Memorandum

To: Bev Everson
Cc: Tom Furgason
From: Kathy Arnold
Doc #: 4.6.2-001/09
Subject: Transmittal of AZ83 Roadway Assessment Report
Date: August 4, 2009

Rosemont is pleased to transmit three hardcopy versions as well as two CDs containing an electronic version of the AZ-83 Roadway Assessment Report. In addition, I am transmitting two hardcopies and one CD containing the electronic version of the document to SWCA.
AZ-83 Roadway Assessment Report

Rosemont Copper Project

Prepared for:

Rosemont Copper
4500 Cherry Creek South Drive, Suite 1040
Denver, Colorado  80246
(303) 300-0138
Fax (303) 300-0135

Prepared by:

Tetra Tech
16241 Laguna Canyon Road, Suite 200
Irvine, CA  92618
(949) 727-7099
Fax (949) 727-7097
Tetra Tech Project: 134-20192-09001A, 134-20192-09002, & 114-320794

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EXECUTIVE SUMMARY

State Route 83 (AZ-83) will be used as main transport corridor for the Rosemont Copper Project (Project). An assessment which analyzed the current roadway geometry and safety conditions was completed along AZ-83 between Interstate 10 (I-10) and State Route 82 (AZ-82). The analysis was based on the Arizona Department of Transportation (ADOT) Roadway Design Guidelines, the American Association of State Highways and Officials (AASHTO) Policy on Geometric Design of Highways and Streets, and AASHTO Roadside Design. Substandard design elements were identified for AZ-83 and included: 1) tight reverse horizontal curves, 2) improper guardrail placement, and 3) insufficient roadway shoulder widths.

Accident data from ADOT was collected for the period between 2002 to 2008 in order to complete a detailed accident assessment for AZ-83. The top five (5) accident prone locations were identified to be Mile Post (MP) 44, 45, 46, 55, and 58. In particular, the roadway segment between MP 44.5 to 44.0 has the highest accident frequency for all fatal accidents along AZ-83. Additionally, locations where substandard designs are present coincide with the high accident frequency locations. The proposed Primary Access Road leading to the Rosemont Project off AZ-83 is located at MP 46.9. This location shows relatively low accident frequency and rate. In summary, the major causes of accidents on AZ-83 are speeding in combination with the curvy roadway geometry. Incidents involving trucks show a relatively low accident rates, suggesting that trucks are not the major vehicle type that contributes to roadway accidents along AZ-83. Therefore, additional truck traffic from the Rosemont Project will not necessarily affect the current roadway safety along AZ-83.

State Route 77 (AZ-77), which also has been and is currently used by several mining operations, was selected for a comparison analysis. Accident analysis results show that the driver’s behavior, especially speeding, and the roadway elements have a significant impact on accident occurrence when compared to vehicle collisions caused by truck traffic. Therefore, truck traffic related to the local mining operations also did not necessarily affect the roadway safety for AZ-77.

Various potential roadway improvements for AZ-83 were suggested in order to improve traffic flow and safety. These improvements included: 1) various designs at the Project’s Primary Access Road “T” Intersection with AZ-83, 2) wide load truck turnouts, 3) school bus stop turnouts, and 4) shoulder upgrades. Additionally, future ADOT projects in the area were reviewed and summarized. Some of these projects will address the current substandard design elements identified in this study.
1.0 INTRODUCTION

1.1 Site Description

Rosemont Copper Company is proposing a new mining operation (Project) located on the east side of the Santa Rita Mountains, approximately 30 miles southeast of Tucson, Arizona (AZ) and west of State Route 83 (AZ-83). Figure 1 shows the location of the Project site. The anticipated life of the Project is 25 to 30 years which includes construction, operations, and closure period. AZ-83 will serve as the major access route to the Project site. With additional traffic loads due to the new Project, it was necessary to analyze potential changes to the AZ-83 network circulation and traffic operation. In March of 2009, Tetra Tech issued a Traffic Analysis Report which examined the existing and future traffic conditions along AZ-83 (Tetra Tech, 2009). This Roadway Assessment Report is a sequential in-depth analysis of the existing roadway geometry, safety, and a collection of Technical Memoranda prepared by Tetra Tech that address potential roadway improvements related to school bus turnouts, wide load truck turnouts, and design alternatives for the Primary Access Road intersection into the Project site. This report also provides a complete documentation of design criteria and standards used for the geometric analysis and the potential roadway improvements. A detail description of the report contents is presented in Section 1.2.

AZ-83 is an existing paved, north-south roadway that begins at Interstate 10 (I-10) and terminates at Parker Canyon Lake. It passes through the counties of Pima, Cochise, and Santa Cruz and the towns of Sonoita and Elgin. The route is sparsely populated and serves as a scenic state highway. Currently, there is one (1) southbound lane and one (1) northbound lane. The posted speed limit ranges from 35 miles per hour (MPH) to 55 MPH. AZ-83 is a fairly curvilinear route, which winds its way through the scenic, high-country vistas of the Coronado National Forest region. A segment of AZ-83 is listed in the top 5% of Arizona’s most accident prone locations per the Federal Highway Administration (FHWA) Highway Safety Improvement Program. Based on site visits to AZ-83, a significant amount of passing and sight distance problems were due to side slopes and/or the curvilinear nature of AZ-83.

1.2 Report Contents

This report consists of four (4) sections including this introduction. The existing roadway geometry of AZ-83 is reviewed and described in Section 2.0. Tetra Tech also conducted site visits to gather field information on roadway curvature, roadway geometrics, potential substandard geometric design features, sight distance elements, and information on current school bus operations. A description of the roadway speed limits and the horizontal and vertical alignments are also presented in Section 2.0. Section 3.0 contains an accident analysis of AZ-83 using the Arizona Department of Transportation (ADOT) accident database for the past six (6) years. An accident analysis of State Route 77 (AZ-77) is also provided in Section 3.0 in order to assess the effect of local mining operations on the roadway. In Section 4.0, various potential roadway improvements to AZ-83 are proposed in order to enhance traffic circulation and roadway safety. The design guidelines used in these roadway improvements were based on the ADOT and American Association of State Highways and Transportation Officials (AASHTO) roadway design guidelines as well as the Manual on Uniform Traffic Control Devices (MUTCD). Detailed information on the proposed roadway improvements are also presented as Technical Memoranda in the appendices of this report.
2.0 AZ-83 ROADWAY ASSESSMENT

The existing AZ-83 roadway geometrics, as well as speed limits along AZ-83, are discussed in this section. AZ-83 is currently classified as a rural major collector per the ADOT approved functional classification map (Figure 2). The roadway is also classified as a rural non-divided highway in mountainous terrain. Per Table 101.3 in the ADOT Roadway Design Guidelines (Appendix A), the design speed for rural, non-divided mountainous terrain is 55 miles per hour (MPH). The design speed is a major element in determining roadway design factors such as curvature and sight distance. The following elements were analyzed to assess the roadway geometrics of AZ-83 and to identify any existing substandard designs.

1. Traffic Speeds
2. Vertical Alignment
3. Horizontal Alignment
4. Existing School Bus Stops
5. Guardrails

The study area considered for this roadway assessment included the entire segment of AZ-83 between the intersection of Interstate 10 (I-10) and State Route 82 (AZ-82) (Figure 1). The existing topography for this study area was provided by Chartiff (http://www.chartiff.com/index.html) with a 25-foot contour interval. Based on the topographic map and field visits, it was determined that the maximum superelevation rate along AZ-83 should not exceed 8%. The superelevation rate is the tilt or bank of a roadway along a horizontal curve. This tilt is designed to allow vehicles to travel through the curve at a higher speed without the need for a larger curve.

While translating the topographic data into computer-aided design data, stationing was set to start at the AZ-83 / I-10 interchange. This starting station is identified as STA 100+00 and is located at approximate Milepost (MP) 58.3 on AZ-83. The end station, STA 1450+75, is located at the intersection of AZ-83 and AZ-82, at MP 32.4. The proposed Primary Access Road for the Project site is located at MP 46.9 or STA 740+75. A plan and profile layout of AZ-83 is presented in Appendix B.

2.1 Traffic Speeds

The traffic speed is a major element in determining roadway design components such as curvature and stopping sight distances. Traffic speed is also used to assess substandard designs. Within the study limits, the design speed varies along AZ-83 and is further explained in Sections 2.1.1 through 2.1.3.

2.1.1 MP 58.3 (I-10 Interchange) to MP 46

For the most part, the posted speed limit on AZ-83 from I-10 to MP 46 (just south of the exiting Rosemont Junction intersection at approximately STA 750+00) is 55 MPH. The majority of this section is straight and the observed actual vehicle driving speeds ranged from 50 to 60 MPH. There is a short section along AZ-83 between MP 47.7 (STA 700+50) and MP 47.2 (STA 730+00) that has multiple curves and an advisory speed of 45 MPH. Within this segment, the observed actual driving speeds ranged from 45 to 55 MPH.
2.1.2 **MP 46 (STA 750+00) to MP 43.6 (STA 910+00)**

The posted speed south of Rosemont Junction to MP 43.6 (STA 910+00) is 45 MPH. There are multiple curves with advisory speeds of 35 MPH (10 MPH less than the posted speed) in both the northbound and southbound directions. The observed actual driving speeds for vehicles travelling northbound were approximately 40 MPH for trucks with trailers and 45 to 55 MPH for passenger cars. The actual speeds going southbound ranged from 38 to 50 MPH for trucks with trailers and 45 to 55 MPH for passenger cars. Illustrations 2.1 and 2.2 show a curvy segment of AZ-83 where the advisory speed is 35 MPH.

**Illustration 2.1** Advanced Curvy Alignment Warning Sign

Note: Photo is taken at the reverse curve (W1-4R) before MP 44 with an advisory speed of 35 MPH.
Illustration 2.2 Curvy Segment Between MP 44 to 45

Note: The advisory speed for this cure segment is 35 MPH.

2.1.3 **MP 43.6 (STA 910+00) to MP 32.4 (intersection of AZ-83 and AZ-82)**

The final section of AZ-83, from MP 43.6 to MP 32.4 (intersection of AZ-83 and AZ-82), has a posted speed limit of 55 MPH. Due to the lack of tight curves in this section, the observed speeds for both trucks with trailers and passenger cars averaged around the posted speed limit.

2.2 **Horizontal Alignment**

The existing horizontal curves along AZ-83, including their corresponding curve information, is provided in Table 2.1. Also included in the table is the minimum required horizontal curve radius based on ADOT’s Roadway Design Guidelines. The main objective of this table is to identify the location of substandard designs which in turn are used to investigate any potential negative impacts to the AZ-83 network circulation. Additional detailed curve information, such as curve length and curvature degree, is described in Appendix B. Most of the curves within the study area show standard radius values except for three (3) locations: 1) MP 49.1, 2) MP 47.7 to 47.5, and 3) MP 44.3 to 44.1. It should be noted that the locations where the substandard designs are present coincide with high accident frequency locations. In particular, the roadway segment between MP 44.5 and 44.0 is ranked as the highest accident rate and the highest accident frequency for all fatal accidents along AZ-83. Additional analysis of accidents on AZ-83 is further discussed in Section 3.0. Per ADOT Roadway Design Guidelines section 203.7, it is recommended to avoid tight reverse curves due to safety issues.

“Reverse curves should be avoided. If used, reverse simple curves should have a tangent between them which allows the superelevation runoff lengths for each curve to be applied to each curve from its standard location without overlapping.”
Table 2.1  Existing Horizontal Curve

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<td>1295+00</td>
<td>12,000</td>
<td>877</td>
<td>55</td>
<td>Standard</td>
</tr>
</tbody>
</table>

#### 2.2.1 Clear Zone or Recovery Zone

The AASHTO Roadside Design Guide defines a “clear zone” or “recovery zone” as the total roadside border area (starting at the edge of the traveled way) available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and/or a clear run-out area. In other words, it is an unobstructed, relatively flat area beyond the edge of the traveled way which allows a driver to stop safely or regain control of a vehicle that leaves the traveled way. A minimum recovery zone/clear zone should be provided in order to meet the AASHTO safety standards. The recovery area width or horizontal clearance to obstructions should be determined by speed, volume, and embankment slope in accordance with Table 303.2A from the ADOT Roadway Design Guidelines (Appendix C). During site visits to AZ-83, proper recovery zone allowances were not observed along the roadway. Illustration 2.3 shows an example of a substandard recovery zone along with a narrow shoulder.
2.2.2 Shoulder

Shoulders along AZ-83 were also found to be substandard in most cases. Furthermore, deterioration of many pavement edges was noticed during the site visit. The deterioration is due to the lack of a shoulder backing system and having an abrupt change from asphalt pavement to dirt. Illustrations 2.4 and 2.5 show deteriorated shoulders along AZ-83. Widening of the shoulder along AZ-83 is proposed as one of the potential roadway improvements proposed in Section 4.0. Increasing the shoulder width will also improve some of the sight distance issues discussed in Section 4.5.
**Illustration 2.4**  Example of Deteriorated Shoulder (Hilton Ranch Road)

![Example of Deteriorated Shoulder (Hilton Ranch Road)](image)

**Illustration 2.5**  Example of Deteriorated Shoulder (MP 46.9)

![Example of Deteriorated Shoulder (MP 46.9)](image)
2.2.3  **Sight distance**

The stopping sight distance for horizontal curves is evaluated by examining the potential obstructions along the inside region of a curve. The existing roadway conditions and sight distance for a horizontal alignment within the vicinity of the proposed Primary Access Road was examined. The roadway conditions and sight distance at the intersection of Sahaurita Road (MP 55.4) and Hilton Ranch Road (MP 49.1) were also evaluated. These two (2) intersections are locations of proposed roadway improvements which are further discussed in Section 4.2. In addition, the curvy alignment of AZ-83 from MP 44 to 46 was also examined since poor sight distances were observed.

2.2.3.1  **Sahaurita Road (MP 55.4)**

At the intersection of AZ-83 and Sahaurita Road, the roadway is flat and has no horizontal or vertical curves within one (1) mile in either direction. The sight distance at the Sahaurita Road intersection is approximately 2,500 feet in both directions. This sight distance provides safe entry from Sahaurita Road onto AZ-83.

2.2.3.2  **Hilton Ranch Road (MP 49.1)**

Near the Hilton Ranch Road and AZ-83 intersection, the combination of a hill and a horizontal curve contribute to a substandard sight distance at this location (Illustration 2.6). The alignment in the vicinity of Hilton Ranch Road is also a concern because the intersection is on blind curve, which makes southbound left turn movements from AZ-83 onto Hilton Ranch Road difficult. Based on the curve data in Table 2.2, this area also has a substandard horizontal curve alignment. Therefore, the fairly sharp curve, coupled with a steep slope, heavy vegetation, and no shoulder, contributes to the poor sight distance at this intersection. Finally, the roadway pavement ends less than one (1) foot beyond the white edge stripe causing shoulder deterioration.
2.2.3.3 Proposed Primary Access Road (MP 46.9)

The intersection of the proposed Primary Access Road and AZ-83 is at a location that provides a clear line of sight for up to 2,500 feet in each direction. The current location of the proposed Primary Access Road is currently undeveloped, has almost no shoulder, and the pavement along the edges are cracking and separating. There is heavy vegetation along both sides of AZ-83; however, the adjacent land is fairly flat. The grade of the roadway in this area is also relatively flat, and there are no utilities, horizontal curves, or outstanding vertical curves within the area. Figure 3 shows the existing roadway conditions at the proposed Primary Access Road intersection (MP 46.9) including pictures taken from different directions. The design of Primary Access Road intersection will be a “T” intersection with AZ-83 that provides safe ingress and egress from the Project site. The proposed “T” intersection design was described in the Mine Plan of Operations (MPO) (Westland, 2007) is also shown on Figure 3. Additional information regarding the MPO design and alternative design options for the proposed “T” intersection is provided in Section 4.0 and Appendix D.

2.2.3.4 MP 44 to 46

A tight horizontal reverse curve (Illustration 2.7), combined with a 6% downgrade, deteriorates the sight distance along AZ-83 between MP 44 and 46. Moreover, the steep road cuts within this area also obstruct the sight distance along the horizontal curves (Illustration 2.8). Some road cuts are also areas of potential rockfall hazards along AZ-83 (Illustration 2.9).
Illustration 2.7  Limited Sight Distance due to Tight Horizontal Curve (MP 44 to 45)

Illustration 2.8  Limited Sight Distance due to Steep Road Cut
Illustration 2.9  Rockfall Warning Sign

Illustration 2.10  Warning Sign for Curvy Horizontal Alignment (MP 44 to 45)
2.3 Vertical Alignment

Vertical curves documented throughout the study area consisted of nine (9) crest curves and nine (9) sag curves. Per ADOT Roadway Design Guidelines, the required minimum vertical grade is 0.4% for proper drainage. Per Table 204.3 of ADOT Roadway Design Guidelines (Appendix E), a maximum of 7% vertical grade is allowed for a 55 MPH rural, non-divided highway in mountainous terrain. In the study area, the observed maximum vertical grade was 6% at approximately MP 44. Therefore, the vertical alignments are standard for the existing grades along AZ-83. With regard to the stopping sight distance in the vertical alignment, the difference in the vertical curve length and grade between the approach and departure grades are major factors in determining a safe stopping sight distance and the required minimum vertical curve length. Table 2.2 presents the existing vertical curve components and associated design elements. It should be noted that unlike the horizontal alignment, the vertical alignment meets the ADOT standard roadway design guidelines. However, a segment along AZ-83 where the vertical alignment was close to falling below the standard was coincident with the segment where the horizontal alignment was below ADOT standards. The major reason the vertical alignment is close to falling below the standard is due to a combination of tight horizontal curves with a relatively steep (at 6%) vertical curve. This segment is located between MP 44 and 45.5.

The vertical stopping sight distance is determined by reviewing both the approach and departure grades for a vertical curve. Except for curves 7 and 8, all of the curves were evaluated for a proper vertical stopping sight distance using a 55 MPH speed. For curves 7 and 8, the speed limit is 45 MPH and thus a 45 MPH speed was used. As shown in Table 2.2, all the vertical curve lengths meet or exceed the minimum required curve length. Therefore, all the vertical curves satisfy the minimum vertical stopping sight distance. In addition, incoming and outgoing grades for all the vertical curves listed in Table 2.2 are within the minimum range (0.4%) and maximum range (7%) requested per the ADOT Roadway Design Guidelines.

<table>
<thead>
<tr>
<th>Curve Number</th>
<th>Milepost</th>
<th>Station</th>
<th>Vertical Curve Length (feet)</th>
<th>Required Minimum Curve Length (feet)</th>
<th>Incoming Grade/Outgoing Grade</th>
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</thead>
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<tr>
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<td>57.5</td>
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<td>1,200</td>
<td>342</td>
<td>Incoming 2% Outgoing -1%</td>
</tr>
<tr>
<td>2</td>
<td>56.9</td>
<td>215+00</td>
<td>1,000</td>
<td>230</td>
<td>Incoming -1% Outgoing 1%</td>
</tr>
<tr>
<td>3</td>
<td>52.6</td>
<td>440+00</td>
<td>800</td>
<td>798</td>
<td>Incoming 4% Outgoing -3%</td>
</tr>
<tr>
<td>4</td>
<td>52.0</td>
<td>475+00</td>
<td>400</td>
<td>345</td>
<td>Incoming -2% Outgoing 1%</td>
</tr>
<tr>
<td>5</td>
<td>49.2</td>
<td>625+00</td>
<td>800</td>
<td>456</td>
<td>Incoming 2% Outgoing -2%</td>
</tr>
<tr>
<td>6</td>
<td>48.8</td>
<td>640+00</td>
<td>600</td>
<td>345</td>
<td>Incoming -2% Outgoing 1%</td>
</tr>
<tr>
<td>7 *</td>
<td>45.9</td>
<td>798+00</td>
<td>500</td>
<td>183</td>
<td>Incoming 2% Outgoing -1%</td>
</tr>
<tr>
<td>8 *</td>
<td>45.6</td>
<td>815+00</td>
<td>900</td>
<td>395</td>
<td>Incoming -1% Outgoing 4%</td>
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<td>Milepost</td>
<td>Station</td>
<td>Vertical Curve Length (feet)</td>
<td>Required Minimum Curve Length (feet)</td>
<td>Incoming Grade/Outgoing Grade</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>---------</td>
<td>------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>9</td>
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<td>800</td>
<td>366</td>
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</tr>
<tr>
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<td>950+00</td>
<td>600</td>
<td>575</td>
<td>Incoming -2% Outgoing 3%</td>
</tr>
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<td>700</td>
<td>570</td>
<td>Incoming 3% Outgoing -2%</td>
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<td>Incoming -2% Outgoing 2%</td>
</tr>
<tr>
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<td>1090+00</td>
<td>800</td>
<td>570</td>
<td>Incoming 2% Outgoing -3%</td>
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<tr>
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<td>1185+00</td>
<td>800</td>
<td>460</td>
<td>Incoming -2% Outgoing 2%</td>
</tr>
<tr>
<td>15</td>
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<td>1242+00</td>
<td>400</td>
<td>342</td>
<td>Incoming 2% Outgoing -1%</td>
</tr>
<tr>
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<td>500</td>
<td>345</td>
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</tr>
<tr>
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<td>1,500</td>
<td>342</td>
<td>Incoming 2% Outgoing -1%</td>
</tr>
<tr>
<td>18</td>
<td>34.2</td>
<td>1415+00</td>
<td>600</td>
<td>230</td>
<td>Incoming -1% Outgoing 1%</td>
</tr>
</tbody>
</table>

* Indicates the design speed was 45 MPH.
2.4 Existing School Bus Stops

Tetra Tech completed a site visit to document the locations and traffic patterns associated with the existing school bus stops along AZ-83 for the Vail School District. A total of seven (7) school bus stops were identified and are shown on Figure 1 in Appendix F. The current school bus traffic pattern consists of two (2) separate loops. One (1) loop runs from Sahuarita Road to the Rest Stop at MP 46.9 on AZ-83. The Rest Stop is located just south of the proposed Primary Access Road. The second school bus loop runs from AZ-82 to Greaterville Road. Figure 1 in Appendix F also shows the traffic patterns for the two (2) school bus loops. Currently the school bus pick-up and drop-off spots are located such that students do not have to cross the roadway in order to get to the bus stop (i.e., pick-up and drop-off occur at the same location on the respective side of AZ-83). With the exception of the Hilton Ranch Road school bus stop, the bus stops do not have a pull-off area along AZ-83 (i.e., the buses stop within the through lane of AZ-83). At the Hilton Ranch Road school bus stop, a wide compacted dirt area was observed on the east side of AZ-83.

Each of the bus stop locations were evaluated for potential improvements with regard to safety and traffic flow conditions. For all of the school bus stops except the Hilton Ranch Road, a pull-off area for loading and unloading students is not available. This increases the chances of a rear-end collision when the buses are loading and unloading students. Furthermore, traffic on AZ-83 is delayed since all traffic must stop and cannot pass during student loading and unloading. Proposed improvements to the school bus stop locations are presented in Section 4.3.
2.5 Guardrails

Most of guardrails along AZ-83 fail to meet ADOT design standards since they are outdated and located too close to the edge of the paved roadway. These guardrails are present throughout the AZ-83 study area between MP 33 and 52. Illustrations 2.12 and 2.13 show an example of a typical substandard guardrail.

Illustration 2.12 Typical Substandard Guardrail (Sahuarita Road)
2.6 ADOT Future Projects

ADOT has approved several projects listed in the American Recovery and Reinvestment Act (ARRA). Two (2) of the projects are located within the AZ-83 study area and one (1) project generally affects the traffic along AZ-83 (Figure 4). A partial list of ARRA projects is provided in Appendix G. The projects within or affecting the study area are described in Sections 2.6.1 through 2.6.3.

2.6.1 AZ-83 MP 31.6 to 44.5 Pavement Project

The existing pavement between MP 31 and 44 has several cracks and areas where the pavement layers are separating. A pavement preservation project to fix the pavement between MP 31 and 44 is identified as Tracs number H747001C and ADOT project number ARRA-083-A(201)A. This project will enhance the roadway safety by providing a better skidding factor for a smoother and faster vehicle stop. This project is also listed as one of the ARRA projects with a priority of 18 out of 28 projects within the greater Arizona region. The pavement project is approximately 11.9 miles long and expected to take 70 working days to complete.

2.6.2 AZ-83 MP 44 to 45.5 Safety Project

The existing roadway conditions along AZ-83 between MP 44 and 45 contains tight horizontal curves. As part of the ADOT Safety Project, the horizontal curves within this roadway segment will be realigned, fixing the substandard curve radii. The project will also replace the existing substandard guardrails, widen the roadway shoulders, flatten the road cuts, and install new signs and striping. These improvements will increase the motorist sight distance and the overall safety of this roadway segment. This safety project is identified as Tracs number H705701C and ADOT project number 083-A(200)A. As of April 14, 2009, the project was still waiting for environmental clearance.
2.6.3  **I-10 MP 288.4 to 290.5 Cienega Creek-Marsh Station Traffic Interchange Reconstruction**

Although the Cienega Creek-Marsh Station Traffic Interchange Reconstruction project is not within the study area, it is expected to affect the truck traffic on AZ-83. This project is listed as an ARRA project with a priority of 3 out of 8 projects within the Pima Association of Governments Region (Appendix G). The project is identified as Tracs number H239001C and ADOT project number 010-E. Currently AZ-83 is the alternate route for many wide or oversized semi trucks that are restricted by the low vertical clearance at the Marsh Station Railroad Bridge along I-10. As shown on Figure 1, trucks traveling between Tucson and Wilcox on I-10 that are restricted by the vertical clearance at the bridge must take an alternate route along AZ-83, AZ-82, and State Route 90. The proposed reconstruction project will eliminate the need for wide load trucks to use AZ-83 since the improvements will remove the vertical clearance issues at the Marsh Station Railroad Bridge.
3.0 ACCIDENT ANALYSIS

The highway design, the vehicle types, and the individual users are the three (3) integral parts of transportation safety and efficiency. Illustration 3.1 shows how the various traffic components relate to overall traffic safety. Completing a detailed accident analysis helps identify the main reasons behind accident prone locations. This analysis also aids in deciding the selection of safety programs and which countermeasures to implement. The analysis also assists in evaluating the countermeasure’s effectiveness.

Illustration 3.1 Safety Diagram

In order to fully assess if the Rosemont Copper Project will have an affect on the safety of AZ-83, a comprehensive accident analysis was performed. Accident data from ADOT was collected between 1-10 (MP 58.3) and AZ-82 (MP 32.4) from 2002 to 2008 in order to establish the current roadway safety conditions. In addition, accident data for State Route 77 (AZ-77) was also collected since this route has been used, and is currently being used, by several mining operations.

Per the Federal Highway Administration (FHWA) Safety Program, and in accordance with Sections 148(c)(1)(D) and 148(g)(3)(A) of Title 23, United States Code, each state is required to identify at least 5% of their roadway locations which currently exhibit the most severe highway safety needs or accident locations. The requirements to be designated as a location in the top 5% are:

- Location should have at least one (1) crash (fatal, any type of injury or property damage only) in three (3) consecutive years.
- Location should have at least one (1) fatal crash in three (3) years.
• At least one (1) crash should be a “run-off-road”, intersection, or pedestrian related. It should be noted that the intersection related crashes considered here are the crashes in which the first harmful event occurred on an approach to or exit from an intersection and resulted from an activity, behavior, or control related to the movement of traffic units through the intersection.

• The total number of fatal or incapacitating injury crashes must be equal to or greater than three (3) for three (3) consecutive years.

Based on the 2008 FHWA accident analysis (http://safety.fhwa.dot.gov/hsip/fivepercent/2008/08az.htm#toc645), the segment of AZ-83 between MP 44 and 45 is listed in the top 5% of all accident locations in Arizona. Figure 5 shows all of the top 5% accident locations in the State of Arizona per the FHWA Highway Safety Program.

In this report, the following six (6) indices were investigated to further analyze the current roadway safety condition and to understand the nature of the past accidents so that appropriate countermeasures could be selected which would improve future roadway conditions.

• Annual accident number: This index represents the total reported accident frequency for a given location. An annual accident frequency analysis is also used to identify trends for a given location.

• Accident Prone Location: In order to improve roadway safety, it is crucial to identify accident prone locations. The two (2) methods commonly used by agencies to identify accident prone locations are the Accident Frequency Method and the Accident Rate Method. These two (2) methods are defined below.

  o Frequency Method: This method ranks an accident prone location by the number of total reported accidents for a selected analysis period.

  o Accident Rate Method: Per the Institute of Transportation Engineers (ITE) Manual, agencies also use accident rates to identify accident prone locations. The accident rate method compares the number of accidents at a location with the number of vehicles or traveled vehicle miles for a location. This comparison results in an accident rate. Accident rates account for exposure, which is the chance that an accident will happen to a particular driver/vehicle or along a highway segment. Furthermore, the Annual Average Daily Traffic (AADT) is embedded in the accident rate, which eliminates the bias originating from different traffic volumes. For example, a roadway segment with an AADT of 32,000 and an accident frequency value of 10 should be considered less prone to accidents compared to a roadway segment with an AADT of 1,000 with the same accident frequency of 10. Accident rates are computed in terms of accidents per 100 million vehicle miles using the following formula:

\[
RSEC_i = \left( \frac{100,000,000 \times A_i}{365 \times T_i \times V_i \times L_i} \right)
\]

\(RSEC_i\): accident rate for the section \(i\)

\(A_i\): number of reported accidents within section \(i\)

\(T_i\): time frame of the analysis, years

\(V_i\): Average Annual Daily Traffic for section \(i\)

\(L_i\): length of the section \(i\), miles
Collision Manner: The ADOT accident database contains a total of 13 different collision manners when classifying an accident.

Vehicle Type: The ADOT accident database classifies vehicles into 26 different types for each recorded accident.

Major Causes: The ADOT accident database contains a total of 19 different reasons or causes for each accident. Speeding or passing in a no passing zone are some examples of the major cause categories.

Injury Type: The ADOT accident database contains a total of six (6) categories for types of injuries resulting from an accident.

### 3.1 AZ-83 Accident Analysis

As mentioned in Section 1.1, AZ-83 is designated as a major rural collector and is a two-lane highway that begins at I-10 and ends at Parker Canyon Lake. For the accident analysis presented in Section 3.1, only accident data for AZ-83 between 1-10 (MP 58.3) and AZ-82 (MP 32.4) was considered. Table 3.1 shows the ADOT AADT values between 2002 and 2007 for AZ-83. Based on the 2007 AADT data, AZ-83 has a T factor of 5% which indicates that 5% of total AADT consists of truck traffic. Figure 6 provides the truck volume along all of the major highways in Arizona. For AZ-83, the accident data from 2003 to 2008 was analyzed and a detailed description of each accident analysis index is presented in Sections 3.1.1 through 3.1.8.

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<th>Year</th>
<th>AADT</th>
<th>Percent Growth</th>
</tr>
</thead>
<tbody>
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<td>-</td>
</tr>
<tr>
<td>2003</td>
<td>2,300</td>
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<tr>
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<td>2,400</td>
<td>+4.0%</td>
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<td>3,000</td>
<td>+25.0%</td>
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<tr>
<td>2006</td>
<td>2,400</td>
<td>-20.0%</td>
</tr>
<tr>
<td>2007</td>
<td>2,100</td>
<td>-12.5%</td>
</tr>
</tbody>
</table>

Table 3.1 AZ-83 Annual AADT (2002 to 2007)
3.1.1 **Annual Accident Frequency**

Illustration 3.2 shows the annual accident frequency trend over the six (6) years analyzed. The accident frequency peaked during 2004 with a total of 39 reported accidents. Starting from 2006, a decrease in the number of total accidents has occurred, especially between the years 2007 and 2008 where there was a 29% decrease.

**Illustration 3.2 AZ-83 Annual Accident Frequency (2002 to 2008)**

3.1.2 **Accident Prone Location Analysis**

Based on the accident frequency method and the accident rate method, the top five (5) accident prone locations were identified to be MP 44, 45, 46, 55, and 58. The proposed Primary Access Road for the Rosemont Project is located at MP 46.9. This location shows a relatively low accident frequency and rate. Figure 7 shows the top five (5) accident prone locations for AZ-83 as well as the proposed Primary Access Road.
3.1.2.1 Accident Frequency Method

As shown on Illustration 3.3, MP 44 and 45 show a significantly higher accident frequency when compared to the rest of the AZ-83 roadway segments. For example, 26% of the total accidents which occur along AZ-83 are located at MP 44. In Section 2.0, the roadway segment between MP 44 to MP 46 was identified as a curvy area with tight horizontal substandard curves. This is a clear indication that the roadway geometry has an influence on accident frequency.

Illustration 3.3 AZ-83 Accident Frequency per Location (2002 to 2008)
3.1.2.2 Accident Rate Method

In order to eliminate the AADT bias on accident frequencies, the accident rate was also examined. No variation in AADT values along AZ-83 was observed. Therefore, the accident rate per location showed the same pattern when compared to the accident frequency. Illustration 3.4 shows a comparison in accident rates between 2006 and 2007. It should be noted that out of the top five (5) accident prone locations, MP 44, 45, and 46 show an increasing accident rate while MP 55 and 58 shown a decreasing accident rate.

Illustration 3.4 AZ-83 Accident Rate per Location (2002 to 2008)
3.1.3 Accident Involved Vehicle Type

Illustration 3.5 shows the distribution of different vehicle types involved in accidents between 2002 and 2008. This illustration indicates that approximately 49% and 30% of the total accidents on AZ-83 are associated with passenger cars and motorcycles, respectively. Accidents involving semi trucks (i.e. truck tractor) show a relatively low value of approximately 3.8%. This low value suggests that trucks are not the major vehicle type that contributes to roadway accidents along AZ-83. Therefore, it is expected that truck traffic added from the Rosemont Project operations will not necessarily affect the current roadway safety for AZ-83. The final vehicle type shown in Illustration 3.5 is a school bus and it accounts for 0.54% of the total accidents between 2002 and 2008.

Illustration 3.5 AZ-83 Accident Involved Vehicle Type (2002 to 2008)
3.1.4 **Accident Collision Manner**

A detailed analysis of the accident collision manner for AZ-83 shows that more than 80% of accidents are a single vehicle collision. Sideswipe and rear-end collision manner types were ranked as 2nd and 3rd respectively. Illustration 3.6 shows the distribution of different collisions manners for accidents between 2002 and 2008.

**Illustration 3.6**  **AZ-83 Accident Collision Manner (2002 to 2008)**

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<tr>
<td>Sideswipe</td>
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<tr>
<td>Angle</td>
<td>4</td>
</tr>
<tr>
<td>Rear End</td>
<td>87</td>
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<tr>
<td>Non-contact</td>
<td>1</td>
</tr>
<tr>
<td>U-Turn</td>
<td>2</td>
</tr>
</tbody>
</table>
3.1.5 **Accident Injury Type**

Between 2002 and 2008, about 47% of the accidents on AZ-83 resulted in no injury and 24% resulted in non-incapacitating injuries. There were three (3) fatal accidents which accounted for 1.6% of the total accidents between 2002 and 2008. All three (3) of the fatal accidents occurred at MP 44; therefore, putting this location in the top 5% accident locations per the FHWA Highway Safety Program. Illustration 3.7 shows the distribution of injury types for accidents between 2002 and 2008.

**Illustration 3.7**  **AZ-83 Accident Injury Types (2002 to 2008)**
3.1.6 Accident Major Causes

As shown in Illustration 3.8, speeding is the major cause of accidents along AZ-83, accounting for 51% of total accidents. About 23% of the accidents are due to no improper driving, which means the driver's behavior was not the main cause of accident; indicating possible problems with the roadway alignment.

Illustration 3.8 AZ-83 Accident Major Causes (2002 to 2008)

3.1.7 AZ-83 Accident Analysis Summary

In summary, the major causes of accidents on AZ-83 are speeding along with the curvy roadway geometry. Additionally, the narrow roadway shoulder and lack of adequate pull off locations along AZ-83 adds to the safety issues since it prevents slow moving vehicles from pulling over and allowing cars to pass. The narrow shoulder and lack of pullouts are also safety concerns for tourists who want to enjoy the scenic views along AZ-83. Potential roadway improvements that address the lack of an adequate shoulder, or places to pull off along AZ-83, are discussed in Section 4.0.

Accidents involving semi trucks (i.e. truck tractor) show a relatively low value of approximately 3.8%. This low value suggests that trucks are not the major vehicle type that contributes to roadway accidents along AZ-83. Therefore, it is expected that truck traffic added from the Rosemont Project operations will not necessarily affect the current roadway safety for AZ-83. As mentioned in Section 3.1.3, one (1) school bus was involved in an accident along AZ-83 between 2002 and 2007. Section 4.0 also describes potential improvements to the existing school bus stops along AZ-83.
3.1.8 **AZ-83 MP 44 Accident Analysis Summary**

A detailed analysis of the fatal injury accidents for the six (6) years of accident data indicated that a total of three (3) fatal accidents occurred at location MP 44. In all three (3) cases, the vehicle type associated with the corresponding accidents was a motorcycle and speeding was the major accident cause. All these accidents were also a single vehicle collision. Tight horizontal reverse curvature, combined with a 6% downgrade and a speed limit too fast for the roadway geometry, suggests motorist’s disregard the advance speed reduction warning signs. Countermeasures which could reduce accidents at MP 44 include widening of the shoulder and modifying the side slopes to enhance sight distance for drivers. The future ADOT Safety Improvement Project, discussed in Section 2.6.2, should enhance the traffic conditions at MP 44 since the project will realign the tight horizontal curve, widen the shoulder to standards, and replace the substandard guardrails.

Since 26% of the total accidents and all fatal accidents along AZ-83 were observed at MP 44, additional analysis was conducted for this location. The most common vehicle type involved in accidents at MP 44 were motorcycles at 69%. Passenger cars accounted for only 19% at MP 44. However, passenger vehicles also only account for 49% of the total accidents along the entire AZ-83 study area. Illustration 3.11 shows the distribution of vehicle types for accidents at MP 44.

**Illustration 3.11** **MP 44 Accident Vehicle Type (2002 to 2007)**
Similar to the entire AZ-83 study area, a total of 98% of the accidents at MP 44 resulted in a single collision manner. As shown in Illustration 3.12, the remaining 2% of accidents were categorized as an “other collision” manner.

Illustration 3.12 MP 44 Accident Collision Manner (2002 to 2007)

At MP 44, 40% of the accident injury types were reported as non-incapacitating while 22% resulted in no injuries (Illustration 3.13). Fatal injuries accounted for 6% at MP 44, while fatal injuries for the entire AZ-83 study area was only 1.6%. When analyzing the accidents that resulted in no injuries, MP 44 showed a lower rate (22%) when compared to the entire study area (47%). This indicates a safety issue with the roadway condition at MP 44.

Illustration 3.13 MP 44 Accident Injury Type (2002 to 2007)
As shown in Illustration 3.14, speeding was identified as the major cause of accidents at MP 44, with a value of 74%. This value is higher than the percentage of accidents caused by speeding along the entire AZ-83 study area (51%). The second major accident cause at MP 44 was no improper driving at a value of 12%.

Illustration 3.14  MP 44 Accident Major Causes (2002 to 2007)

3.2 AZ-77 Accident Analysis

AZ-77 is a north-south highway stretching from its northern terminus at the boundary of the Navajo Nation (approximately at MP 408.93), north of Holbrook, to its junction with I-10 in Tucson (approximately at MP 68.10). Per the ADOT roadway functional classification map (Figure 2), AZ-77 is classified as an urban minor arterial, rural principal arterial, and a rural minor arterial depending on the segment location. The 2007 AADT data shows a wide range of values for AZ-77. For instance in 2007, the AADT was 4,400 vehicles from MP 118 to 134 and the AADT was 47,000 vehicles from MP 77 to 78. The T factor also ranged from 8% (MP 91 to 135) to 15% (rest AZ-77 segments). Accident data from 2003 to 2007 was collected for AZ-77 between MP 77 and 134 (Figure 8). This section of AZ-77 was selected since it is the major access route for several local mining operations. Figure 8 illustrates the location of the active and inactive mines along AZ-77, as well as the top five (5) accident locations for this segment of AZ-77. The following sections describe the results of an accident analysis conducted for AZ-77 between MP 77 to 134.
3.2.1 Annual Accident Frequency

Illustration 3.15 shows the annual accident frequency trend of AZ-77 over the five (5) years analyzed. In 2004, the accident frequency was the highest at a value of 112. A steep change in accident frequency was observed between 2006 and 2007 when the frequency dropped by 32%.

Illustration 3.15 AZ-77 Annual Accident Frequency (2003 to 2007)

3.2.2 Accident Prone Location analysis

The top five (5) accident prone locations between MP 77 to 134 were identified by analyzing the accident frequency and accident rate at each MP. Unlike AZ-83, AZ-77 shows a varying AADT value per roadway segment. Therefore, identifying the top five (5) accident locations varies depending if the accident frequency or accident rate is used. Section 3.2.2.1 describes the top five (5) accident locations using the Accident Frequency Method and Section 3.2.2.2 describes the top five (5) accident locations using the Accident Rate Method.
3.2.2.1 Accident Frequency Method

As shown on Illustration 3.16, MP 86, 85, 87, 88, and 106 were identified as the top five (5) accident prone locations based on the Accident Frequency Method. All of these locations also have a relatively high AADT value. From MP 77 to 91, the AADT value ranged from 30,000 to 47,000 and from MP 92 to 117 the AADT value ranged from 6,300 to 7,600. These values are relatively high when compared to the average AADT value of 4,400 between MP 118 and 134.

Illustration 3.16 AZ-77 Accident Frequency (2003 to 2007)
3.2.2.2 Accident Rate Method

Based on the Accident Rate Method, the top five (5) accident prone locations for AZ-77 were MP 103, 105, 106, 112, and 124. These locations are different from the top five (5) locations following the Accident Frequency Method because the accident rate method uses an adjustment factor based on the AADT value. MP 106, however, is identified in the top five (5) accident prone locations using both the accident frequency and accident rate methods. As shown on Illustration 3.17, most of the MP locations showed a decreasing pattern from 2006 to 2007.

Illustration 3.17 AZ-77 Accident Rate per Location (2006 to 2007)
3.2.3 Accident Involved Vehicle Type

As shown on Illustration 3.18, approximately 61% and 31% of the accidents along AZ-77 between 2003 and 2007 were associated with a passenger car and pick-up truck, respectively. Accidents involving semi trailer trucks (i.e. truck tractor) accounted for only 4.3% of the total accidents between 2003 and 2007.

Illustration 3.18 AZ-77 Accident Involved Vehicle Types (2003 to 2007)
3.2.4 Accident Collision Manner

Illustration 3.19 shows the different collision manners for accidents between 2003 and 2007. Approximately 53% of the total accidents were single vehicle collisions and 18% were rear-end collisions. Sideswipe and angle collisions accounted for only 8% of the total accidents.

Illustration 3.19 AZ-77 Accident Collision Manner (2003 to 2007)
3.2.5 Accident Injury Type

As shown on Illustration 3.20, approximately 70% of the total accidents between 2003 and 2007 resulted in no injuries. Approximately 11.5% of the total accidents between 2003 and 2007 resulted in non-incapacitation injuries. A total of three (3) fatal accidents were observed between 2003 and 2007 at three (3) different locations (MP 93, 106, and 107). It should be noted that MP 106 is also identified as a top five (5) accident prone location following both the accident frequency and accident rate methods.

Illustration 3.20 AZ-77 Accident Injury type (2003 to 2007)
3.2.6 Accident Major Causes

As shown on Illustration 3.21, the two (2) major causes for accidents between 2003 and 2007 are speeding (29.5%) and no improper driving (27%). As previously mentioned, when no improper driving is identified as the accident cause, possible issues with the roadway alignment may be present since the driver's behavior was not the major cause of the accident. Failure to yield and inattention were both 9.8% of the total accident major causes between 2003 and 2007.

Illustration 3.21 AZ-77 Major Accident Causes (2003 to 2007)

3.2.7 AZ-77 Accident Analysis Summary

The two (2) major causes of accidents on AZ-77 between MP 77 and 134 are speeding and no improper driving. Accidents due to no improper driving suggest a possible problem with the roadway geometry alignment. When comparing the existing road alignment with ADOT guidelines, MP 109 was found to have a substandard horizontal curve. MP 106 was identified as a top five (5) accident prone location by both the accident frequency and accident rate methods and also had one (1) fatal accident between 2003 and 2007. However, the overall accident rate and accident frequency showed decreasing trend for AZ-77.

Fatal accidents on AZ-77 occurred at MP 93, 106, and 107 between 2003 and 2007. In all cases, the major cause of the fatal accident was driving in the opposing lane, resulting in a head on collision. The three (3) locations were all spots with a curvy horizontal alignment.

Accidents involving semi trucks (i.e. truck tractor) show a relatively low value of approximately 4.3%. This low value suggests that trucks are not the major vehicle type that contributes to
roadway accidents along AZ-77. Therefore, the truck traffic added from the local mining operations along AZ-77 does not necessarily affect the current roadway safety.
4.0 AZ-83 POTENTIAL ROADWAY IMPROVEMENTS

Potential improvements to AZ-83 focus on eliminating possible delays from tailgating semi trucks as well as improving overall traffic safety by providing standard roadway design features. The proposed roadway improvements follow the ADOT Roadway Design Guidelines, the AASHTO Geometric Design of Highways and Streets, and the AASHTO Roadside Design Guides. Proposed improvements that include roadway striping and sign installation follow the Manual on Unified Traffic Control Devices (MUTCD) and Standard Highway Signs. All potential roadway improvements were designed not to affect existing utilities or guardrails.

4.1 Design Vehicle

In order to assess the design options for a potential roadway improvement, the design vehicle must first be established. Based on Table 407.2 in the ADOT Roadway Design Guidelines (Appendix H), a WB-62 type, Interstate Semi Trailer is recommended as the design vehicle for intersections along a State Route. In AASHTO’s Geometric Design of Highways and Streets, a WB-65 type is recommended as the minimum sized design vehicle for intersections on state highways that carry high volumes of traffic and/or provide local access for large trucks. Therefore, a WB-65 type was chosen as design vehicle since a safe truck turning with WB-65 will also satisfy a safe truck turning for a WB-62.

When assessing potential improvements for existing school bus stops on AZ-83, the large, S-BUS-40 school bus was chosen as the design vehicle. This vehicle was selected since it also satisfies requirements for the more common smaller school bus type, S-BUS-36. A detailed illustration of the S-BUS-40 is presented in the Technical Memorandum provided in Appendix F.

4.2 Primary Access Road “T” Intersection

The “T” intersection design presented in the MPO (WestLand, 2007) consisted of the Primary Access Road being “stop” controlled with traffic along AZ-83 being uncontrolled (i.e., no stop sign). The intersection design also included a 12-foot wide, 500-foot long center lane to the south of the intersection. This center lane allows northbound traffic to make a left turn onto the Primary Access Road without impeding northbound traffic. A deceleration and right turn lane was also proposed along the western edge of AZ-83, north of the intersection. The lane also continues to the south of the intersection and serves as an acceleration lane for Project related traffic going south on AZ-83. Standard shoulders were added along both sides of the road affected by widening. Figure 3 illustrates this intersection configuration. A widened shoulder with gravel was also added along the west side of AZ-83 near the intersection to allow trucks to pull off.

An in-depth analysis of the MPO “T” intersection design was completed as part of this study. A total of four (4) alternatives were identified and included: 1) a three-way stop sign, 2) a speed limit reduction, 3) an acceleration lane with both 55 and 35 MPH speed limits, and 4) a bypass lane. Design information about each of these alternative designs, including before and after photos, are provided in Appendix D.

4.3 School Bus Stops

The current locations and traffic patterns for the school bus stops along AZ-83 were previously described in Section 2.4. For all of the school bus stops, except the Hilton Ranch Road location, a pull-off area for loading and unloading students is not available. This increases the chance of a rear-end collision when the buses are loading and unloading students. Furthermore, traffic on
AZ-83 is delayed since all traffic must stop and cannot pass during student loading and unloading. Potential improvements to the school bus stop locations include the development of a designated turnout area off AZ-83. The proposed turnout design includes a 210-foot long, and 20-foot wide paved area with a merging lane or taper to enable easy re-entry onto AZ-83. For the Hilton Ranch Road location, only minimal grading is required since the area is fairly flat. The remaining locations will require grading in order to construct a school bus turnout. Detailed design information for the proposed school bus turnouts, including before and after photos, are presented in Appendix F.

4.4 Wide Load Truck Turnout

As mentioned in Section 3.1.7, the lack of adequate places to pull off along AZ-83 adds to safety issues since it prevents slow moving trucks from pulling over and allowing cars to pass. Two (2) potential locations for wide load truck turnouts were identified along AZ-83. These locations are at MP 55.4 near Sahuarita Road and MP 47.2 just north of the proposed Primary Access Road. The proposed design for the truck turnouts include a 400-foot long, 20-foot wide paved area with entry and exit tapers. Both of the proposed locations are fairly flat and the alignment of AZ-83 in these areas has no horizontal or vertical curves, thus providing an adequate sight distance (Section 2.2.3). Design information for the proposed wide load truck turnouts, including before and after photos, are presented in Appendix I.

4.5 Utilities

In order to avoid conflicts or utility relocation, existing utility lines were documented and reviewed for all locations where potential roadway improvements are proposed (Figure 4). Such locations include: 1) proposed wide load truck turnouts at Sahuarita Road and north of the Primary Access Road, 2) existing school bus stops, and 3) the “T” intersection of the Primary Access Road. No overhead utility lines were present at the Sahuarita Road intersection area. However, a power company pedestal was observed in the unpaved parking area directly north of the intersection. This suggests possible underground power lines. The development of a wide load truck turnout at this location will not affect this pedestal. At Hilton Ranch Road, major overhead utility lines run through the shoulder as shown on Illustrations 4.1 and 4.2. The school bus turnout proposed at this location, including any of the other existing school bus stops, are not expected to impact the existing utility lines. No utility lines were observed within the vicinity of the proposed Primary Access Road area.
Illustration 4.1 Utility Lines on East Side of AZ-83 at Hilton Ranch Road

Illustration 4.2 Utility Lines on East Side of AZ-83 North of Hilton Ranch Road
4.6 Shoulder Upgrade

The shoulders along AZ-83 are cracked and at most locations the width is less than the standard required 6-foot width. This standard shoulder width is based on Table 302.4 in the ADOT Roadway Design Guidelines (Appendix J). One of the planned ADOT projects highlighted in Section 2.6 focuses on upgrading shoulders to the required standards. Shoulder widening will enhance traffic safety along AZ-83 by providing an improved sight distance and consequently providing more reaction time to drivers who need to act in order to prevent an accident. Moreover, potential dangerous situations such as rock falls from road cuts can be avoided since a wide shoulder serves as a buffer zone. Figure 9 shows the improved sight distance that can be achieved by implementing standard shoulder widths. In order to access the visual changes associated with shoulder widening, before and after photos are provided in Illustrations 4.3 through 4.5.
Illustration 4.3  Before Shoulder Widening and Recovery Zone Improvement

Illustration 4.4  After Shoulder Widening and Recovery Zone Improvement
Illustration 4.5  Before Shoulder Widening

Illustration 4.6  After Shoulder Widening
REFERENCES


FIGURES
Note: "T" Intersection design shown is from the Mine Plan of Operations.

Legend: ROW - Right of Way

Location:
Mile Post 46.9
Intersection of SR-83 and Primary Access Road
LEGEND:
MP = Mile Post
ADOT = Arizona Department of Transportation
- Existing Vall School District Bus Stop

PROPOSED ROSEMONT PROJECT SITE

PROPOSED WIDE LOAD TRUCK TURNOUT
MILE POST 47.8
NEAR PRIMARY ACCESS ROAD
SOUTHBOUND DIRECTION ONLY

PROPOSED WIDE LOAD TRUCK TURNOUT
MILE POST 56.4
NEAR EAST SAHUARITA ROAD
SOUTHBOUND DIRECTION ONLY

POTENTIAL BUS STOP UPGRADE
MILE POST 62.0
Hoffman's Bus Stop

POTENTIAL BUS STOP UPGRADE
MILE POST 43.3
GHOST DANCE INTERSECTION

POTENTIAL BUS STOP UPGRADE
MILE POST 47.7

POTENTIAL BUS STOP UPGRADE
MILE POST 63.3

POTENTIAL BUS STOP UPGRADE
MILE POST 53.5
Yucca Ash Farms Rd Bus Stop

POTENTIAL BUS STOP UPGRADE
MILE POST 49.3
Hilton Ranch Intersection

POTENTIAL BUS STOP UPGRADE
MILE POST 48.5
Primary Access Road

PROPOSED SCHOOL BUS TURNOUT
MILE POST 48.5
Primary Access Road

ADOT SAFETY IMPROVEMENTS
MILE POST 46.4
Realignment and new guiderails

ADOT PAVEMENT RESTORATION
MILE POST 41.8-44.8

NOT TO SCALE
Source: Arizona 2008 Highway Safety Improvement Program Top 5% Report, prepared for Arizona Department of Transportation.

Note:
The Lane Departure symbol denotes accidents that result from a single flow of traffic, not at any intersection. The Intersection Accidents symbol denotes accidents that result from 2 or more traffic flows intersecting, either in a controlled or uncontrolled environment.
Source:
Multimodal Freight Analysis Study, prepared for Arizona Department of Transportation
Shoulder Widening Designed Per:

Location:
Mile Post 48.5
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<th>Highway Type</th>
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<tr>
<td>Level terrain*</td>
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<td>Urban/Fringe Urban areas</td>
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<tr>
<td><strong>Rural Divided Highways</strong></td>
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<td>60</td>
</tr>
<tr>
<td><strong>Rural Non-divided Highways</strong></td>
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<tr>
<td>Mountainous terrain</td>
<td>55**</td>
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<tr>
<td><strong>Urban/Fringe Urban Highways</strong></td>
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<tr>
<td>Arterial streets (C &amp; G With Development)</td>
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<tr>
<td>Urban Highways</td>
<td>30 – 60</td>
</tr>
</tbody>
</table>

* Note: Throughout this document, level, rolling and mountainous terrain are defined as follows:

** LEVEL TERRAIN:** Any combination of geometric design elements that permits trucks to maintain speeds that equal or approach speeds of passenger cars.

** ROLLING TERRAIN:** Any combination of geometric design elements that causes trucks to reduce speed substantially below that of passenger cars on some sections of the highway but which does not involve sustained crawl speeds by trucks for any substantial distance.

** MOUNTAINOUS TERRAIN:** Any combination of geometric design elements that will cause trucks to operate at crawl speed for considerable distances or at frequent intervals.

** Note: The Designer should try to achieve a 60 mph design speed if there is the expectation of future development to a 4-lane divided highway.
APPENDIX B
EXISTING AZ-83 ROADWAY PLAN AND PROFILE SHEETS
Note:
25-Foot Contour Interval

Legend:
MP - Mile Post
VC - Vertical Curve
Note: 25-Foot Contour Interval

Legend:
- MP - Mile Post
- VC - Vertical Curve
Note:
25-Foot Contour Interval

Legend:
MP - Mile Post
VC - Vertical Curve
Note:
25-Foot Contour Interval

Legend:
MP - Mile Post
VC - Vertical Curve
Note:
25-Foot Contour Interval

Legend:
MP - Mile Post
VC - Vertical Curve
Note:
25-Foot Contour Interval

Legend:
MP - Mile Post
VC - Vertical Curve
303.2 - Roadside Recovery Area

Many highway crashes are the result of a vehicle leaving the pavement and striking an obstruction before having an opportunity to recover. The number and severity of the crashes may be reduced by providing a recovery area or clear zone outward from each outer travel lane that is free of obstructions and non-traversable slopes.

The recovery area width or horizontal clearance to obstructions should be determined based upon speed, volume, and embankment slope in accordance with Table 303.2A. Modification of the recovery area width for horizontal curvature using the factors in Table 303.2B is not required unless the crash history indicates otherwise. The recovery area width is designed and determined based upon the horizontal distance from the roadway plans typical section travel lane (normally 12 ft) to the near side of the obstruction.

Table 303.2A
Recovery Area Width Criteria
Distances in Feet

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<tr>
<th>DESIGN SPEED</th>
<th>DESIGN ADT</th>
<th>FILL SLOPES</th>
<th>CUT SLOPES</th>
</tr>
</thead>
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<td></td>
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<td>6:1 OR FLATTER</td>
<td>5:1 TO 4:1 INCL</td>
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<td>Under 750</td>
<td>7-10</td>
<td>7-10</td>
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<tr>
<td></td>
<td>750-1500</td>
<td>10-12</td>
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<td></td>
<td>1500-6000</td>
<td>12-14</td>
<td>14-16</td>
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<td>Over 6000</td>
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<td>16-18</td>
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<td>45-50 MPH</td>
<td>Under 750</td>
<td>10-12</td>
<td>12-14</td>
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<td>750-1500</td>
<td>12-14</td>
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</tr>
<tr>
<td></td>
<td>Over 6000</td>
<td>18-20</td>
<td>24-28</td>
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<tr>
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<td>Under 750</td>
<td>12-14</td>
<td>14-18</td>
</tr>
<tr>
<td></td>
<td>750-1500</td>
<td>16-18</td>
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<td></td>
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<tr>
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<td>Over 6000</td>
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<td>26-30</td>
</tr>
<tr>
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<td>Under 750</td>
<td>16-18</td>
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<tr>
<td></td>
<td>Over 6000</td>
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</tbody>
</table>

Where fixed object obstructions are placed on cut backslopes the recovery area width requirement should meet the recovery area width indicated by the fill slope table shown utilizing the foreslope of the cut as the appropriate fill slope rate.
APPENDIX D
TECHNICAL MEMORANDA – “T” INTERSECTION UPGRADE ALTERNATIVES
APPENDIX D1
STOP SIGN AND SPEED REDUCTION
Rosemont Copper Project
Locator Sheet

Record # 012371

Document Date 2009 Dec 04

Document Title: Rosemont "T" Intersection Analysis - Stop Sign & Speed Reduction

Document Author: Tetra Tech

Document Description: Design alternative for the proposed primary access road

This document is located in the following [CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS

10. FEIS

11. Geospatial Analysis (GIS Data)

12. FOIA Exempt Documents

13. ROD (Including BLM & ACOE)
APPENDIX D2
ACCELERATION LANE ALTERNATIVE
Rosemont Copper Project
Locator Sheet

Record # 012372

Document Date 2009 06 04

Document Title: Rosemont "T" Intersection Analysis - Acceleration Lane

Document Author Tetra Tech

Document Description Design alternative to the proposed Primary Access Road

Other Notes

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[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
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   a. Cumulative Effects Catalog
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   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
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   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS
10. FEIS
11. Geospatial Analysis (GIS Data)
12. FOIA Exempt Documents
13. ROD (including BLM & ACOE)
APPENDIX D3
BYPASS LANE ALTERNATIVE
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1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action
   a. Mine Plan (including compilation)
   b. Supporting Documents
   c. Detailed Designs

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation
9. DEIS
10. FEIS
11. Geospatial Analysis (GIS Data)
12. FOIA Exempt Documents
13. ROD (including BLM & ACOE)
204.3 - Grades

A) Minimum grades: The desirable minimum grade for a highway with a curb and gutter section is 0.4 percent. Special care should be taken in checking storm water drainage requirements to keep the spread of water on the traveled way within tolerable limits.

Above 4000 ft elevation the minimum grade for roadways with curb and gutter shall be 0.5 percent.

Level grades may be used on rural highways below 4000 ft elevation with adequate roadway crown and with proper consideration of drainage requirements.

B) Maximum grades: The maximum grades which may be used are shown in Table 204.3 for each type of highway and its allowable range of design speeds.

Exceptions to the maximums shown in Table 204.3 shall require the approval of the Assistant State Engineer, Roadway Engineering Group.

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Note: Maximum grades shown in bold correspond to the design speed for given conditions, see Table 101.3. Grades at other design speeds are for information only.
Rosemont Copper Project
Locator Sheet

Record # 012374

Document Date 2009 06 25

Document Title: State Route 83 School Bus Stop Improvements

Document Author Tetra Tech

Document Description Presents potential improvements for the current school bus stops along SR 83

Other Notes APPENDIX F

This document is located in the following
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
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7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation
9. DEIS
10. FEIS
11. Geospatial Analysis (GIS Data)
12. FOIA Exempt Documents
13. ROD (Including BLM & ACOE)
APPENDIX G
ARIZONA DEPARTMENT OF TRANSPORTATION (ADOT) AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA) APPROVED PROJECT LIST
### Pima Association of Governments Region

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<th>Priority</th>
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## Maricopa Association of Governments Region

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## Arizona Department of Transportation
### American Recovery and Reinvestment Act - Approved Projects (March 13, 2009)

### Greater Arizona

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<td>$2,750,000</td>
<td>$137,901,000</td>
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<td>19</td>
<td>22</td>
<td>60</td>
<td>278.8</td>
<td>286.4</td>
<td>GI</td>
<td>Timber Mountain - Seneca</td>
<td>Pavement Preservation</td>
<td>No</td>
<td>$5,000,000</td>
<td>$142,901,000</td>
</tr>
<tr>
<td>20</td>
<td>23</td>
<td>19</td>
<td>1 175</td>
<td>185</td>
<td>GE</td>
<td>Lower Coronado Trail at MP 175</td>
<td>Drainage Improvement</td>
<td>No</td>
<td>$400,000</td>
<td>$143,301,000</td>
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<td>Priority</td>
<td>Project ID</td>
<td>RT</td>
<td>Begin MP</td>
<td>Ending MP</td>
<td>CO</td>
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<td>Type of Work</td>
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<td>Cost</td>
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</tr>
<tr>
<td>----------</td>
<td>------------</td>
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<td>----------</td>
<td>-----------</td>
<td>----</td>
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<td>--------------</td>
<td>-------------</td>
<td>------</td>
<td>-------------------</td>
</tr>
<tr>
<td>21</td>
<td>24</td>
<td>19</td>
<td>148.36</td>
<td>48.94</td>
<td>CH</td>
<td>Sunsites at High Street</td>
<td>Widen Roadway for Turn Lanes</td>
<td>Yes</td>
<td>$595,000</td>
<td>$143,896,000</td>
</tr>
<tr>
<td>22</td>
<td>25</td>
<td>16</td>
<td>0311.5</td>
<td>320.5</td>
<td>CN</td>
<td>Jct 89 – Vann's Trading Post</td>
<td>Pavement Preservation</td>
<td>Yes</td>
<td>$4,100,000</td>
<td>$147,996,000</td>
</tr>
<tr>
<td>23</td>
<td>42</td>
<td>40</td>
<td>205</td>
<td>208</td>
<td>CN</td>
<td>Walnut Canyon</td>
<td>Reconstruct Roadway</td>
<td>Yes</td>
<td>$12,000,000</td>
<td>$159,996,000</td>
</tr>
<tr>
<td>24</td>
<td>28</td>
<td>80</td>
<td>316.5</td>
<td>317.8</td>
<td>CH</td>
<td>Tombstone Streets</td>
<td>Pavement Preservation</td>
<td>No</td>
<td>$1,956,000</td>
<td>$161,952,000</td>
</tr>
<tr>
<td>25</td>
<td>30</td>
<td>40</td>
<td>347</td>
<td>348</td>
<td>AP</td>
<td>Black Creek Br. #1134, 1642 and 954</td>
<td>Bridge Rehabilitation</td>
<td>Yes</td>
<td>$700,000</td>
<td>$162,652,000</td>
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<td>26</td>
<td>31</td>
<td>40</td>
<td>316</td>
<td>317</td>
<td>AP</td>
<td>Dead River Bridge EB (STR # 565)</td>
<td>Scour Retrofit</td>
<td>Yes</td>
<td>$280,000</td>
<td>$162,932,000</td>
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<tr>
<td>27</td>
<td>32</td>
<td>95</td>
<td>128.9</td>
<td>131.3</td>
<td>LA</td>
<td>Passing Lanes South of Bouse Wash</td>
<td>Construct Passing Lanes</td>
<td>Yes</td>
<td>$1,800,000</td>
<td>$164,732,000</td>
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<tr>
<td>28</td>
<td>115</td>
<td>95</td>
<td>24.2</td>
<td>24.8</td>
<td>YU</td>
<td>16th St @ MP 24.2 - 24.8</td>
<td>Roadway/Bridge Widening</td>
<td>No</td>
<td>$11,500,000</td>
<td>$176,232,000</td>
</tr>
<tr>
<td>County</td>
<td>TOTAL</td>
<td>Amount</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gila County</td>
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<td>$23,110,000</td>
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<tr>
<td>Yavapai County</td>
<td>TOTAL</td>
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<td>Cochise County</td>
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<td>Pinal County</td>
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<td>Greenlee County</td>
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<td>La Paz County</td>
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<td>$12,800,000</td>
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</tr>
<tr>
<td>Coconino County</td>
<td>TOTAL</td>
<td>$24,100,000</td>
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<tr>
<td>Apache County</td>
<td>TOTAL</td>
<td>$5,980,000</td>
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<td>Mohave County</td>
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</tr>
<tr>
<td>Graham County</td>
<td>TOTAL</td>
<td>$191,000</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Navajo County</td>
<td>TOTAL</td>
<td>$10,400,000</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Santa Cruz County</td>
<td>TOTAL</td>
<td>$2,750,000</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yuma County</td>
<td>TOTAL</td>
<td>$11,500,000</td>
<td></td>
<td></td>
<td></td>
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<td>Statewide</td>
<td>TOTAL</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**GRAND TOTAL** $176,232,000
intercity bus (BUS-40 and BUS-45); city transit bus (CITY-BUS); conventional school bus (S-BUS-36); large school bus (S-BUS-40); articulated bus (A-BUS); intermediate semi-trailer (WB-40 and WB-50); interstate semitrailer (WB-62, WB-65 and WB-67); double-trailer combination (WB-67D); motor home (MH); passenger car with camper trailer (P/T); passenger car with boat trailer (P/B); and motor home with boat trailer (MH/B). It is noted that the AASHTO triple-trailer combination (WB-100T) and turnpike-double combination (WB-109D) are restricted to specific routes in Arizona by legislative action. The configuration of the design vehicles and the minimum turning radii for a 180° turn are as shown in the AASHTO Green Book. Larger minimums may be possible for lesser degrees of turn.

### 407.2 - Design Vehicle Selection

The selection of a design vehicle should be made with care, with consideration given to the appropriate uses of the intersection and the consequences of not providing for the largest vehicles anticipated. The design vehicle is determined by the types of roadways involved, the area where the intersection is located, and the types and volume of vehicles using the intersection. Recommended desirable and minimum design vehicles are given for various types of intersections in Table 407.2. The turning radii given are to the inside edge of the turning lane. (Three-centered curves may also be used at intersections. See Section 408.13).

Major street intersections on highways carrying articulated bus routes should be checked for lane encroachment by the A-BUS design vehicle.

<table>
<thead>
<tr>
<th>Intersection Type</th>
<th>Design Vehicle</th>
<th>Design Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate - Ramp/ Crossroad</td>
<td>WB-67</td>
<td>WB-67</td>
</tr>
<tr>
<td>Other Controlled Access- Ramp/ Crossroad</td>
<td>WB-67</td>
<td>WB-62</td>
</tr>
<tr>
<td>Junction of Major Truck Routes</td>
<td>WB-67</td>
<td>WB-62</td>
</tr>
<tr>
<td><strong>Recommended Design Vehicles</strong> *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction of State Routes</td>
<td>WB-62, WB-50, WB-40</td>
<td></td>
</tr>
<tr>
<td>Other Rural</td>
<td>WB-50, WB-40, SU</td>
<td></td>
</tr>
<tr>
<td>Urban Major Streets</td>
<td>WB-50, WB-40, SU</td>
<td></td>
</tr>
<tr>
<td>Other Urban</td>
<td>WB-40, SU, P</td>
<td></td>
</tr>
</tbody>
</table>

* Recommended Design Vehicle to be selected based upon anticipated intersection usage. Alternate Design Vehicles may be selected for special use areas (e.g. A-BUS).
APPENDIX I
TECHNICAL MEMORANDUM – WIDE LOAD TRUCK TURNOUT
## Rosemont Copper Project

Locator Sheet

**Record #** 012375  
**Document Date** 2009-01-18  
**Document Title:** Wide Load Truck Turnouts for State Route 89  
**Document Author:** Tetra Tech  
**Document Description:** Presentation of possible turnouts for  
**Other Notes:** APPENDIX I

This document is located in the following  
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. **Project Management**
   - a. Formal recommendations & Directions  
   - b. Formal meeting minutes & memos  
   - c. General Correspondence  
   - d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)  
   - e. Other

2. **Public Involvement**
   - a. Announcements & Public Meetings  
   - b. Mailing Lists  
   - c. Scoping Period Comments  
   - d. Udall Foundation Working Group  
   - e. Scoping Reports  
   - f. Comments after Scoping Period  
   - g. DEIS Public Comments

3. **Agency Consultation & Permits**
   - a. Army Corps of Engineers (404 permit)  
   - b. US Fish & Wildlife Service (Sec. 7 T&E)  
   - c. State Historic Preservation Office (Sec. 106)  
   - d. Tribes (Sec. 106)  
   - e. Advisory Council on Historic Preservation (Sec. 106)  
   - f. Other

4. **Communication**
   - a. Congressional  
   - b. Cooperating Agencies  
   - c. Organizations  
   - d. Individuals  
   - e. FOIA  
   - f. Internal  
   - g. Proponent

5. **Proposed Action**

6. **Alternatives**
   - a. Cumulative Effects Catalog  
   - b. Connected Actions  
   - c. Dismissed from Detailed Analysis  
   - d. Analyzed In Detail

7. **Resources**
   - a. Air Quality & Climate Change  
   - b. Biological  
   - c. Dark Skies  
   - d. Fuels & Fire Management  
   - e. Hazardous Materials  
   - f. Heritage  
   - g. Land Use  
   - h. Livestock Grazing  
   - i. Noise & Vibration  
   - j. Public Health & Safety  
   - k. Recreation & Wilderness  
   - l. Riparian  
   - m. Socioeconomics & Environmental Justice  
   - n. Soils & Geology  
   - o. Transportation & Access  
   - p. Visual  
   - q. Water

8. **Reclamation**

9. **DEIS**

10. **FEIS**

11. **Geospatial Analysis (GIS Data)**

12. **FOIA Exempt Documents**

13. **ROD (including BLM & ACOE)**
### 302.4 – Shoulder Width

The shoulder width given in Table 302.4 shall be the minimum continuous usable width of paved shoulder.

#### Table 302.4

<table>
<thead>
<tr>
<th>Highway Type</th>
<th>Paved Shoulder Width³ (ft) (In Direction of Travel)</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controlled-access Highways</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 lanes</td>
<td></td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>6 or more lanes</td>
<td></td>
<td>10₁, ²</td>
<td>10²</td>
</tr>
<tr>
<td>Auxiliary lanes</td>
<td>--</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>1-lane freeway to freeway directional ramp</td>
<td></td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>2-lane freeway to freeway directional ramp</td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>1-lane and 2-lane ramps</td>
<td></td>
<td>2</td>
<td>8⁴</td>
</tr>
<tr>
<td>Ramp Termini at Crossroad</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Non-Controlled-access Highways</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural multi-lane divided</td>
<td></td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Rural 2-lane:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHV &gt; 200 vph</td>
<td></td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>DHV &lt; 200 vph</td>
<td></td>
<td>--</td>
<td>6</td>
</tr>
<tr>
<td>Fringe-urban multi-lane divided:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w/ curbed median</td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>w/o curbed median</td>
<td></td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Fringe-urban multi-lane undivided</td>
<td></td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>Urban multi-lane divided</td>
<td></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Urban multi-lane undivided:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 or more lanes</td>
<td></td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>4 lanes</td>
<td></td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>Right turn lanes (without curb and gutter)</td>
<td></td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>Acceleration lanes</td>
<td></td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>Frontage Roads (2-lane)</td>
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</tr>
<tr>
<td>One-way</td>
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<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Two-way</td>
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<td>--</td>
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<tr>
<td>Passing Lanes/Climbing Lanes</td>
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<tr>
<td>See Sections 209.1 &amp; 209.2</td>
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</tr>
</tbody>
</table>

₁ May be reduced to 8 ft in urban areas for interim conditions.

² 12 ft desirable with truck traffic DDHV > 250

³ For shoulders with curb and gutter, widths include gutter pan.

⁴ Use 2 ft for two-lane dual metered ramps.