.Sum	0	0.00	0

Table 45 – Alternative 2, Segment 1 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	20	$600.00	$12,000
Pull Box (No. 9)	Each	10	2,500.00	25,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	30,000	5.00	150,000
Loop Detector For Traffic Surveillance (6'x6')	Each	20	500.00	10,000
Luminaire (Vertical Mount) (400 Watt)	Each	130	750.00	98,000
Relocate Ramp Metering Equipment	Each	5	15,000.00	75,000
Landscaping	Mile	3.00	200,000.00	600,000
Concrete Curb And Gutter	L.Ft.	7,928	20.00	159,000
Concrete Half Barrier	L.Ft.	18,363	70.00	1,286,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	1,836	100.00	184,000
24th Street TI Overpass	L.Sum	1	1,081,000.00	1,081,000
32nd Street TI Overpass	L.Sum	1	853,000.00	853,000
Grand Canal Bridge	L.Sum	1	595,000.00	595,000
40th Street TI Overpass	L.Sum	1	724,000.00	724,000
44th Street TI Overpass	L.Sum	1	1,353,000.00	1,353,000
East Papago TI Underpass EB	L.Sum	1	1,703,000.00	1,703,000
48th Street Overpass EB	L.Sum	1	903,000.00	903,000
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	1	9,154,500.00	9,155,000
Retaining Wall (Type: Regular)	Sq. Ft.	45,800	50.00	2,290,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	3,800	75.00	285,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	29,700	60.00	1,782,000
Retaining Wall (Type: Barrier)	Sq. Ft.	400	25.00	10,000
Access Road Embankment	L.Sum	0	0.00	0

SUBTOTAL OF ABOVE ITEMS:		**$29,800,000**
Maintenance And Protection of Traffic	10%	2,980,000
Dust And Water Palliative	0.75%	230,000
Quality Control	2%	600,000
Construction Surveying	2%	600,000
Erosion Control	0.3%	90,000
Mobilization (8% of Total Construction Items)		3,642,000
SUBTOTAL - CONSTRUCTION ITEMS:		**$37,940,000**
Unidentified Items	20%	7,590,000
TOTAL CONSTRUCTION COST:		**$45,530,000**
Construction Engineering	9%	4,100,000
Construction Contingencies	5%	2,280,000
Engineering Design (Includes Surveying And Geotechnical)	8%	3,650,000
Right-of-Way		0
Utility Relocation	1%	460,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)		0
TOTAL PROJECT COST:		**$56,000,000**

Table 46 – Alternative 2, Segment 2 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	2,282	$6.00	$14,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	593	25.00	15,000
Removal of Concrete Half Barrier	L.Ft.	5,931	16.00	95,000
Removal of PCCP Pavement	Sq.Yd.	6,170	15.00	93,000
Roadway Excavation	Cu.Yd.	7,770	6.00	47,000
Roadway Embankment (Borrow)	Cu.Yd.	36,533	8.00	293,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	4,597	45.00	207,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	11,814	50.00	591,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	16,411	5.00	83,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	238	70.00	17,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	500	140.00	70,000
Concrete Pipe Collar	Each	91	500.00	46,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	3	3,000.00	9,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	2	3,500.00	7,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	8	3,000.00	24,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	8	3,500.00	28,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	1	500.00	1,000
Removal of Pipe	L.Ft.	240	30.00	8,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	21	750.00	16,000
Fill Abandoned Manhole & Plug Pipe	Each	2	1,200.00	3,000
Removal of Miscellaneous Concrete	L.Sum	1	13,000.00	13,000
Removal of Structural Concrete	Cu.Yd.	12	750.00	9,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	16	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	717	25.00	18,000
Relocate Signs (Including VMS)	Each	2	1,000.00	2,000
Relocate Signs (VMS)	Each	1	50,000.00	50,000
Milepost Marker (S-10)	Each	0	250.00	0
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	28	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	101,173	0.15	16,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	78,905	0.25	20,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	22,268	0.25	6,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	24	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	18	150.00	3,000
Pavement Marker, Raised, Type C	Each	1,170	3.50	5,000
Impact Attenuation Device	Each	2	25,000.00	50,000
Electrical Conduit (3-3")(PVC)	L.Ft.	1,000	20.00	20,000
Flagging Services	L.Sum	1	125,000.00	125,000

Table 46 – Alternative 2, Segment 2 (EB) Order of Magnitude itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	2	$600.00	$2,000
Pull Box (No. 9)	Each	1	2,500.00	3,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	3,000	5.00	15,000
Loop Detector For Traffic Surveillance (6'x6')	Each	2	500.00	1,000
Luminaire (Vertical Mount) (400 Watt)	Each	13	750.00	10,000
Relocate Ramp Metering Equipment	Each	1	15,000.00	15,000
Landscaping	Mile	2.00	200,000.00	400,000
Concrete Curb And Gutter	L.Ft.	2,312	20.00	47,000
Concrete Half Barrier	L.Ft.	5,942	70.00	416,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	594	100.00	60,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	1	580,000.00	580,000
52nd Street Overpass EB	L.Sum	1	754,000.00	754,000
Van Buren Street Overpass EB	L.Sum	1	533,000.00	533,000
Washington Street Overpass EB	L.Sum	1	651,000.00	651,000
SPRR/Grand Canal Bridge EB	L.Sum	1	1,873,000.00	1,873,000
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	1	651,000.00	651,000
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	1	546,800.00	547,000
Retaining Wall (Type: Regular)	Sq. Ft.	34,500	50.00	1,725.000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	0	75.00	0
Retaining Wall (Type: Specialty 2)	Sq. Ft.	0	60.00	0
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	0	0.00	0
SUBTOTAL OF ABOVE ITEMS				**$10,500,000**
Maintenance And Protection of Traffic		10%		1,050,000
Dust And Water Palliative		0.75%		80,000
Quality Control		2%		210,000
Construction Surveying		2%		210,000
Erosion Control		0.3%		40,000
Mobilization (8% of Total Construction Items)				1,284,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$13,370,000**
Unidentified Items		20%		2,680,000
TOTAL CONSTRUCTION COST:				**$16,050,000**
Construction Engineering		9%		1,450,000
Construction Contingencies		5%		810,000
Engineering Design (Includes Surveying And Geotechnical)		8%		1,290,000
Right-of-Way				0
Utility Relocation		1%		170,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$19,800,000**

Table 47 – Alternative 2, Segment 3 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	9,691	$6.00	$59,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	640	25.00	16,000
Removal of Concrete Half Barrier	L.Ft.	6,397	16.00	103,000
Removal of PCCP Pavement	Sq.Yd.	25,418	15.00	382,000
Roadway Excavation	Cu.Yd.	730	6.00	5,000
Roadway Embankment (Borrow)	Cu.Yd.	40,968	8.00	328,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	9,650	45.00	435,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	32,974	50.00	1,649,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	42,624	5.00	214,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	76	70.00	6,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	310	140.00	44,000
Concrete Pipe Collar	Each	20	500.00	10,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	1	3,000.00	3,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	2	3,000.00	6,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	1	3,500.00	4,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	0	3,500.00	0
Concrete Catch Basin (C-15.80) (Median)	Each	3	3,000.00	9,000
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	4	4,000.00	16,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	296	30.00	9,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	9	750.00	7,000
Fill Abandoned Manhole & Plug Pipe	Each	1	1,200.00	2,000
Removal of Miscellaneous Concrete	L.Sum	1	16,000.00	16,000
Removal of Structural Concrete	Cu.Yd.	12	750.00	9,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	0	80,000.00	0
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	0	7,500.00	0
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	5	7,000.00	35,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	4	5,000.00	20,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	16	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1,109	25.00	28,000
Relocate Signs (Including VMS)	Each	8	1,000.00	8,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	3	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	15	50.00	1,000
Temporary Painted Marking (Stripe)	L.Ft.	98,033	0.15	15,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	82,665	0.25	21,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	15,368	0.25	4,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	0	0.75	0
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	24	150.00	4,000
Pavement Marker, Raised, Type C	Each	2,072	3.50	8,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	5,000	20.00	100,000
Flagging Services	L.Sum	1	125,000.00	125,000

Table 47 – Alternative 2, Segment 3 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	10	$600.00	$6,000
Pull Box (No. 9)	Each	5	2,500.00	13,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	15,000	5.00	75,000
Loop Detector For Traffic Surveillance (6'x6')	Each	10	500.00	5,000
Luminaire (Vertical Mount) (400 Watt)	Each	65	750.00	49,000
Relocate Ramp Metering Equipment	Each	2	15,000.00	30,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	8,824	20.00	177,000
Concrete Half Barrier	L.Ft.	7,868	70.00	551,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	787	100.00	79,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	1	3,175,000.00	3,175,000
W Pedestrian Overpass EB	L.Sum	1	471,000.00	471,000
E Pedestrian Overpass EB	L.Sum	1	464,000.00	464,000
College Avenue Overpass	L.Sum	1	560,000.00	560,000
Scottsdale Road TI Overpass	L.Sum	1	1,108,000.00	1,108,000
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	80,700	50.00	4,035,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	9,700	75.00	728,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	10,700	60.00	642,000
Retaining Wall (Type: Barrier)	Sq. Ft.	2,200	25.00	55,000
Access Road Embankment	L.Sum	0	0.00	0
SUBTOTAL OF ABOVE ITEMS:				**$16,200,000**
Maintenance And Protection of Traffic		10%		1,620,000
Dust And Water Palliative		0.75%		130,000
Quality Control		2%		330,000
Construction Surveying		2%		330,000
Erosion Control		0.3%		50,000
Mobilization (8% of Total Construction Items)				1,982,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$20,640,000**
Unidentified Items		20%		4,130,000
TOTAL CONSTRUCTION COST:				**$24,770,000**
Construction Engineering		9%		2,230,000
Construction Contingencies		5%		1,240,000
Engineering Design (Includes Surveying And Geotechnical)		8%		1,990,000
Right-of-Way				0
Utility Relocation		1%		250,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$30,500,000**

Table 48 – Alternative 2, Segment 4 (EB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	2,158	$6.00	$13,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	455	25.00	12,000
Removal of Concrete Half Barrier	L.Ft.	4,551	16.00	73,000
Removal of PCCP Pavement	Sq.Yd.	8,991	15.00	135,000
Roadway Excavation	Cu.Yd.	3,761	6.00	23,000
Roadway Embankment (Borrow)	Cu.Yd.	15,118	8.00	121,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	6,506	45.00	293,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	7,815	50.00	391,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	14,321	5.00	72,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	624	70.00	44,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	1,120	140.00	157,000
Concrete Pipe Collar	Each	35	500.00	18,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	7	3,000.00	21,000
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	10	3,000.00	30,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	9	3,500.00	32,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	9	3,000.00	27,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	9	3,500.00	32,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	6	4,000.00	24,000
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	50	750.00	38,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	3,000.00	3,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	5	80,000.00	400,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	0	3,500.00	0
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	8	7,500.00	60,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	0	30,000.00	0
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	0	7,000.00	0
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	0	5,000.00	0
Relocate Existing Tapered Tube Sign Structure	Each	0	4,000.00	0
Slip Base (New)	Each	3	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	3	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	16	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1,837	25.00	46,000
Relocate Signs (Including VMS)	Each	1	1,000.00	1,000
Relocate Signs (VMS)	Each	1	50,000.00	50,000
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	22	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	84,984	0.15	13,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	69,301	0.25	18,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	15,683	0.25	4,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	84	0.75	1,000
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	2	150.00	1,000
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	20	150.00	3,000
Pavement Marker, Raised, Type C	Each	1,473	3.50	6,000
Impact Attenuation Device	Each	4	25,000.00	100,000
Electrical Conduit (3-3")(PVC)	L.Ft.	6,000	20.00	120,000
Flagging Services	L.Sum	0	0.00	0

Table 48 – Alternative 2, Segment 4 (EB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	12	$600.00	$8,000
Pull Box (No. 9)	Each	6	2,500.00	15,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	18,000	5.00	90,000
Loop Detector For Traffic Surveillance (6'x6')	Each	12	500.00	6,000
Luminaire (Vertical Mount) (400 Watt)	Each	78	750.00	59,000
Relocate Ramp Metering Equipment	Each	2	15,000.00	30,000
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	1,910	20.00	39,000
Concrete Half Barrier	L.Ft.	5,301	70.00	372,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	530	100.00	54,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Indian Bend Wash Bridge EB	L.Sum	1	2,801,000.00	2,801,000
Indian Bend Wash Bridge WB	L.Sum	0	0.00	0
Salt River Bridge EB	L.Sum	1	15,014,000.00	15,014,000
Salt River Bridge WB	L.Sum	0	0.00	0
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	14,900	50.00	745,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	1,500	75.00	113,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	2,500	60.00	150,000
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$22,600,000**
Maintenance And Protection of Traffic		10%		2,260,000
Dust And Water Palliative		0.75%		170,000
Quality Control		2%		460,000
Construction Surveying		2%		460,000
Erosion Control		0.3%		70,000
Mobilization (8% of Total Construction Items)				2,763,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$28,780,000**
Unidentified Items		20%		5,760,000
TOTAL CONSTRUCTION COST:				**$34,540,000**
Construction Engineering		9%		3,110,000
Construction Contingencies		5%		1,730,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,770,000
Right-of-Way				0
Utility Relocation		1%		350,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$42,500,000**

Table 49 – Alternative 2, Segment 5 (WB) Order of Magnitude Itemized Estimate

Description	Unit	Quantity	Unit Price	Amount
Removal of Concrete Curb And Gutter	L.Ft.	1,344	$6.00	$9,000
Removal of Half Barrier And Trim Retaining Wall	L.Ft.	421	25.00	11,000
Removal of Concrete Half Barrier	L.Ft.	4,210	16.00	68,000
Removal of PCCP Pavement	Sq.Yd.	8,261	15.00	124,000
Roadway Excavation	Cu.Yd.	1,422	6.00	9,000
Roadway Embankment (Borrow)	Cu.Yd.	9,965	8.00	80,000
Portland Cement Concrete Pavement (10" PCCP Over 4" AB)	Sq.Yd.	6,105	45.00	275,000
Portland Cement Concrete Pavement (13" PCCP Over 4" AB)	Sq.Yd.	6,069	50.00	304,000
AR-ACFC Overlay (1 Inch)	Sq.Yd.	12,174	5.00	61,000
Pipe, Reinforced Concrete, Class III, 18"	L.Ft.	0	60.00	0
Pipe, Reinforced Concrete, Class III, 24"	L.Ft.	268	70.00	19,000
Pipe, Reinforced Concrete, Class III, 30"	L.Ft.	0	90.00	0
Pipe, Reinforced Concrete, Class III, 48"	L.Ft.	0	170.00	0
Pipe, Corrugated Metal, Slotted, 24"	L.Ft.	385	140.00	54,000
Concrete Pipe Collar	Each	26	500.00	13,000
Concrete Catch Basin (C-15.30) Single, H=8' Or Less	Each	0	3,000.00	0
Concrete Catch Basin (C-15.91), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.91), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.92), H=8' Or Less	Each	4	3,000.00	12,000
Concrete Catch Basin (C-15.92), H= More Than 8'	Each	3	3,500.00	11,000
Concrete Catch Basin (C-15.80) (Median)	Each	0	3,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes 6" To 36")	Each	0	4,000.00	0
Manhole (C-18.10) (No. 1) (For Pipes Over 36")	Each	0	5,500.00	0
Junction Box	Each	0	2,000.00	0
Strom Drain Outlet	Each	0	500.00	0
Removal of Pipe	L.Ft.	28	30.00	1,000
Fill Abandoned Pipe Culvert (30" Diameter)	Cu.Ft	0	10.00	0
Concrete Catch Basin (Modify Existing)	Each	14	750.00	11,000
Fill Abandoned Manhole & Plug Pipe	Each	0	1,200.00	0
Removal of Miscellaneous Concrete	L.Sum	1	2,000.00	2,000
Removal of Structural Concrete	Cu.Yd.	3	750.00	3,000
Bridge Sign Structure (SD9.20, Type 4f)	Each	1	80,000.00	80,000
Drilled Shaft Foundation Tapered Tube Structure Single Beam	Each	2	3,500.00	7,000
Foundation For Bridge Sign Structure (SD9.20, Type 4f)	L.Ft.	1	7,500.00	8,000
Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	1	30,000.00	30,000
Foundation For Cantilever Sign Structure (SD9.10, Type 4c)	L.Ft.	4	7,000.00	28,000
Relocate Existing Bridge Sign Structure	Each	0	10,000.00	0
Relocate Existing Cantilever Sign Structure	Each	3	5,000.00	15,000
Relocate Existing Tapered Tube Sign Structure	Each	1	4,000.00	4,000
Slip Base (New)	Each	5	200.00	1,000
Sign Post (Perforated) (2 S)	L.Ft.	0	12.00	0
Sign Post (Perforated) (2 1/2 S)	L.Ft.	23	12.00	1,000
Sign Post (Perforated) (2 1/2 T)	L.Ft.	38	18.00	1,000
Foundation For Sign Post (Concrete)	Each	5	150.00	1,000
Sign Panel (Fluorescent Warning)(30 Sq.Ft. Or Smaller)	Sq.Ft.	48	20.00	1,000
Extruded Alum Sign Panel With Type III/IV Sheet	Sq.Ft.	1,005	25.00	26,000
Relocate Signs	Each	4	1,000.00	4,000
Relocate Signs (VMS)	Each	0	50,000.00	0
Milepost Marker (S-10)	Each	2	250.00	1,000
Temporary Painted Marking (Arrow, Symbol Or Legend)	Each	27	50.00	2,000
Temporary Painted Marking (Stripe)	L.Ft.	81,075	0.15	13,000
Pavement Marking (White Sprayed Thermoplastic)(0.060")	L.Ft.	58,570	0.25	15,000
Pavement Marking (Yellow Sprayed Thermoplastic)(0.060")	L.Ft.	22,505	0.25	6,000
Pavement Marking (Transverse) (Thermoplastic) (Alkyd) (0.090")	L.Ft.	0	0.75	0
Pavement Legend (Extruded Thermoplastic) (Alkyd) (0.090")	Each	0	150.00	0
Pavement Symbol (Extruded Thermoplastic) (Alkyd) (0.090")	Each	33	150.00	5,000
Pavement Marker, Raised, Type C	Each	2,033	3.50	8,000
Impact Attenuation Device	Each	1	25,000.00	25,000
Electrical Conduit (3-3")(PVC)	L.Ft.	4,000	20.00	80,000
Flagging Services	L.Sum	0	0.00	0

Table 49 – Alternative 2, Segment 5 (WB) Order of Magnitude Itemized Estimate (continued)

Description	Unit	Quantity	Unit Price	Amount
Pull Box (No. 7)	Each	8	$600.00	$5,000
Pull Box (No. 9)	Each	4	2,500.00	10,000
Single Mode Fiber Optic Cable (52 Fibers)	L.Ft.	12,000	5.00	60,000
Loop Detector For Traffic Surveillance (6'x6')	Each	8	500.00	4,000
Luminaire (Vertical Mount) (400 Watt)	Each	52	750.00	39,000
Relocate Ramp Metering Equipment	Each	0	15,000.00	0
Landscaping	Mile	1.00	200,000.00	200,000
Concrete Curb And Gutter	L.Ft.	2,037	20.00	41,000
Concrete Half Barrier	L.Ft.	3,694	70.00	259,000
Concrete Half Barrier (Adjacent To Retaining Wall)	L.Ft.	369	100.00	37,000
24th Street TI Overpass	L.Sum	0	0.00	0
32nd Street TI Overpass	L.Sum	0	0.00	0
Grand Canal Bridge	L.Sum	0	0.00	0
40th Street TI Overpass	L.Sum	0	0.00	0
44th Street TI Overpass	L.Sum	0	0.00	0
East Papago TI Underpass EB	L.Sum	0	0.00	0
48th Street Overpass EB	L.Sum	0	0.00	0
Ramp B Overpass EB	L.Sum	0	0.00	0
52nd Street Overpass EB	L.Sum	0	0.00	0
Van Buren Street Overpass EB	L.Sum	0	0.00	0
Washington Street Overpass EB	L.Sum	0	0.00	0
SPRR/Grand Canal Bridge EB	L.Sum	0	0.00	0
Sky Harbor Boulevard WB Overpass (SR 202L EB)	L.Sum	0	0.00	0
Mill Avenue Viaduct EB	L.Sum	0	0.00	0
W Pedestrian Overpass EB	L.Sum	0	0.00	0
E Pedestrian Overpass EB	L.Sum	0	0.00	0
College Avenue Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	0	0.00	0
Scottsdale Road TI Overpass	L.Sum	1	890,000.00	890,000
Indian Bend Wash Bridge EB	L.Sum	0	0.00	0
Indian Bend Wash Bridge WB	L.Sum	1	2,304,000.00	2,304,000
Salt River Bridge EB	L.Sum	0	0.00	0
Salt River Bridge WB	L.Sum	1	11,385,000.00	11,385,000
Noise Wall	L.Sum	0	0.00	0
Retaining Wall (Type: Regular)	Sq. Ft.	23,900	50.00	1,195,000
Retaining Wall (Type: Specialty 1)	Sq. Ft.	2,400	75.00	180,000
Retaining Wall (Type: Specialty 2)	Sq. Ft.	2,100	60.00	126,000
Retaining Wall (Type: Barrier)	Sq. Ft.	0	25.00	0
Access Road Embankment	L.Sum	1	500,000.00	500,000
SUBTOTAL OF ABOVE ITEMS:				**$18,700,000**
Maintenance And Protection of Traffic		10%		1,870,000
Dust And Water Palliative		0.75%		150,000
Quality Control		2%		380,000
Construction Surveying		2%		380,000
Erosion Control		0.3%		60,000
Mobilization (8% of Total Construction Items)				2,288,000
SUBTOTAL - CONSTRUCTION ITEMS:				**$23,830,000**
Unidentified Items		20%		4,770,000
TOTAL CONSTRUCTION COST:				**$28,600,000**
Construction Engineering		9%		2,580,000
Construction Contingencies		5%		1,430,000
Engineering Design (Includes Surveying And Geotechnical)		8%		2,290,000
Right-of-Way				0
Utility Relocation		1%		290,000
Environmental Mitigation (404, 4f, Wetlands)(Unknown At This Time)				0
TOTAL PROJECT COST:				**$35,200,000**

APPENDIX A

AASHTO CONTROLLING DESIGN CRITERIA REPORT

PROJECT 202L MA 0.0 H6871 01L

I-10/SR 51 TI – SR 101L

RED MOUNTAIN FREEWAY (SR 202L)

AASHTO CONTROLLING DESIGN CRITERIA REPORT

September 2006

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL TRANSPORTATION DIVISION

ROADWAY ENGINEERING GROUP

ROADWAY PREDESIGN SECTION

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LIST OF EXISTING FEATURES REQUIRING DESIGN EXCEPTIONS

The following is a list of the existing design features requiring design exceptions:

(Note: The analysis of all design elements of the following roadways have been compared with the recommended AASHTO Controlling Design Criteria to identify geometric elements that do not comply with the AASHTO 2004 "Green" Book criteria.)

SR 202L MAINLINE (EB & WB)

The existing lane width is less than the recommended 12' as follows:

1. MP 1.84 to MP 3.37 (EB Stations 1075+00 to a33+00) – 1.0' less than recommended.

The existing shoulder width is less than the recommended 10' (median) as follows:

1. MP 1.84 to MP 3.37 (EB Station 1075+00 to a33+00) – 8.0' less than recommended.
2. MP 6.45 (Center Parkway TI UP) – 2.60' less than recommended.
3. MP 7.78 to MP 7.97 (EB Station d265+00 to d275+00) – 0.3' less than recommended.

The existing shoulder provides less than the AASHTO recommended horizontal stopping sight distance due to roadway curvature and the placement of concrete median barrier adjacent to the median shoulder:

1. MP 4.70 to MP 5.17 (EB HPI Station c117+45.68) – 174' less than the recommended 670'.
2. MP 6.74 to MP 6.93 (EB HPI Station d215+77.33) – 25' less than the recommended 632'.

The superelevation rate is less than the recommended minimum on the following horizontal curves:

1. Beginning MP 3.74 (HPI Station 67+71.49) – .003 ft/ft less than the minimum.
2. Beginning MP 4.70 (HPI Station 117+45.26) – .002 ft/ft less than the minimum.
3. Beginning MP 5.58 (HPI Station 155+75.79) – .001 ft/ft less than the minimum.
4. Beginning MP 6.74 (HPI Station 215+76.74) – .002 ft/ft less than the minimum.
5. Beginning MP 7.15 (HPI Station 238+30.78) – .001 ft/ft less than the minimum.
6. Beginning MP 8.88 (HPI Station 328+97.91) – .001 ft/ft less than the minimum.

I-10/SR 51 TI

Ramp North-East

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 44+79.62 – .021 ft/ft less than the minimum.

I-10/SR 51 TI

Ramp South-East

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 32+36.11 – .021 ft/ft less than the minimum.

32ND STREET TI

Ramp B

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 13+82.73 – .007 ft/ft less than the minimum.

Ramp D

The sag vertical curve stopping sight distance is less than the recommended 250' as follows:

1. VPI Station 4+00.00 – 16' less than recommended.

44TH STREET TI

Ramp D

The superelevation rate is less than the recommended minimum on the following horizontal curves:

1. HPI Station 17+13.74 – .021 ft/ft less than the minimum.
2. HPI Station 24+97.43 – .014 ft/ft less than the minimum.

52ND STREET TI

Ramp B

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 7+02.20 – .010 ft/ft less than the minimum.

The existing shoulder provides less than the AASHTO recommended horizontal stopping sight distance due to roadway curvature and the placement of concrete barrier adjacent to the outside shoulder:

1. HPI Station 7+02.20 – 154' less than the recommended 517'.

VAN BUREN STREET TI

Ramp D

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 23+12.40 – .004 less than the minimum.

The existing shoulder provides less than the AASHTO recommended horizontal stopping sight distance due to roadway curvature and the placement of concrete barrier adjacent to the outside shoulder:

1. HPI Station 12+25.04 – 56' less than the recommended 500'.

PRIEST DRIVE TI

Ramp D

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 7+46.61 – .001 ft/ft less than the minimum.

SKY HARBOR TI

EB Entrance Ramp

The superelevation rate is less than the recommended minimum on the filling horizontal curve:

1. HPI Station 95+20.73 – .004 ft/ft less than the minimum.

MCCLINTOCK DRIVE TI

Ramp A

The vertical curve stopping sight distance is less than the recommended 250' as follows:

1. VPI Station 11+50.00 – 63' less than recommended.

SR101l/SR202l TI

Ramp East-South

The superelevation rate is less than the recommended minimum on the following horizontal curve:

1. HPI Station 10+66.30 – .002 less than the minimum.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAIN LINE SUMMARY (DIVIDED)

PROJECT NUMBER:	202L MA 0 H687101L	**ROUTE:**	EB & WB 202L
PROJECT LOCATION:	I-10/SR51 TI - SR101L	**BEGINNING MP:**	0.420
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	**ENDING MP:**	9.201
FUNCTIONAL CLASSIFICATION:	Urban Freeway/Expressway - Controlled Access		

LANE AND SHOULDER WIDTH

	EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)
LANE WIDTH:	11-12 [1] **	10
INSIDE SHOULDER WIDTH:	2-10 [2] **	10
OUTSIDE SHOULDER WIDTH:	10-12	10

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 60-65 MPH [4]

THE POSTED SPEED LIMIT IS: 55 & 65 MPH [3]

TERRAIN IS: LEVEL

GRADES

EXISTING MAXIMUM GRADE IS: 3.0000%

AASHTO ALLOWABLE MAXIMUM GRADE IS: 3.0000%

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020'/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020'/ft

TRAFFIC VOLUMES AND FACTORS

	Existing 2004 ADT (VPD)	Design Year 2030 ADT (VPD)	TRAFFIC FACTORS K=	D=	T=

See Attachment No. 4

REMARKS

** Design Exception will not be required because the lane and median shoulder widths will be upgraded with this project.

[1] Lane width is 12' from MP 0.42 to MP 1.84, 11' from 1.84 to MP 3.37, and 12' from MP 3.37 to MP 9.20

[2] Median shoulder width is 10' from MP 0.42 to MP 1.84, 2' from 1.84 to MP 3.37, and 10' from MP 3.37 to MP 9.20

[3] Posted 55 MPH MP 0.7 to MP 2.9, Posted 65 MPH MP 2.9 to MP 9.2

[4] Original design speed is 60 MPH from MP 0.42 to MP 2.5, and 65MPH from MP 2.5 to MP 9.20

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
MAINLINE EB & WB - CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Post Construction Clearance	AASHTO Minimum Allowable Clearance
See Attachment No. 3				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
See Attachment No. 5							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
See Attachment No. 1							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	EXISTING SPEED (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
See Attachment No. 2 *						

REMARKS

* Design Exception Required.

ATTACHMENT NO. 1

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

Direction: SR 202L Eastbound (1 way with Sta.)

VPI Station	Curve Length (Ft)	Grades (%)		Existing SDs (Ft)	AASHTO Minimum SDs (Ft)	Existing Speed (mph)	Design Speed (mph)
		Approach	Departure				
1000+00.00	1,300	2.9829	-3.0000	685	645	65	65
1011+00.00	800	-3.0000	0.4700	923	645	78	65
1040+00.00	800	0.4700	2.1663	>1500	645	>90	65
1048+00.00	800	2.1663	0.3308	988	645	85	65
1073+00.00	800	0.3308	-1.1047	1,152	645	>90	65
1088+00.00	1,400	-1.1047	2.0050	1,748	645	>90	65
1106+00.00	1,400	2.0050	-1.2007	971	645	82	65
1117+77.00	850	-1.2007	1.8844	1,132	645	90	65
1131+00.00	1,650	1.8844	-1.5101	1,024	645	84	65
21+50.00	800	-1.5101	1.9000	942	645	80	65
40+00.00	1,000	1.9000	0.4000	1,219	645	>90	65
80+75.00	1,250	0.4000	-1.2000	1,299	645	>90	65
108+50.00	600	-1.2000	-2.1649	1,418	645	>90	65
131+26.46	800	-2.1649	0.4000	1,504	645	>90	65
173+25.00	800	0.4002	3.0000	1,459	645	>90	65
194+25.00	2,600	3.0000	-3.0000	967	645	80	65
213+75.00	900	-3.0000	1.0000	889	645	76	65
244+50.00	1,350	1.0000	-1.6808	1,042	645	85	65
256+50.00	800	-1.6808	0.5000	2,489	645	>90	65
279+50.00	800	0.5000	1.9200	>1500	645	>90	65
296+25.00	1,800	1.9200	-1.9200	1,006	645	83	65
309+82.61	800	-1.9200	0.2513	2,536	645	>90	65
335+00.00	800	0.2513	-0.7500	1,478	645	>90	65

Direction: SR 202 Westbound (1 way against Sta.)

VPI Station	Curve Length (Ft)	Grades (%)		Existing SDs (Ft)	AASHTO Minimum SDs (Ft)	Existing Speed (mph)	Design Speed (mph)
		Approach	Departure				
244+50.00	1,350	1.0000	-1.6808	1,042	645	86	65
256+50.00	800	-1.6808	0.5000	2,489	645	>90	65
279+50.00	800	0.5000	1.9200	>1500	645	>90	65
296+25.00	1,800	1.9200	-1.9200	1,006	645	83	65
309+82.61	800	-1.9200	0.2513	2,536	645	>90	65
335+00.00	800	0.2513	-0.7500	1,478	645	>90	65

ATTACHMENT NO. 2

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION			EXISTING SPEED (MPH)	DEGREE OF CURVE	
	Maximum (Ft/Ft)	Existing (Ft/Ft)	Minimum (Ft/Ft)		Maximum	Existing
1038+89.46	0.060	0.024	0.021	60	3°-27'	0°-45'
1075+46.81	0.060	0.032	0.027	60	3°-27'	1°-00'
1101+13.40	0.060	0.040	0.032	60	3°-27'	1°-15'
22+33.25 (EB)	0.060	0.023	0.020	65	3°-27'	0°-35'-42"
67+71.49	0.060	0.055 *	0.058	65	3°-27'	2°-45'
117+45.26	0.060	0.057 *	0.059	65	3°-27'	3°-00'
155+75.79	0.060	0.029 *	0.030	65	3°-27'	1°-00'
197+58.13	0.060	0.020	NC	65	3°-27'	0°-15'
215+76.74	0.060	0.048 *	0.050	65	3°-27'	2°-00'
238+30.78	0.060	0.029 *	0.030	65	3°-27'	1°-00'
328+97.91	0.060	0.040 *	0.041	65	3°-27'	1°-30'

REMARKS

* Design Exception Required

ATTACHMENT NO. 3

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Post Construction Clearance	AASHTO Minimum Allowable Clearance
24th Street TI Overpass Structure No. 2021	0.70	N/A	17.60' NB 17.43' SB	16'
32nd Street TI Overpass Structure No. 2022	1.75	N/A	17.11 NB 17.65 SB	16'
40th Street TI Overpass Structure No. 2024	2.45	N/A	17.84' NB 17.86' SB	16'
44th Street Overpass Structure No. 2140	2.90	N/A	16.19'	16'
East Papago TI Underpass EB Structure No. 2160	3.25	N/A	17.89' NB 17.32' SB	16'
48th Street Overpass EB Structure No. 2198	3.45	N/A	17.86' NB 17.28'SB	14.5'
Ramp B Overpass EB Structure No. 2208	3.89	N/A	16.66'	16'
52nd Street Overpass EB Structure No. 2210	4.04	N/A	18.50'	16'
Van Buren Street Overpass EB Structure No. 2212	4.20	N/A	16.61' EB 16.51' WB	16'
Washington Street Overpass EB Structure No. 2214	4.52	N/A	16.98' EB 17.04' WB	16'
SPRR/Grand Canal Bridge EB Structure No. 2217	4.83	N/A	24.47'	23'
Sky Harbor Boulevard WB Overpass EB Structure No. 2219	5.02	N/A	16.72'	16'
Priest Drive TI Underpass Structure No. 2405	5.70	N/A	20.42'	16'
Center Parkway TI Underpass Structure No. 2227	6.45	N/A	18.70'	16'
Mill Avenue Viaduct EB Structure No. 2258	6.34	N/A	24.35'	23'
Mill Avenue Viaduct EB Structure No. 2258	6.34	N/A	18.07'	16'
Mill Avenue Viaduct EB Structure No. 2258	6.34	N/A	18.81'	16'
College Avenue Overpass EB Structure No. 2261	7.55	N/A	15.57'	14.5'
Scottsdale Road TI Overpass EB Structure No. 2263	7.71	N/A	16.53' NB & SB	16'
Salt River Bridge EB Structure No. 2268	8.17	N/A	16.58' EB	16'
Salt River Bridge WB Structure No. 2269	8.17	N/A	19.58 WB	16'
Salt River Bridge EB Structure No. 2268	8.17	N/A	15.58' **	16'
Salt River Bridge WB Structure No. 2269	8.17	N/A	16.44'	16'

REMARKS

** Design Exception will not be required because the Vertical Clearance will be upgraded under this project.

ATTACHMENT NO. 4

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA

TRAFFIC VOLUMES AND FACTORS

Begin MP	Section Begins At	End MP	Section Ends At	Existing 2004 ADT (VPD)	Design Year 2030 ADT (VPD)	TRAFFIC FACTORS		
						K=	D=	T=
0	I-10/SR-51 (Exit 1A)	0.74	24th St (Exit 1B)	112,000	139,100	9%	50%	9%
0.74	24th St (Exit 1B)	1.75	32nd St (Exit 1C)	231,000	243,000	9%	50%	9%
1.75	32nd St (Exit 1C)	2.7	40th St/44th St (Exit 2)	220,000	246,200	9%	50%	9%
2.7	40th St/44th St (Exit 2)	3.5	SR-143/McDowell Rd (Exit 3)	212,000	220,200	9%	50%	9%
3.5	SR-143/McDowell Rd (Exit 3)	4.5	52nd St/Van Buren St (Exit 4)	158,000	179,800	9%	50%	9%
4.5	52nd St/Van Buren St (Exit 4)	5.7	Priest Dr/Center Pkwy (Exit 6)	168,000	180,600	9%	50%	9%
5.7	Priest Dr/Center Pkwy (Exit 6)	7.8	Rural Rd/Scottsdale Rd (Exit 7)	206,000	233,700	9%	50%	9%
7.8	Rural Rd/Scottsdale Rd (Exit 7)	8.8	McClintock Dr/Hayden Rd (Exit 8)	206,000	227,600	9%	50%	9%
8.8	McClintock Dr/Hayden Rd (Exit 8)	10.5	SR-101 (Exit 9)	172,000	200,100	9%	50%	9%
10.5	SR-101 (Exit 9)	11.07	Dobson Rd (Exit 10)	99,100	145,100	9%	50%	9%

Note: Design Year 2030 traffic volumes are based on No-Build conditions and include HOV volumes.

ATTACHMENT NO. 5

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
24th Street TI Overpass Structure No. 2021	0.70	138'	138'	Yes	Yes	HS-20	HS-20
32nd Street TI Overpass Structure No. 2022	1.75	138'	138'	Yes	Yes	HS-20	HS-20
Grand Canal Bridge Structure No. 2023	2.01	198.9'-180.1'	198.9'-180.1'	Yes	Yes	HS-20	HS-20
40th Street TI Overpass Structure No. 2024	2.45	138'	138'	Yes	Yes	HS-20	HS-20
44th Street Overpass Structure No. 2140	2.90	111.8'	111.8'	Yes	Yes	HS-20	HS-20
East Papago TI Underpass EB Structure No. 2160	3.25	68'	68'	Yes	Yes	HS-20	HS-20
48th Street Overpass EB Structure No. 2198	3.45	67.9'	67.9'	Yes	Yes	HS-20	HS-20
Ramp B Overpass EB Structure No. 2208	3.89	67.9'	67.9'	Yes	Yes	HS-20	HS-20
52nd Street Overpass EB Structure No. 2210	4.04	67.9'	67.9'	Yes	Yes	HS-20	HS-20
Van Buren Street Overpass EB Structure No. 2212	4.20	67.9'	67.9'	Yes	Yes	HS-20	HS-20
Washington Street Overpass EB Structure No. 2214	4.52	86.0' - 90.33'	86.0' - 90.33'	Yes	Yes	HS-20	HS-20
SPRR/Grand Canal Bridge EB Structure No. 2217	4.83	67.9'	67.9'	Yes	Yes	HS-20	HS-20
Sky Harbor Boulevard WB Overpass EB Structure No. 2219	5.02	89.3'	89.3'	Yes	Yes	HS-20	HS-20
Priest Drive TI Underpass Structure No. 2405	5.70	124'	124'	Yes	Yes	HS-20	HS-20
Center Parkway TI Underpass Structure No. 2227	6.45	52'	52'	Yes	Yes	HS-20	HS-20
Mill Avenue Viaduct EB Structure No. 2258	6.34	155.5'	155.5'	Yes	Yes	HS-20	HS-20
West Pedestrian Overpass EB Structure No. 2259	7.13	159.2'	159.2'	Yes	Yes	HS-20	HS-20
East Pedestrian Overpass EB Structure No. 2260	7.41	174.1'	174.1'	Yes	Yes	HS-20	HS-20
College Avenue Overpass EB Structure No. 2261	7.55	195.2'	195.2'	Yes	Yes	HS-20	HS-20
Scottsdale Road TI Overpass EB Structure No. 2263	7.71	156.3'	156.3'	Yes	Yes	HS-20	HS-20
Scottsdale Road TI Overpass WB Structure No. 2263	7.71	156.3'	156.3'	Yes	Yes	HS-20	HS-20
Indian Bend Wash Bridge EB Structure No. 2265	8.06	159.4'	159.4'	Yes	Yes	HS-20	HS-20
Indian Bend Wash Bridge WB Structure No. 2265	8.06	159.4'	159.4'	Yes	Yes	HS-20	HS-20
Salt River Bridge EB Structure No. 2268	8.17	80.0'	80.0'	Yes	Yes	HS-20	HS-20
Salt River Bridge WB Structure No. 2269	8.17	80.0'	80.0'	Yes	Yes	HS-20	HS-20

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
DIRECTIONAL RAMP

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 0.8
PROJECT LOCATION: I-10 to SR101L
HIGHWAY SECTION: Red Mountain Freeway
INTERCHANGE: I-10 / 202L TI
RAMP DESIGNATION: Ramp N-E [1]
DESCRIPTION: Directional Ramp South to East

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-40	21	22	700

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Freeway to Freeway Ramp Design Speed 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
0.0000	0.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
N/A	17,000	

REMARKS

[1] "As-Built" Name - Current Ramp designation would be Ramp S-E per the ADOT "Roadway Design Guidelines"

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
I-10 / 202L TI Ramp N-E - Continued

VERTICAL CLEARANCE

STRUCTURE	Station	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Structure No. 2116	39+02 - 42+07	NA	16.73'	16'

STRUCTURES

STRUCTURE	Station	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Structure No. 2116	39+02 - 42+07	43.2' to 37.1'	43.2' to 37.1'	Yes	Yes	HS-20	HS-20

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
44+79.62	0.100	0.020 [2] *	0.041	50	8°-15'	2°-00'

REMARKS

* Design Exception Required.

[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28.

[2] Superelevation controlled by existing mainline superelevation

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
DIRECTIONAL RAMP

PROJECT NUMBER: 202L MA 0.0 H6871 01L
MAINLINE MILEPOST: 0.8
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: I-10 / 202L TI
RAMP DESIGNATION: Ramp S-E [1]
DESCRIPTION: Directional Ramp North to East

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-40	21	22	700

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Freeway to Freeway Ramp Design Speed 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
4.4000	NA	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
25,200	34,000	

REMARKS

[1] "As-Built" Name - Current Ramp designation would be Ramp N-E per the ADOT "Roadway Design Guidelines"

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
I-10 / 202L TI Ramp S-E - Continued

VERTICAL CLEARANCE

STRUCTURE	Station	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Structure No. 2116	39+02 - 42+07	NA	16.73'	16'

STRUCTURES

STRUCTURE	Station	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Structure No. 2116	39+02 - 42+07	33.6'	33.6'	Yes	Yes	HS-20	HS-20

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
32+36.11	0.100	0.020 [2] *	0.041	50	8°-15'	2°-00'

REMARKS

* Design Exception Required.
[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28.
[2] Superelevation controlled by existing mainline superelevation

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 0.7
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	24th Street TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	1000+00 SR202 Cst Cl = 20+00.00 24th Street Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet) SB	EXISTING (Feet) NB	AASHTO RECOMMENDED MINIMUM (Feet)
LANE WIDTH:	10-12	10-12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	6' Min		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 45 MPH

THE POSTED SPEED LIMIT IS: 45 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%) Ascending	EXISTING MAXIMUM GRADE IS (%) Decending	AASHTO ALLOWABLE MAXIMUM GRADE (%) Ascending	AASHTO ALLOWABLE MAXIMUM GRADE (%) Descending
NB	+0.3110	NA	6.0	6.0
SB	NA	-0.3110	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
24th Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
16+00.00	-0.2445	-0.2683	0	>2500	360	>90	45
26+25.00	-0.2683	-0.3110	0	>2500	360	>90	45

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.02	0.02	0.015	45		N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 0.5
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 24th Street TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-32	21	28	100

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+2.0400	-4.5600	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
6,300	7,000	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
24th St. Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
21+25.00	-4.5600	2.0400	500	351	305	42	40
27+00.00	2.0400	0.5450	300	872	250	79	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [2] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [2] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
25+25.07	0.100	0.071	0.580	35	17°-50'	6°-00'-00"
30+17.26	0.020	0.020	0.020 [1]	10-20 [1]	N/A	20°-36'-36"
Ramp B SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	57°-18'

REMARKS

[1] Assumed design speed 10-20 mph SPUI turning movement
[2] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 0.9
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 24th Street TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
28-40	21	28	114

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 45 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.1584	NA	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
7,200	11,000	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
24th Street TI Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
2+50.00	0.8249	1.1584	100	>1500	250	>90	35
9+00.00	1.1584	0.0169	600	1,245	425	>90	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
Ramp D SPUR	0.020	0.020	0.02 [1]	10-20 [1]	N/A	50°-16'
2+03.61	0.020	0.020	0.02 [1]	10-20 [1]	N/A	21°-13'
5+44.28	0.020	0.020	0.02 [1]	10-20 [1]	N/A	6°-00'
24+74.06 (New)	0.060	0.042	0.023	55	5°-24'	1°-00'

REMARKS

[1] Asumed design speed 10-20 mph at SPUI turning movement

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 1.8
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	32nd Street TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	1053+66.77 SR202 Cst Cl = 20+08.25 32nd Street Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	SB	**NB**	
LANE WIDTH:	12	12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	6' Min		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 50 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	1.7900	NA	6.0	6.0
SB	NA	-1.7900	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
32nd Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
13+18.95	-1.7900	-0.6247	200	>1500	425	>90	50
18+00.00	-0.6247	-0.2886	200	>1500	425	>90	50
24+02.99	-0.2886	-0.4318	GB	7,535	425	>90	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	50		N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 1.5
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 32nd Street TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-28 [1]	22-30	30	100

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 45 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.4688	-2.4975	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,500	9,500	

REMARKS

[1] Single lane exit tapers to two-lane right turn & two-lane left turn at SPUI

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
32nd Street TI Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
10+00.00	1.4688	-2.4975	600	571	425	59	50
16+75.00	-2.4975	-0.3060	150	825	250	73	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
Ramp BB SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	45°-28'
18+26.83	0.020	0.020	0.020 [1]	10-20 [1]	N/A	22°-50'
13+82.73 (New)	0.060	0.024 [2] **	0.031	50	8°-15'	1°-44'

REMARKS

** Design Exception will not be requested because this segment of the ramp will be upgraded under this project
[1] Assumed design speed 10-20 mph in SPUI turning movements
[2] Superelevation controlled by mainline superelevation; less than recommended minimum

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 2.0
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 32nd Street TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
20 [1]	18	29	100

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 45 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+4.3244	-0.2309	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,700	13,200	

REMARKS

[1] One Right turn lane and two left turn lanes from the crossroad transitions to two ramp lanes on ramp body, then to one lane at Ramp D gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
32nd Street TI Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
4+00.00	-0.2309	4.3244	200	234	200	34	30
12+00.00	4.3244	0.1747	600	559	425	60	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
Ramp D SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	50°-16'
3+69.41	0.020	0.020	0.020 [1]	10-20 [1]	N/A	12°-30'
14+19.20 ***	0.060	0.032 [2]	0.023	55	5°-24'	Tangent

REMARKS

[1] Assumed design speed 10-20 mph in SPUI turning movements
[2] Ramp superelevation controlled by existing mainline superelevation

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 2.5
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	40th Street TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	1108+41.43 SR202 Cst Cl = 20+00.00 40th Street Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	SB	**NB**	
LANE WIDTH:	12	12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	4' Min		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 50 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	+0.3976	NA	6.0	6.0
SB	NA	-0.3976	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
40th Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
13+60.86	-0.2176	-0.3976	0	>1500	425	>90	50
17+83.00	-0.3976	-0.2230	0	>1500	425	>90	50
22+90.10	-0.2230	-0.2002	0	>1500	425	>90	50
24+00.00	-0.2002	-0.7275	200	>1500	425	>90	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	50		N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 2.2
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 40th Street TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-40 [1]	21	28	2,864

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
1.8403	-1.4894	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
11,300	12,000	

REMARKS

[1] One lane at exit tapers to four lanes at cross road

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
40th Street TI Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
2+25.00	1.8403	-1.4894	600	624	425	63	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
9+38.85	0.060	0.042	0.040	50	6°-53'	2°-00'

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 2.9
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	44th Street TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	1133+11.54Bk.=Sta 10+00.00Ahd SR202 Cst Cl = 29+56.13 44th St. Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	EB	**WB**	
LANE WIDTH:	11-12	11-12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	4' Min		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 50 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	+0.8826	NA	6.0	6.0
SB	NA	-0.8826	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
44th Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
35+50.00	0.4000	0.8826	500	>1500	429	>90	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	50		N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
FRONTAGE ROAD

PROJECT NUMBER: 202L MA 0.0 H6871 01L
MAINLINE MILEPOST: 2.9
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 44th Street TI
RAMP DESIGNATION: N/A
DESCRIPTION: EB Frontage Road

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
28-40 [1]	27	29	120

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Frontage Road 40 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.2600	-0.5750	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

[1] Two lane frontage road tapers to two lane left turn & one lane right turn at SPUI

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Eastbound Frontage Road - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
12+00.00	0.3371	0.7333	0	>1500	305	>90	40
21+00.00	0.7333	-0.5750	200	925	305	80	40
25+00.00	-0.5750	1.2600	200	4,512	305	>90	40
30+00.00	1.2600	-0.4825	200	719	305	69	40

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
16+02.50	0.060	0.040	0.038	40	11°-49'	3°-30'
22+79.53	0.060	0.060	0.055	40	11°-49'	8°-00'
28+45.03	0.040	0.040	0.040	40	10°-45'	10°-00'

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0.0 H6871 01L
MAINLINE MILEPOST: 3.1
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 44th Street TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-28 [1]	21	22	120

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+2.300	NA	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,800	10,200	

REMARKS

[1] One lane right turn and two lane left turn SPUI combines to two lane ramp tapering to single lane at gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
44th Street Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
East Papago TI Underpass EB Structure No. 2160	3.25	N/A	16.8'	16'

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
East Papago TI Underpass EB Structure No. 2160	3.25	28'	28'	Yes	Yes	HS-20	HS-20

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
17+00.00	0.6601	2.3000	400	>1500	360	>90	45
21+00.00	2.3000	0.6471	400	853	425	78	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
17+13.74	0.060	0.020 *	0.041	35	8°-55'	5°-30'
24+97.43	0.060	0.030 *	0.044	50	8°-15'	3°-00'

REMARKS

* Design Exception Required.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
DIRECTIONAL RAMP

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 2.7
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 202L / SR143 TI
RAMP DESIGNATION: Ramp ES / EN
DESCRIPTION: Directional Ramp East to South

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
36 [1]	27	29	752

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Body = 50 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+3.8500	-3.3368	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 9%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
20,806	36,000	

REMARKS

[1] Two Lane exit ramp splits into two lane E-S and one lane E-N after gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
202L / SR143 TI Ramp ES - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Structure No. 2144 E-S OP of EB frontage Rd.		N/A	16.48'	16'
Structure No. 2143 E-S OP of 44th St.		N/A	16.63'	16'

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Structure No. 2144 E-S OP of EB frontage Rd.		36'	36'	Yes	Yes	HS-20-44	HS-20-44
Structure No. 2143 E-S OP of 44th St.		48'-9" to 63'-9"	48'-9" to 63'-9"	Yes	Yes	HS-20-44	HS-20-44

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
21+00.00	1.2429	0.4833	400	1,620	425	>90	50
27+00.00	0.4833	1.6000	400	>1500	425	>90	50
34+00.00	1.6000	-3.3368	900	627	425	62	50
43+50.00	-3.3368	-0.4000	400	663	425	64	50
49+50.00	-0.4000	3.8500	400	420	425	50	50
53+50.00	3.8500	1.7300	400	709	425	70	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
16+41.00	0.100	0.051	0.050	50	8°-15'	2°-30'
37+27.15	0.100	0.099	0.099	50	8°-15'	7°-30'
60+88.18	0.100	0.035	0.029	50	8°-15'	1°-14'

REMARKS

[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0.0 H6871 01L	**MAINLINE MILEPOST:** 4.0
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	52nd Street St. TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	68+15.74 SR202 Cst Cl = 20+00.00 52nd Street Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	NB	**SB**	
LANE WIDTH:	11-12	11-12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	0-5		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 50 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	2.0000	-1.4800	6.0	6.0
SB	1.4800	-2.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
52nd Street Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
14+75.00	-1.8958	-0.2800	250	>1500	425	>90	50
19+25.00	-0.2800	1.4800	250	>1500	425	>90	50
23+50.00	1.4800	0.9600	250	2,200	425	>90	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015			N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 4.6
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: 52nd Street TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
22-40 [1]	21	708

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+2.1983	-2.8000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
5,700	8,400	

REMARKS

[1] Single lane exit tapers to two lanes at cross road

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
52nd Street TI Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
7+00.00	0.2996	-2.8000	450	573	495	59	55
15+50.00	-2.8000	2.1983	900	729	425	68	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
7+02.20	0.100	0.086 **	0.096	55	8°-15'	5°-15'
14+92.17	0.100	0.100	0.100	50	8°-15'	8°-00'
21+40.89	0.100	0.065	0.063	35	19°-35'	6°-59'-24"

REMARKS

** Design Exception will not be requested because this segment of the ramp will be upgraded under this project
[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 4.2
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	Van Buren St. TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	76+60.99 SR202 Cst Cl = 20+00.00 Van Buren Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	EB	**WB**	
LANE WIDTH:	11-12	11-12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	0-5		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 50 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
EB	+0.3446	-2.2000	6.0	6.0
WB	+2.2000	-0.3446	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Van Buren Street - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
15+00.00	0.2400	-0.3400	200	1,960	425	>90	50
24+00.00	-0.3400	-2.2000	200	680	425	66	50
26+00.00	-2.2000	0.2000	150	585	425	60	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015			N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 4.4
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Van Buren TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
22-52 [1]	21	1,514

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 50 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.5000	-2.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
7,700	8,700	

REMARKS

[1] Three lane ramp tapers to one lane at Ramp D gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Van Buren Street Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
1+50.00	-2.0000	1.5000	200	314	250	40	35
12+00.00	1.5000	-0.9682	400	637	495	64	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
5+48.43	0.100	0.070	0.068	50	8°-15'	3°-45'-00"
12+25.15	0.100	0.067 **	0.076	55	8°-15'	3°-30'-00"

REMARKS

** Design Exception will not be requested because this segment of the ramp will be upgraded under this project
[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 5.4
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	Priest Drive St. TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	138+96.40 SR202 Cst Cl = 41+71.31 Priest Drive Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	NB	**SB**	
LANE WIDTH:	12	12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	0-4		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 45 MPH

THE POSTED SPEED LIMIT IS: 45 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	+2.8204	-2.6000	6.0	6.0
SB	+2.6000	-2.8204	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Priest Drive - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
41+00.00	1.0000	2.8200	400	8,057	360	>90	45
49+30.00	2.8200	-2.6000	1300	719	360	67	45

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	45		N/A

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 6.1
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Priest Road TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
70-22 [1]	21	22	2,857

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+0.4140	-2.6855	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS	
2004	2030	K =	7%
		D =	N/A
ADT (VPD)	ADT (VPD)	T =	9%
8,100	9,000		

REMARKS

[1] Two lane ramp tapers to one lane at SR202 gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Priest Drive TI Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
13+00.00	-2.6855	0.4140	400	608	495	61	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
7+46.61	0.060	0.020	0.020	30	16°-51'	2°-00'
23+12.40	0.060	0.028 **	0.032	55	6°-53'	1°-30'

REMARKS

** Design Exception will not be requested because this segment of the ramp will be upgraded under this project

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp F

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 4.9
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Priest Drive TI
RAMP DESIGNATION: Ramp F
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
52-22 [1]	21	1,957

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.9212	-1.1783	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.100 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,400	10,600	

REMARKS

[1] One lane ramp tapers to four lanes at Priest Dr.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Priest Drive TI Ramp F - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Sky Harbor EB OP (#2221)	5.138	N/A	16'-6"	16'

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Sky Harbor EB OP (#2221)	5.138	28'-0"	28'-0"	Yes	Yes	HS-20-44	HS-20-44

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
8+50.00	-1.7300	0.4000	400	1,647	495	>90	55
12+50.00	0.4000	-1.1783	400	884	425	78	50
18+50.00	-1.1783	1.9212	550	780	425	72	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
2+35.66	0.100	0.059 **	0.066	55	8°-15'	2°-54'-23"
13+84.40	0.100	0.092	0.082	45	10°-37'	6°-00'

REMARKS

** Design Exception will not be requested because the superelevation will be upgraded under this project.
[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp EB

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 12.0
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Priest Drive TI
RAMP DESIGNATION: Sky Harbor EB
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
36 [1]	27	3,536

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+0.4375	-1.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
22,900	28,000	

REMARKS

[1] Two Lane Entrance Ramp

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Sky Harbor EB - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
70+20.00	-1.0000	0.2504	800	>1500	425	>90	50
92+00.00	0.2504	-0.2500	400	2,356	425	>90	50
98+00.00	-0.2500	0.4375	400	>1500	495	>90	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
95+20.73	0.060	0.030 *	0.034	55	6°-53'	1°-37'-00"

REMARKS

* Design Exception Required.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 6.0
PROJECT LOCATION: I-10 to SR101L
HIGHWAY SECTION: Red Mountain Freeway
INTERCHANGE: Center Pkwy TI
FUNCTIONAL CLASSIFICATION: Urban Freeway/Expressway - Controlled Access
Intersection Sta. 173+98.00 SR202 Cst Cl = 20+00.00 Center Pkwy Cst Cl

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	NB	**SB**	
LANE WIDTH:	12	12	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	0		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 35 MPH

THE POSTED SPEED LIMIT IS: 35 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	4.0000	-5.4800	6.0	6.0
SB	5.4800	-4.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Center Pkwy - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
17+16.24	5.4800	-4.0000	600	370	268	43	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	40	10°-44'-59"	Tangent

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 7.7
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Center Parkway TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
30-22 [1]	21	22	2,857

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.9611	-1.7254	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 14%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
3,700	5,200	

REMARKS

[1] Two lane ramp tapers to one lane at SR202 gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Center Parkway TI Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
3+50.00	-1.7254	1.9611	400	484	250	53	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
4+20.60	0.060	0.028	0.021	35	16°-51'	1°-30'
10+47.82	0.060	0.035 **	0.039	55	5°-23'	2°-00'

REMARKS

** Design Exception will not be required because the superelevation will be upgraded under this project.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER:	202L MA 0 H687101L	**MAINLINE MILEPOST:** 7.4
PROJECT LOCATION:	I-10/SR51 TI - SR101L	
HIGHWAY SECTION:	Red Mountain Freeway (SR202L)	
INTERCHANGE:	Scottsdale Road TI	
FUNCTIONAL CLASSIFICATION:	Urban Arterial	
Intersection Sta.	245+60.17 SR202 Cst Cl = 19+71.97 Scottsdale Road Cst Cl	

LANE AND SHOULDER WIDTH

	EXISTING (Feet)		AASHTO RECOMMENDED MINIMUM (Feet)
	NB	**SB**	
LANE WIDTH: [1]	11	11	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	2	2	0
MEDIAN WIDTH:	4		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 40 MPH

THE POSTED SPEED LIMIT IS: 40 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
	Ascending	Decending	Ascending	Descending
NB	+0.4200	-3.0000	6.0	6.0
SB	+3.0000	-0.4200	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

[1] 3 NB & 3 SB, and 2 left-turn lanes between ramp intersections

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Scottsdale Road - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
12+00.00	-0.3950	0.4100	200	>1500	425	>90	50
17+00.00	0.4100	-0.4200	200	1,400	425	>90	50
24+40.00	-0.4200	3.0000	400	529	425	56	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
N/A	0.020	0.020	0.015	40	10°-45'	Tangent

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 7.2
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Scottsdale Road TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
22-44 [1]	21	75

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+0.5800	-3.2400	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
13,300	15,300	

REMARKS

[1] One lane ramp tapers to three lanes at cross road

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Scottsdale Road TI Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
9+75.00	0.5800	-3.2400	700	629	495	62	55
13+75.00	-3.2400	0.7467	300	357	250	43	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
10+29.56	0.060	0.020	0.020	50	6°-53'	1°-00'
37+94.53	0.020	0.020	0.020 [1]	10-20 [1]	N/A	28°-39'
40+27.03	0.020	0.020	0.020 [1]	10-20 [1]	N/A	13°-29'
Ramp B SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	76°-24'

REMARKS

[1] Assumed design speed 10-20 mph at SPUI turning movement

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp C

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 7.7
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Scottsdale Road TI
RAMP DESIGNATION: Ramp C
DESCRIPTION: WB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
24-22 [1]	21	100

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+0.4228	-2.2400	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,600	9,700	

REMARKS

[1] Two lane ramp tapers to one lane at SR202 gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Scottsdale Road TI Ramp C - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
3+00.00	-0.4228	2.2400	400	803	250	72	35
8+00.00	2.2400	0.4813	400	814	425	73	50

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
5+44.45	0.060	0.020	0.020	40	6°-53'	1°-00'
59+04.38	0.020	0.020	0.020 [1]	10-20 [1]	N/A	12°-44'
61+26.08	0.020	0.020	0.020 [1]	10-20 [1]	N/A	38°-12'
Ramp C SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	57°-18'

REMARKS

[1] Assumed design speed 10-20 mph at SPUI turning movement

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp D

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 7.7
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Scottsdale Road TI
RAMP DESIGNATION: Ramp D
DESCRIPTION: EB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	Minimum Ramp Inside Radius (Feet)
28-22 [1]	21	75

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+2.5400	-0.5122	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
15,800	16,000	

REMARKS

[1] Two lane ramp tapers to one lane at SR202 gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Scottsdale Road TI Ramp D - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
3+00.00	-0.5122	2.5400	400	622	250	63	35
8+50.00	2.5400	0.2796	500	727	495	70	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
5+51.16	0.060	0.026	0.023	35	16°-51'-06"	2°-15'
11+57.35	0.060	0.035 **	0.040	55	8°-54'-39"	2°-00'
79+06.32	0.020	0.020	0.020 [1]	10-20 [1]	N/A	16°-00'
81+08.65	0.020	0.020	0.020 [1]	10-20 [1]	N/A	27°-17'
Ramp D SPUR	0.020	0.020	0.020 [1]	10-20 [1]	N/A	76°-24'

REMARKS

** Design Exception will not be requested because the superelevation will be upgraded under this project.
[1] Assumed design speed 10-20 mph at SPUI turning movement

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
CROSS ROAD

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 8.2
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: McClintock Drive TI (SR202)
FUNCTIONAL CLASSIFICATION: Urban Arterial
Intersection Sta. 296+48.96 SR202 Cst Cl = 20+00.00 McClintock Dr Cst Cl

LANE AND SHOULDER WIDTH

	EXISTING (Feet) NB	EXISTING (Feet) SB	AASHTO RECOMMENDED MINIMUM (Feet)
LANE WIDTH:	11	11	10
INSIDE (left) SHOULDER WIDTH:	0	0	0
OUTSIDE (right) SHOULDER WIDTH:	0	0	0
MEDIAN WIDTH:	0		0

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 45 MPH

THE POSTED SPEED LIMIT IS: 50 MPH
TERRAIN IS: LEVEL

GRADES

	EXISTING MAXIMUM GRADE IS (%) Ascending	EXISTING MAXIMUM GRADE IS (%) Decending	AASHTO ALLOWABLE MAXIMUM GRADE (%) Ascending	AASHTO ALLOWABLE MAXIMUM GRADE (%) Descending
NB	+3.0000	-3.0000	6.0	6.0
SB	+3.0000	-3.0000	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft

AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = N/A
		D = N/A
ADT (VPD)	ADT (VPD)	T = N/A
N/A	N/A	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
McClintock Drive - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
119+86.00	3.0000	-3.0000	1600	759	360	69	45
130+36.00	-3.0000	1.3200	400	414	360	48	45

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
17+28.88	0.020	0.020	0.015	45	7°-45'	1°-24'-41"

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp A

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 8.0
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: McClintock Drive TI
RAMP DESIGNATION: Ramp A
DESCRIPTION: WB Entrance Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
24-22 [1]	21	22	1,623

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+4.8000	-1.7600	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
9,600	14,200	

REMARKS

[1] Two lane ramp tapers to one lane at SR202 gore

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
McClintock Drive TI Ramp A - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
6+00.00	1.7600	-4.8000	800	513	495	55	55
11+50.00	-4.8000	1.2430	200	187	155	29	25

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
2+57.15	0.060	0.044 **	0.050	55	5°-23'	3°-00'
8+04.85	0.060	0.038 **	0.043	45	8°-55'	3°-30'-00"

REMARKS

** Design Exception will not be requested because the superelevation will be upgraded under this project.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp B

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 8.0
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: McClintock Drive TI
RAMP DESIGNATION: Ramp B
DESCRIPTION: EB Exit Ramp

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
22-44 [1]	21	22	571

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+1.6000	-2.5600	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
10,500	13,300	

REMARKS

[1] One lane ramp tapers to four lanes at cross road

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
McClintock Drive TI Ramp B - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
7+50.00	1.6000	-2.5600	500	509	495	55	55
13+75.00	-2.5600	1.0800	400	491	425	53	50
19+00.00	1.0800	-0.3440	400	958	250	82	35

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
12+19.22	0.060	0.055 **	0.059	50	6°-53'	6°-00'
18+20.71	0.060	0.055	0.053	35	16°-51'	10°-00'

REMARKS

** Design Exception will not be requested because the vertical clearance will be upgraded under this project.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
DIRECTIONAL RAMP

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 9.5
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Pima, Red Mt TI
RAMP DESIGNATION: Ramp S-W
DESCRIPTION: Directional Ramp South to West

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
28	21	22	900

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Gore Area = 55 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
+2.5490	-3.7225	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 8%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
18,600	21,200	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp S-W - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Bridge Structure #2344	9.5	N/A	N/A	N/A

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Bridge Structure #2344	9.5	28'	28'	Yes	Yes	HS-20-24	HS-20-24

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
23+50.00	2.5490	-3.7225	1200	643	495	62	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
27+78.34	0.100	0.950	0.940	50	8°-15'	6°-21'-58"

REMARKS

[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28 with e_{max} = 10%

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
DIRECTIONAL RAMP

PROJECT NUMBER: 202L MA 0 H687101L
MAINLINE MILEPOST: 9.5
PROJECT LOCATION: I-10/SR51 TI - SR101L
HIGHWAY SECTION: Red Mountain Freeway (SR202L)
INTERCHANGE: Pima, Red Mt TI
RAMP DESIGNATION: Ramp E-S
DESCRIPTION: Directional Ramp East to South

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH

Existing (Feet)	AASHTO Recommended Minimim (Feet)	AASHTO Maximum (Feet)	Minimum Ramp Inside Radius (Feet)
36	27	29	2,329

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Gore Area = 55 mph; Ramp Body = 50 mph; Ramp Gore Area = 55 mph

GRADES

EXISTING MAXIMUM GRADE IS (%)		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
Ascending	Decending	Ascending	Descending
4.0122	-1.3009	6.0	6.0

CROSS SLOPE

EXISTING CROSS SLOPE IS: 0.020 '/ft
AASHTO ALLOWABLE RANGE IS: 0.015'/ft - 0.020 '/ft

TRAFFIC VOLUMES AND FACTORS

YEAR	DESIGN YEAR	TRAFFIC FACTORS
2004	2030	K = 7%
		D = N/A
ADT (VPD)	ADT (VPD)	T = 9%
40,100	45,000	

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
Ramp E-S - Continued

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	Preconstruction Clearance	Postconstruction Clearannce	AASHTO Minimum Allowable Clearance
Not Applicable				

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
Not Applicable							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)
15+00.00	-1.0000	4.0122	700	584	495	61	55
23+20.00	4.0122	-1.3009	900	605	495	62	55

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION Maximum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Minimum [1] (Ft/Ft)	Existing Speed (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
10+66.30	0.100	0.055 *	0.057	55	6°-53'	2°-27'-00"
26+71.25	0.100	0.038	0.036	50	6°-53'	1°-45'-35"
38+84.35	0.100	0.038	0.032	50	6°-53'	1°-30'-17"

REMARKS

* Design Exception Required.
[1] Existing design was with e_{max} = 10%. Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-28.

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

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DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
I-10	147.27	2116	16.8'	305'	33.6'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	97.62
			COMMENTS:										
202L	0.70	2021	17.43'	252'	135.8'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	90.08
			COMMENTS:										
202L	1.75	2022	17.11'	194'	135.8'	Coc. Barrier	Yes	Yes	1"			HS20	98
			COMMENTS:										
202L	2.01	2023	N/A	143'	176.1'	Conc. Barrier	Yes	Yes	1"			HS20	85
			COMMENTS:										
202L	2.45	2024	17.84'	158'	135.8'	Conc. Barrier	Yes	Yes	1"			HS20	78
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

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DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

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ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
202L	2.90	2140	15.83'	295'	111.8'	Conc. Barrier	Yes	Yes	2"			HS20	80
			COMMENTS:										
202L	3.25	2159	16.17'	681'	28'	Conc. Barrier	Yes	Yes	2"			HS20	94.85
			COMMENTS:										
202L	3.25	2160	17.32'	324'	68'	Conc. Barrier	Yes	Yes	2"			HS20	85.93
			COMMENTS:										
202L	3.45	2198	17.28	181'	67.9'	Conc. Barrier	Yes	Yes	1"			HS20	85
			COMMENTS:										
202L	3.89	2208	17.04'	154'	67.9'	Conc. Barrier	Yes	Yes	1"			HS20+	85
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

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DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
202L	4.04	2210	18.5'	307'	67.9'	Conc. Barrier	Yes	Yes	1"			HS20+	92.8
			COMMENTS:										
202L	4.20	2212	16.56'	203'	67.9'	Conc. Barrier	Yes	Yes	1"			HS20+	F88.55
			COMMENTS:										
202L	4.52	2214	16.98'	216'	86'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	81.16
			COMMENTS:										
202L	4.83	2217	24.47'	418'	67.9'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	86.85
			COMMENTS:										
202L	5.02	2219	16.72'	271'	89.3'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	92.43
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

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DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
202L	5.70	2405	20.42'	271'	124'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	82.89
			COMMENTS:										
202L	6.34	2258	18.07'	1029'	155.5'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	68
			COMMENTS:										
202L	6.45	2227	18.7'	281'	52'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	79.07
			COMMENTS:										
202L	7.13	2259	N/A	74'	159.2'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	78.8
			COMMENTS:										
202L	7.41	2260	N/A	74'	174.1'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	80
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRE-DESIGN SECTION

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DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO:
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
202L	7.55	2261	15.56'	126'	195.2'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	78
			COMMENTS:										
202L	7.71	2263	16.53'	201'	156.3'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	87.45
			COMMENTS:										
202L	8.06	2265	N/A	1008'	159.4'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	80.89
			COMMENTS:										
202L	8.17	2268	16.58'	5287'	80'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	84
			COMMENTS:										
202L	8.17	2269	16.58'	5165'	80'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	83
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

PAGE__OF__

DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
101L	50.98	2343	17.77'	2290'	28'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	95.75
			COMMENTS:										
101L	51.00	2358	16.94'	3096'	36'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	78
			COMMENTS:										
101L	51.24	2379	16.73'	245'	28'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	97.55
			COMMENTS:										
101L	51.37	2381	24.12'	282'	82'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	91.47
			COMMENTS:										
101L	51.37	2382	22.97'	282'	87.4'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20	86.13
			COMMENTS:										

ROADWAY ENGINEERING GROUP
ROADWAY PRESIGN SECTION

PAGE__OF__

DATE:

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FEDERAL REFERENCE NO: _____ TRACS NO: H6871 01L
HIGHWAY: 202L
LOCATION: Phoenix, AZ
MP LIMITS: 0 TO: _____
PROJECT DESCRIPTION: Red Mountain Freeway Widening (202L)

FROM: Christopher A. Labye, PE
DMJM Harris, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO.	MINIMUM VERTICAL CLEARANCE	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE BARRIER			AC OVERLAY			BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
						TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)		
101L	51.37	2409	16.63'	301'	28'	Conc. Barrier	Yes	Yes	N/A	N/A	N/A	HS20+	89.41
			COMMENTS:										

Information Completed by: Mohammed A. Baki Date: 9/15/2006

APPENDIX B

EVALUATION OF SR202L WESTBOUND EXIT RAMP AT MCCLINTOCK DRIVE

DMJM HARRIS | AECOM

2777 East Camelback Road, Suite 200
Phoenix, Arizona 85016-4302
Tel: (602) 337-2777
Fax: (602) 337-2624

Memorandum

Date: August 7, 2006

To: File

From: Rodney Bragg

Subject: Red Mountain Freeway (I-10/SR51 TI – SR 101L)
TRACS No. 202L MA 0.0 H6871 01L
SR 202L Exit Ramp at McClintock Drive

This memorandum describes the development and evaluation of an additional westbound exit ramp at McClintock Drive on the Red Mountain Freeway (SR202L) between McClintock Drive (Milepost 8.71) and the SR202L/SR101L Traffic Interchange (Milepost 9.80). This Project is located in the Arizona Department of Transportation's (ADOT's) Phoenix District within Maricopa County in south-central Arizona.

The City of Tempe (COT) and the Salt River Pima Indian Community (SRPIC) requested that ADOT evaluate this additional westbound exit ramp. The addition of this ramp would provide additional access to future developments adjacent to this section of the SR202L Freeway.

This evaluation is in conjunction with the Red Mountain Freeway (SR202L) – Interstate 10 (I-10) to Price Freeway (SR101L) Design Concept Report and Environmental Documentation for the addition of general purpose lanes.

Existing Conditions

The Red Mountain Freeway (SR 202L) is classified as a controlled-access Urban Principal Freeway/Expressway with a posted speed limit of 65 mph. The roadway section generally includes three general-purpose lanes and one High Occupancy Vehicle (HOV) lane in each direction of travel. Figure 1 shows the existing lane configuration and traffic volumes along the SR 202L near McClintock Drive.

Approaching the Price/Pima Freeway (SR 101L), westbound SR 202L currently provides three general-purpose lanes. The Dobson Road entrance ramp adds an auxiliary lane (4th westbound lane) approaching the SR 101L exit ramp. The SR 101L exit ramp is a two-lane exit ramp with the outside lane being a "forced exit" (exit only) and the adjacent lane being an "optional exit" (through or exit). Immediately west of the SR 101L exit ramp, the outside general-purpose lane is dropped to provide two general-purpose lanes through the SR 101L system interchange. The westbound HOV lane currently begins within the SR 101L system interchange.

Departing the SR 101L system interchange, westbound 202L currently provides four general-purpose lanes and one HOV lane. The SR 101L entrance ramp is a three-lane ramp with the outside lane being dropped upon entry to the 202L.

Currently, the McClintock Drive traffic interchange is a half-diamond interchange that provides access to and from the west (westbound entrance ramp and eastbound exit ramp).

Future Conditions

ADOT is currently conducting a Design Concept Report (DCR) for the addition of a westbound general purpose lane(s) departing the SR 101L system interchange. Alternative 1 includes the addition of one westbound lane departing the system TI and includes no improvements within the system TI. This alternative would provide five westbound lanes departing the SR 101L system interchange. Alterative 2

includes the addition of two westbound lanes departing the system TI - one lane would be added within the system TI to provide three westbound lanes through the system TI; and one lane would be added with the SR 101L entrance ramp. This alternative would provide six westbound lanes departing the SR 101L system interchange. Figure 2 shows the future lane configuration associated with Alternative 1, as described above, and traffic volumes along the SR 202L near McClintock Drive.

Alternative Discussion

Currently, the McClintock Drive traffic interchange is a half-diamond interchange that provides access to and from the west (westbound entrance ramp and eastbound exit ramp). This section will discuss the addition of a westbound exit ramp at the McClintock Drive interchange.

On urban freeways, two or more ramp connections are often located in close succession. To provide sufficient weaving length and allow for the completion of the necessary lane changes, a sufficient weaving distance should be provided between successive ramp connections. Weaving is defined as the crossing of two or more travel paths in the same general direction along a significant length of highway without the aid of traffic control devices. Weaving segments require lane-change maneuvers as drivers must access lanes appropriate to their desired exit point.

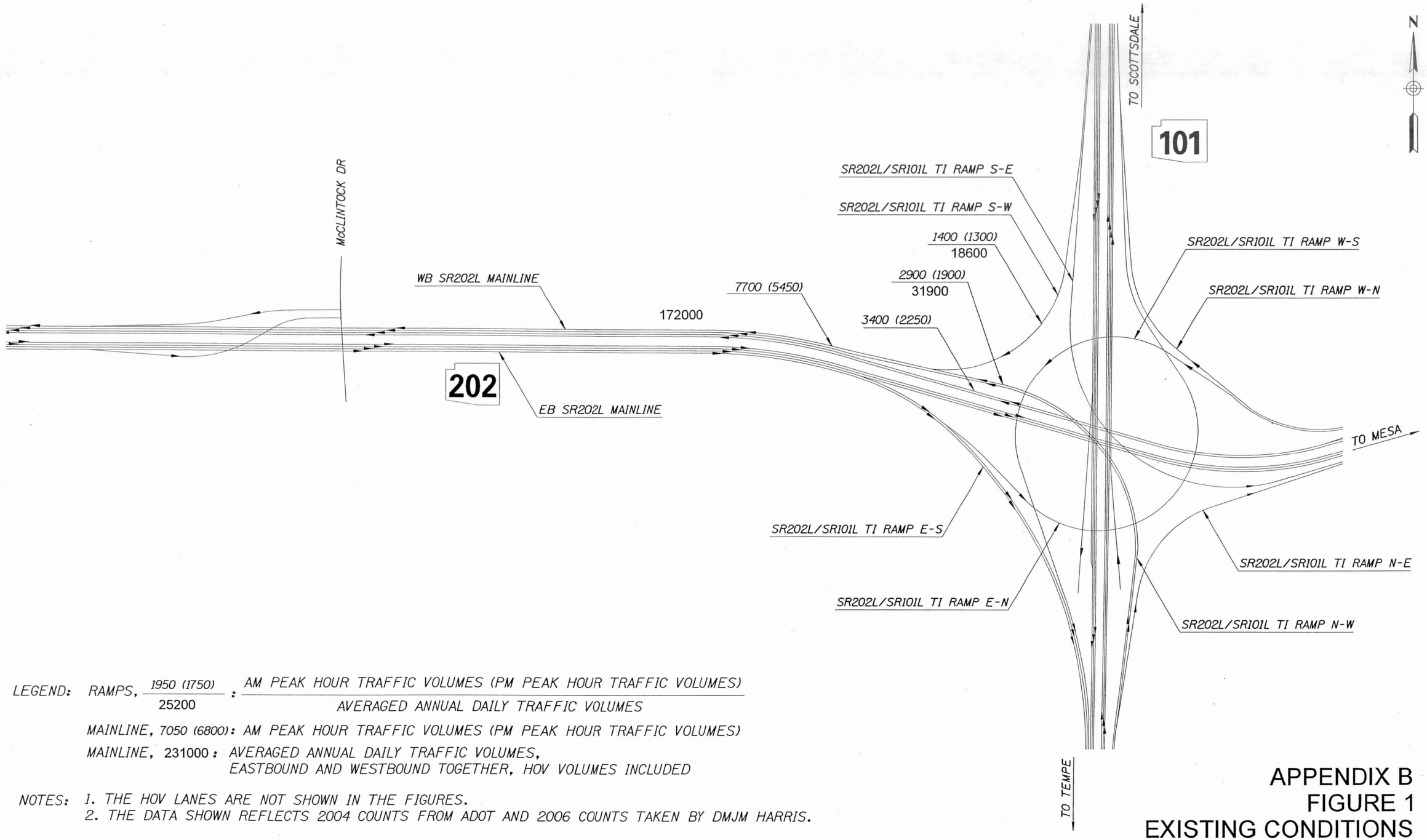
The addition of the westbound McClintock Drive exit ramp would primarily serve traffic east of SR 101L, destined for McClintock Drive. Traffic on SR 101L is provided access to McClintock Drive via McKellips Road and University Drive. Full access is provided to SR 101L at McKellips Road with service ramp connections to the north and to the south, while access to and from the south is provided at University Drive with service ramp connections to the SR 101L. Therefore, a vast majority of traffic using the proposed westbound McClintock Drive exit ramp would be on westbound SR 202L.

The existing configuration requires a westbound SR 202L driver to execute two lane changes within approximately 7,500 feet in order to exit at Scottsdale Road, as shown in Figure 1. The addition of a McClintock Drive exit ramp, in conjunction with the future configuration described above, would require a westbound SR 202L driver to execute three lane changes within approximately 2,500 feet in order to exit at McClintock Drive, as shown in Figure 3.

An operational analysis was conducted to evaluate this weaving area. Using the Highway Capacity Software (HCS) and the 2030 A.M. peak hour projections adjusted for the addition of the McClintock Drive exit ramp, an operational analysis was conducted. This analysis showed that the weaving area would operate at LOS 'F' under the projected 2030 A.M. peak hour conditions. This weaving areas is constrained by the amount of traffic entering the SR 202L freeway from the SR 101L entrance ramp. This entering volume is so high that there are no opportunities for a vehicle to successfully make a lane-change. A sensitivity analysis showed that the projected 2030 A.M peak hour SR 101L entering traffic volume would need to reduced by approximately 40% in order to achieve a LOS 'D' in the weaving area. This reduced volume would be significantly less than the existing (2006) volume at this location.

Conclusion

The addition of a McClintock Drive exit ramp, in conjunction with the future configuration described above, would require a westbound SR 202L driver to execute three lane changes within approximately 2,500 feet in order to exit at McClintock Drive. During the 2030 A.M. peak hour, the addition of the McClintock Drive exit ramp is expected to create a weaving area between the SR 101L entrance ramp and the McClintock Drive exit ramp that would experience a very high density of vehicles, thus making the necessary lane-change movements infeasible. With a high density of traffic expected on the SR 101L entrance ramp, the ability of a driver to make three lane changes will be severely restricted. The addition of vehicles attempting to weave across three travel lanes will exacerbate the problem, thus potential creating a safety issue. Even with a limited number of weaving vehicles, this area would experience degraded operations due to the number of lane-changes required in such a short distance. Therefore, it is recommended that exiting ramp configuration be maintained at McClintock Drive and the westbound exit should not be added.



LEGEND: RAMPS, $\frac{1950\ (1750)}{25200}$: $\frac{\text{AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)}}{\text{AVERAGED ANNUAL DAILY TRAFFIC VOLUMES}}$

MAINLINE, 7050 (6800): AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)

MAINLINE, 231000 : AVERAGED ANNUAL DAILY TRAFFIC VOLUMES, EASTBOUND AND WESTBOUND TOGETHER, HOV VOLUMES INCLUDED

NOTES: 1. THE HOV LANES ARE NOT SHOWN IN THE FIGURES.
2. THE DATA SHOWN REFLECTS 2004 COUNTS FROM ADOT AND 2006 COUNTS TAKEN BY DMJM HARRIS.

SR 202L
I-10/SR 51 to SR 101L

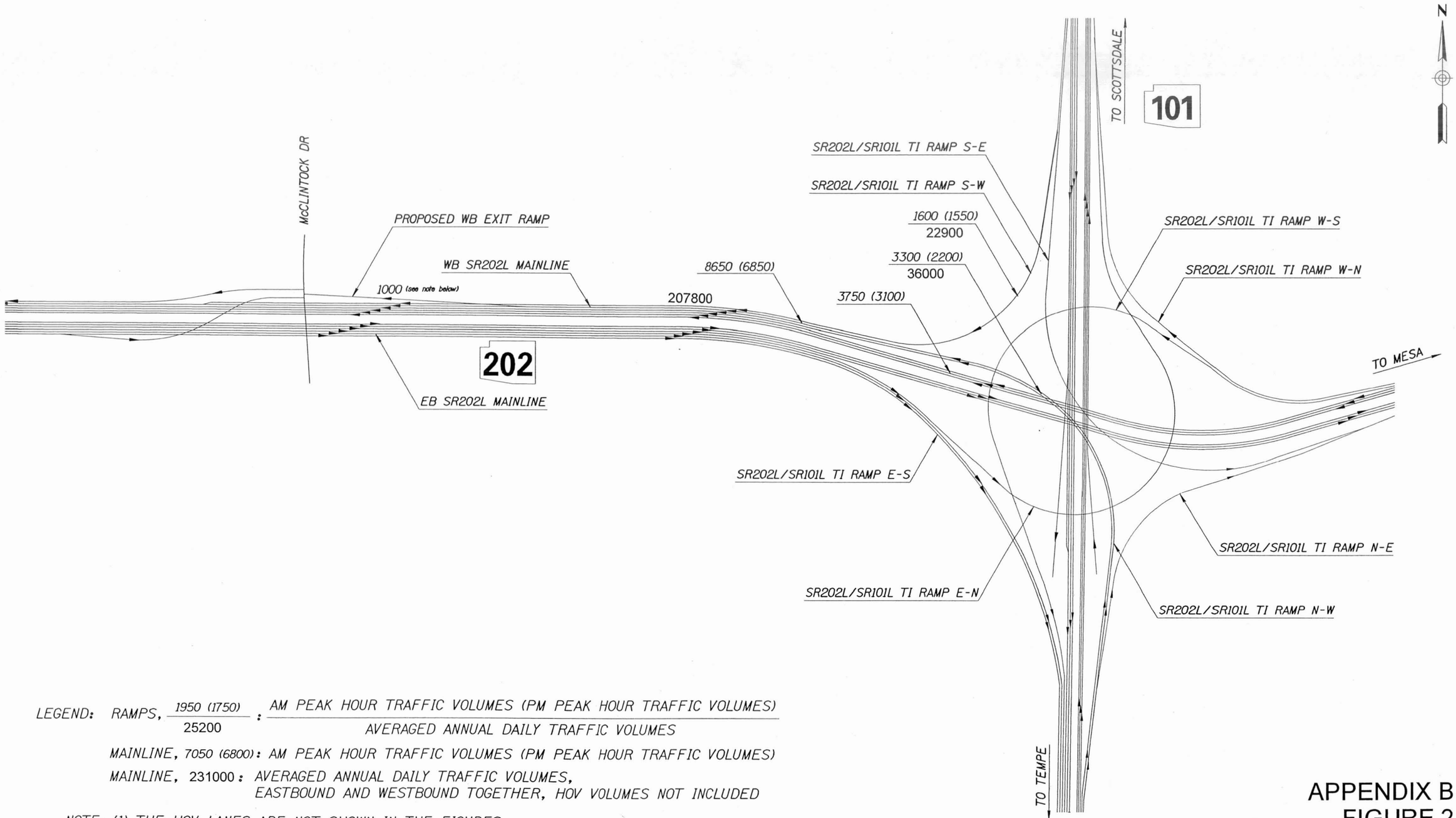
NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

APPENDIX B
FIGURE 1
EXISTING CONDITIONS

DMJM HARRIS | AECOM

u:\rm01\Design\tra\Report Graphics\McClintock Memo Fig 1.dgn
9/26/2006



LEGEND: RAMPS, $\frac{1950\ (1750)}{25200}$: $\frac{\text{AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)}}{\text{AVERAGED ANNUAL DAILY TRAFFIC VOLUMES}}$

MAINLINE, 7050 (6800): AM PEAK HOUR TRAFFIC VOLUMES (PM PEAK HOUR TRAFFIC VOLUMES)

MAINLINE, 231000 : AVERAGED ANNUAL DAILY TRAFFIC VOLUMES, EASTBOUND AND WESTBOUND TOGETHER, HOV VOLUMES NOT INCLUDED

NOTE: (1) THE HOV LANES ARE NOT SHOWN IN THE FIGURES.
(2) AM PEAK HOUR VOLUME SHOWN FOR MCCLINTOCK DR EXIT RAMP IS ASSUMED & IS NOT BASED ON MAG MODEL

SR 202L
I-10/SR 51 to SR 101L

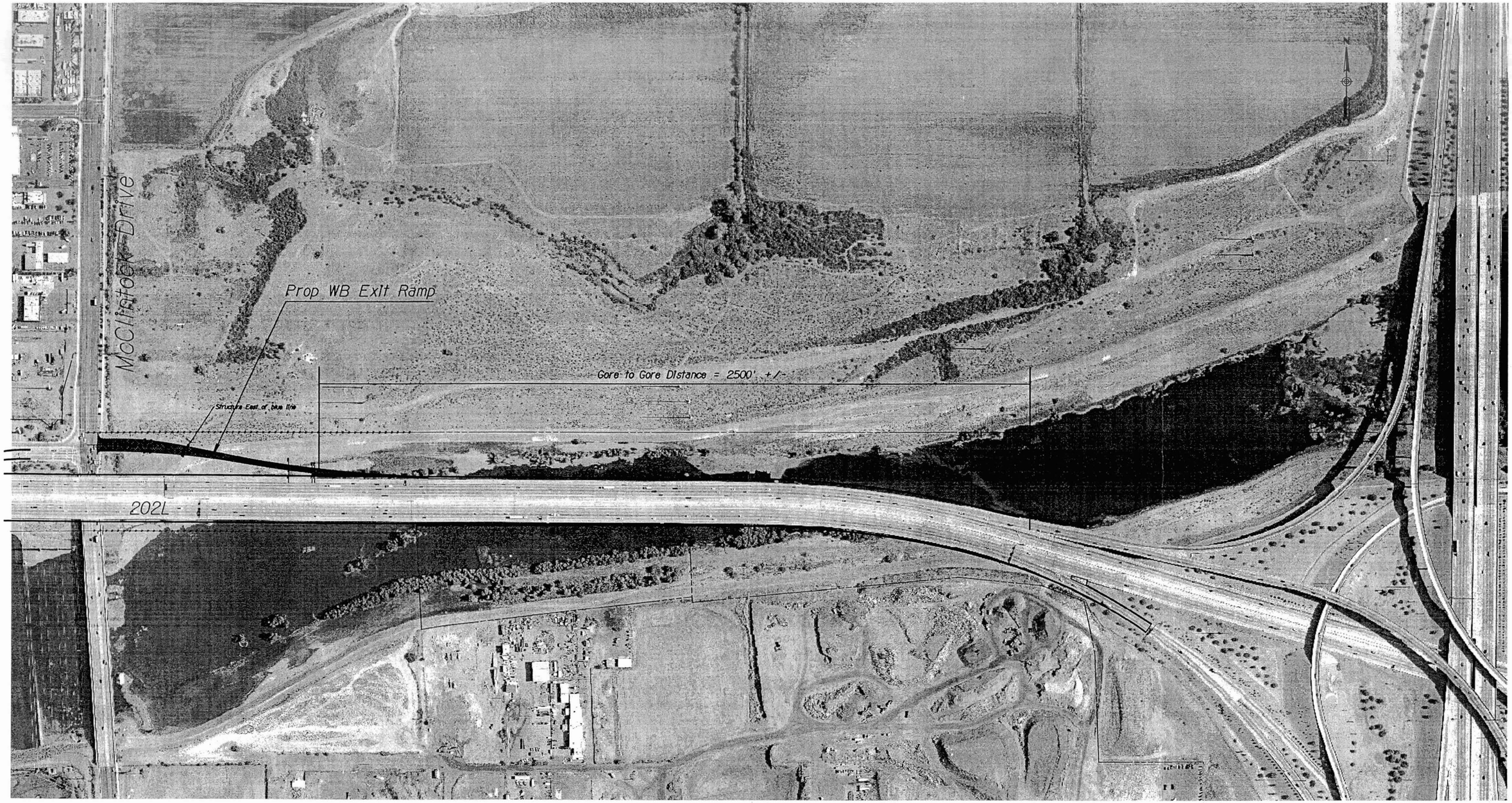
NOT TO SCALE - SCHEMATIC ONLY

ON THE MOVE
PARTNERS IN PROGRESS

APPENDIX B
FIGURE 2
FUTURE 2030 CONDITIONS

DMJM HARRIS | AECOM

u:\rm01\Design\tra\Report Graphics\McClintock Memo Fig 2.dgn
9/26/2006



APPENDIX B - FIGURE 3
MCCLINTOCK DRIVE WESTBOUND EXIT RAMP

SR 202L
I-10/SR 51 to SR 101L

ON THE MOVE
PARTNERS IN PROGRESS

DMJM HARRIS | AECOM

NOT TO SCALE - SCHEMATIC ONLY

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9/26/2006

APPENDIX C

SUMMARY OF COMMENTS

(To Be Provided with the Final DCR)