

## 4.0 DESIGN CONCEPT ALTERNATIVES

### 4.1 Introduction

The improvement of SR 86 will provide additional capacity for the mainline roadway and intersections to meet the requirements of projected traffic in design year 2030. Improvements will be constructed within the existing corridor of SR 86 and will utilize the existing roadway to the extent feasible. Design concept alternatives will be defined, developed and evaluated to present a preferred alternative for implementation.

Major objectives of the study include providing needed capacity, improving safety, and improving operational features within the study limits.

SR 86 serves as a regional transportation corridor between the City of Tucson and the rural areas to the west, including the Tohono O'odham Indian Reservation, the Kitt Peak Observatory, and the US/Mexico border crossings at Sasabe and Lukeville, AZ. SR 86 also provides a primary connection between the City of Tucson and the developing residential areas both north and south of SR 86 easterly of San Joaquin Road.

The local road system does not provide alternative routes for traffic to use during construction of improvements. Valencia Road is an east/west arterial roadway that could be used by some of the SR 86 traffic easterly of Ryan Airfield. However, Valencia Road does not have the capacity to accommodate all of the SR 86 traffic. The following goals should be considered in the evaluation of alternatives:

- Maintain at least two through lanes of traffic during construction.
- Minimize delays to traffic through the area.
- Provide access to adjacent property during construction.

#### 4.1.1 No-Build Alternative

The No-Build Alternative is provided for comparison purposes. It provides no improvements to the capacity, safety and operational features of the existing roadway, and involves no cost and no apparent change to the environmental features of the SR 86 corridor.

#### 4.1.2 Evaluation Criteria

The evaluation criteria address the capacity, safety and operating characteristics of the highway, as well as concerns expressed by public agencies and the general public in scoping sessions. Roadway

improvement alternatives were evaluated according to the following criteria:

- Provide peak hour LOS C-D for the SR 86 mainline from Sandario Road to Kinney Road in design year 2030.
- Provide peak hour LOS D for the overall intersection at all major intersections in design year 2030.
- Left-turn channelization on SR 86 at all major County road intersections.
- Where major County roads intersect SR 86 with a tee intersection, left-turn lanes will be provided on SR 86 for vehicles turning from SR 86 to the County road and for U-turn movements for both westbound and eastbound vehicles on SR 86.
- Provide signalization at major local road intersections east of Continental Road. Signal warrants will have to be met before signalization occurs. The intersections of SR 86 with Postvale Road and Continental Road will be channelized to accommodate left and right turns to and from both SR 86 and the local roads, but signalization will not be warranted until some time in the future.
- Restrict turning movements at minor local road intersections and at turnouts to right-in/right-out movements.
- Provide median crossovers, including auxiliary deceleration and acceleration lanes, at approximately ½-mile intervals for U-turn movements where appropriate.
- Utilize a fringe-urban median configuration in accordance with Figure 306.3 of the ADOT RDG for divided highway alternatives, except the centerline to centerline separation of roadways will be widened from 70-feet to 74-feet, which results in a median width of 50-feet. The additional median width will facilitate adding additional directional lanes in the median in the future.
- Use the existing roadway as part of the 4-lane divided highway to the extent feasible.
- Maintain access to adjacent properties.
- Minimize impact to adjacent properties.
- Minimize the additional R/W needed for the improvements.
- Retain drainage dikes adjacent to SR 86. Include repairs and reconstruction as required. Overtopping of SR 86 by storm flows has occurred in the past due to failure of dikes.
- Fix the flooding of the Kinney Rd/SR 86 intersection.

### 4.2 Design Concept Alternatives Studied

#### 4.2.1 Typical Sections and Intersection Layouts

The traffic analysis for SR 86 within the project limits shows that a four-lane roadway is necessary to accommodate projected 2030 traffic volumes on the mainline roadway. Signalization of major intersections will be required to accommodate turning movements. It will also be necessary to add additional east/west through-traffic lanes at the signalized intersection of Kinney Road and SR 86 and an additional eastbound through-traffic lane at the signalized intersection of Sunset Blvd. and SR 86.

Since the easterly part of the project area is currently within the urban limits, and development is likely to continue to expand to the west. The entire project area will become urbanized within the period of time prior to design year 2030. The typical section for improvements to SR 86 will be based on the Fringe-Urban Highway Typical Section IS3 as shown in Figure 306.3 of the ADOT Roadway Design Guides (RDG) **except** the centerline to centerline separation between the eastbound and westbound roadways will be 74-feet, with a median width of 50-feet. The 50-foot wide median is being used to provide 2-foot shy distance between the median barrier and the shoulder in the future when additional through lanes are added and the inside shoulders are widened to 10-feet. Typical sections for the improvement alternatives are shown in **Appendix A**.

Intersection layouts have been developed that accommodate the turning movements identified in the traffic study. Lane configurations on SR 86 are shown including taper lengths and storage lanes for auxiliary lanes. Through lanes and turning movements for crossroads are also shown. See **Appendix A**.

#### 4.2.2 Roadway Improvement Alternatives

The following alternatives have been identified for consideration to achieve the desired improvements in highway capacity, safety, and operating conditions. All of the alternatives will provide similar improvements to the ability of the highway to accommodate traffic both on the SR 86 mainline and at the intersections of SR 86 and the crossroads.

Each of the design concept alternatives was developed based on the project objectives outlined in **Section 1**, using the design controls stipulated in **Section 5**. A narrative description of each design concept alternative is presented below. Plan and profile sheets for the preferred alternative are provided in **Appendix B**. Plan and profile sheets for other alternatives studied are shown in **Appendix C**.

Access to SR 86 through the local road system and from turnouts to adjacent property will be the same for all alternatives. The access points are described in **Section 6, Access Management Plan**.

Where existing local road connections to SR 86 are relocated, the existing roadway is to be removed and the area re-graded to approximately original ground.

#### **Alternative A:**

Alternative A consists of constructing a new 2-lane westbound roadway on the north side of the existing 2-lane roadway to provide a 4-lane divided highway for the entire length of the project. The existing roadway will be converted to carry eastbound traffic. Crossroad intersections will be improved. Signalization and turn lanes will be constructed at major intersections. Where required, local roads will be realigned at their intersection with SR 86. See **Plan Sheets, Appendix C**.

Alternative A begins just east of Sandario Road at MP 156.88 (Sta. 622+79.42).

SR 86 will transition from two-12-foot lanes with 8-foot shoulders to a 4-lane divided Urban / Fringe-Urban highway with a 50-foot median at MP 157.29. Where turn lanes are constructed on SR 86 the shoulder width adjacent to the turn lane can be reduced to 4-feet.

This configuration will continue from MP 157.29 to the Sunset Avenue intersection where a third eastbound lane will be added. A third westbound lane will be added at the Sheridan Avenue intersection. Three through lanes in each direction will be continued easterly through the Kinney Road Intersection to provide needed capacity through the intersection of SR 86 and Kinney Road (See **Section 2.1.7 of this report**). Both the eastbound and westbound roadways will transition back to two lanes just east of Kinney Road.

The new 2-lane westbound roadway will be 38-feet wide and will have a 10-foot outside shoulder, two-12-foot lanes and a 4-foot inside shoulder. The existing 40-foot roadway will be reconfigured to provide a 10-foot outside shoulder, two-12-foot lanes and a 6-foot inside shoulder. The 6-foot shoulder results from using the existing 40-foot roadway, rather than removing 2-feet of existing pavement. In areas where the existing roadway is being removed and new eastbound and

westbound roadways will be constructed the inside shoulder of both roadways will be 4-feet wide. Auxiliary lanes will be constructed at intersections.

The Drainage Report prepared for this project shows that 15-RCBCs, 7-CMPs and the two bridge structures do not have adequate capacity to carry the design volume of water. See **Section 5.6** for the drainage criteria and a summary of the drainage structures.

Existing drainage culverts that are adequately sized will be extended to the north through the new westbound roadway. Where existing culverts are undersized the culverts as shown in **Table 5-2** will be constructed under the new roadway. After traffic is moved to the new roadway the existing culverts will be upsized as required. Where guard rail is currently used on the south side of SR 86 because of inadequate recovery zone, the existing culverts will be extended to provide the required recovery zone, and guard rail will be removed.

A new 260-foot long bridge will be constructed on the new westbound roadway at Black Hills Wash (MP 162.1) and a new 200-foot long bridge will be constructed at Snyder Hills Wash (MP 162.3).

The existing bridges will be supplemented as follows to carry the design volumes of water.

- Black Hills Wash (MP 162.1): The existing bridge will remain and a new 130-foot long bridge will be constructed immediately to the east of the existing bridge. The channel will be widened under the new bridge.
- Snyder Hills Wash (MP 162.3): The existing bridge will remain. The wash bottom will be cleared out and excavated to the stable slope invert, which is at the approximate existing elevation of 2436-feet. Further analysis is required during final design to determine a design stable slope invert.

Construct drainage inlets in the median of the 4-lane divided highway and connect them to cross-culverts as required.

#### **Alternative B:**

Alternative B consists of constructing a new 2-lane eastbound roadway on the south side of the existing 2-lane roadway to provide a 4-lane divided highway for the entire length of the project. The existing roadway will be converted to carry westbound traffic. Crossroad intersections will be improved. Signalization and turn lanes will be constructed at major intersections. Where required, local roads will be realigned at their intersection with SR 86. See **Plan Sheets, Appendix C**.

Alternative B begins just east of Sandario Road at MP 156.88 (Sta. 622+79.42).

SR 86 will transition from 2-12-foot lanes with 8-foot shoulders to a 4-lane divided Urban / Fringe-Urban Highway with a 50-foot median at MP 157.29 (Sta. 644+45.55).

This configuration will continue from approximately MP 157.29 to the Sunset Avenue intersection where a third eastbound lane will be added. A third westbound lane will be added at the Sheridan Avenue intersection. Three through lanes in each direction will be continued easterly through the Kinney Road Intersection to provide needed capacity through the intersection of SR 86 and Kinney Road (See **Section 2.1.7**). Both the eastbound and westbound roadways will transition back to two lanes just east of Kinney Road.

The new 2-lane eastbound roadway will be 38-feet wide and will have a 10-foot outside shoulder, two-12-foot lanes and a 4-foot inside shoulder. The existing 40-foot roadway will be reconfigured to provide a 10-foot outside shoulder, two-12-foot lanes and a 6-foot inside shoulder. The 6-foot shoulder results from using the existing 40-foot roadway, rather than removing 2-feet of existing pavement. In areas where the existing roadway is being removed and new eastbound and westbound roadways will be constructed the inside shoulder of both roadways will be 4-feet wide. Auxiliary lanes will be constructed at intersections.

The Drainage Report prepared for this project shows that 15-RCBCs, 7-CMPs and the two bridge structures do not have adequate capacity to carry the design volume of water. See **Section 5.6** for the drainage criteria and a summary of the drainage structures.

Existing drainage culverts that are adequately sized will be extended to the south through the new eastbound roadway. Where existing culverts are undersized the culverts as shown in **Table 5-2** will be constructed under the new roadway. After traffic is moved to the new roadway the existing culverts will be upsized as required. Where guard rail is currently used on the north side of SR 86 because of inadequate recovery zone, the existing culverts will be extended to provide the required recovery zone, and guard rail will be removed.

A new 260-foot long bridge will be constructed on the new eastbound roadway at Black Hills Wash (MP 162.1) and a new 200-foot long bridge will be constructed at Snyder Hills Wash (MP 162.3).

The existing bridges will be supplemented as follows to carry the design volumes of water.

- Black Hills Wash (MP 162.1): The existing bridge will remain and a new 130-foot long bridge will be constructed immediately to the east of the existing bridge. The channel will be widened under the new bridge.

- Snyder Hills Wash (MP 162.3): The existing bridge will remain. The wash bottom will be cleared out and excavated to the stable slope invert, which is at the approximate existing elevation of 2436-feet. Further analysis is required during final design to determine a design stable slope invert.

Construct drainage inlets in the median of the 4-lane divided highway and connect them to cross-culverts as required.

### Alternative C:

A third alternative, Alternative C, was identified that essentially combines elements of both Alternatives A and B to better fit the corridor, minimize adverse impacts to adjacent properties and utilize as much of the existing drainage channels and dikes as is feasible. Alternative C will provide a 4-lane divided roadway, and will utilize the existing 2-lane roadway for one direction of travel through the majority of the length of the project. The horizontal alignment will be modified to shift the location of the new 2-lane roadway from one side of the existing roadway to the other as described in the following text and as shown on the plans (**Appendix B**) and typical sections (**Appendix A**).

Crossroad intersections will be improved. Signalization and turn lanes will be constructed at major intersections. Where required, local roads will be realigned at their intersections with SR 86. See **Plan Sheets, Appendix B**.

Alternative C begins just east of Sandario Road at MP 156.88 (Sta. 622+79.42).

SR 86 will transition from 2-12-foot lanes with 8-foot shoulders to a 4-lane divided Urban / Fringe-Urban Highway with a 50-foot median at MP 157.29 (Sta. 644+45.55).

Existing SR 86 will be used as the westbound roadway and a new eastbound roadway will be constructed on the south side of the existing roadway from MP 157.29 to approximately MP 160.1. From MP 160.1 to MP 160.4 the horizontal alignment transitions to the north. Through the transition the existing roadway will be removed and new eastbound and westbound roadways will be constructed.

From MP 160.4 to MP 163.2 the existing 2-lane roadway will be converted to the eastbound roadway and a new westbound roadway will be constructed on the north side of the existing roadway.

Between MP 163.2 and MP 163.6 the horizontal alignment will again transition to the south with the existing roadway being removed and new eastbound and westbound roadways being constructed.

From MP 163.6 to MP 164.2 the existing 2-lane roadway will be converted to the westbound roadway and a new eastbound roadway will be constructed on the south side of the existing roadway.

At MP 164.2 the horizontal alignment will again transition to the north and the 4-lane divided roadway will be constructed approximately symmetrically to the north and south of the centerline of the existing roadway. The existing roadway will be removed and new eastbound and westbound roadways will be constructed. A third eastbound lane will be added to SR 86 at the Sunset Avenue intersection. A third westbound lane will be added at the Sheridan Avenue intersection, and three through lanes in each direction will be continued easterly through the Kinney Road Intersection to provide needed capacity through the intersection of SR 86 and Kinney Road (See **Section 2.1**.) Both the eastbound and westbound roadways will transition back to two lanes just east of Kinney Road.

The new 2-lane roadway, whether eastbound or westbound, will be 38-foot wide and will have a 10-foot outside shoulder, two-12-foot lanes and a 4-foot inside shoulder. Where the existing roadway is being used for one direction of travel, the 40-foot roadway will be reconfigured to provide a 10-foot outside shoulder, two-12-foot lanes and a 6-foot inside shoulder. The 6-foot shoulder results from using the existing 40-foot roadway, rather than removing 2-feet of existing pavement. In areas where the existing roadway is being removed and new eastbound and westbound roadways will be constructed, the inside shoulder of both roadways will be 4-feet wide. Auxiliary lanes will be constructed at intersections.

The Drainage Report prepared for this project shows that 15-RCBCs, 7-CMPs and the two bridge structures do not have adequate capacity to carry the design volume of water. See **Section 5.6** for the drainage criteria and a summary of the drainage structures.

Existing drainage culverts that are adequately sized will be extended as required. RCBC and pipe culverts will be extended through the median and across the new roadway to provide the required recovery zone adjacent to the new roadway. Where new roadway construction occurs on both sides of the existing roadway, existing culverts will have to be extended on both ends. During the design phase of the project it may be necessary to make adjustments to the vertical alignment of culvert extensions to assure that they are below the structural section of the roadway.

Where guard rail is currently used on the existing roadway because of inadequate recovery zone, and the existing roadway is being used for one direction of travel, the existing culverts will be extended to provide the required recovery zone adjacent to the existing roadway, and guard rail will be removed.

Where existing culverts are undersized the culverts as shown in **Table 5-2** will be constructed under the new roadway. After traffic is moved to the new roadway the existing culverts will be upsized as required and will be extended to provide the required recovery zone. Existing guard rail will be removed.

A new 260-foot long bridge will be constructed on the new westbound roadway at Black Hills Wash (MP 162.1) and a new 200-foot long bridge will be constructed at Snyder Hills Wash (MP 162.3).

The existing bridges will be supplemented as follows to carry the design volumes of water.

- Black Hills Wash (MP 162.1): The existing bridge will remain and a new 130-foot long bridge will be constructed immediately to the east of the existing bridge. The channel will be widened under the new bridge.
- Snyder Hills Wash (MP 162.3): The existing bridge will remain. The wash bottom will be cleared out and excavated to the stable slope invert, which is at the approximate elevation of 2436-feet. Further analysis is required during final design to determine a design stable slope invert.

Construct drainage inlets in the median of the 4-lane divided highway and connect them to cross-culverts as required.

## 4.3 Evaluation of Alternatives

Many of the characteristics of the alternatives developed for improving SR 86 are the same for all three alternatives:

- The LOS for mainline SR 86 and for intersections will be the same for all alternatives.
- Turning movements at intersections and turnouts will be the same for all alternatives.
- Signalization of major local road intersections is the same for all alternatives.
- Realignment and improvement of local Roads and R/W requirements for the local Roads will be similar for all alternatives.
- Auxiliary turning lanes will be the same for all alternatives.
- Median crossovers will be the same for all alternatives.
- Noise walls to mitigate noise impact to adjacent properties, if required, will be the same for all alternatives.
- Access to adjacent properties will be provided by all three alternatives.
- The fringe-urban configuration with 74-foot centerline to centerline separation of roadways will be used for all alternatives.
- Drainage structures including RCBC, CMP, bridges and drainage channels will be the same for all alternatives. The length of new dikes is different for each alternative and is shown in **Table 4-1, Evaluation of Alternatives**.

TABLE 4-1, EVALUATION OF ALTERNATIVES

Design Evaluation Factors	Alternative A	Alternative B	Alternative C
Use of Existing Roadway	Alt. A uses the existing roadway for the eastbound direction of travel from MP 157.29 to MP 165.77, which is 8.48 miles.	Alt. B uses the existing roadway for the westbound direction of travel from MP 157.29 to MP 165.77, which is 8.48 miles.	Alt. C uses the existing roadway for one direction of travel from MP 157.29 to MP 160.1; from MP 160.5 to MP 163.2; and from MP 163.6 to 164.2, which is a total of 6.0 miles.
Minimize Impact to Adjacent Properties	<p>Alt A will construct the new roadway on the north side of the existing roadway.</p> <p>Impact to Property – South side of SR 86:</p> <ul style="list-style-type: none"> <li>Property adjacent to the south side of the existing SR 86 roadway will not be impacted between MP 156.88 and MP 159.48 and between MP 160.14 and MP 166. Between MP 159.48 and MP 160.14 an additional 30-foot wide strip of R/W will be required on the south side of SR 86. Ryan Airfield is on the north side of SR 86. The R/W is narrower through this area and additional width is required for the turning lanes at the intersection of SR 86 and Valencia Road. The property is undeveloped. Between MP 166 and MP 166.20 an additional 20-foot wide strip of R/W will be required on the south side of SR 86 for additional lanes through the Kinney Road intersection.</li> </ul> <p>Impact to Property – North side of SR 86:</p> <ul style="list-style-type: none"> <li><u>MP 156.88 to MP 159.3</u>: An additional 74-foot wide strip of R/W would be required. However the property is undeveloped.</li> <li><u>MP 159.3 to MP 160.2</u>: The width of additional R/W along Ryan Airfield would vary from approximately 54-feet to approximately 74-feet. Ryan Airfield would be severely impacted:                     <ul style="list-style-type: none"> <li>The roadway would be closer to the existing Airfield buildings.</li> <li>The airport flight pattern may be affected.</li> <li>The loss of property would impact their parking area.</li> <li>The existing access road located on the Airfield property would have to be realigned and moved to the north, which would take additional Airfield parking area.</li> </ul> </li> <li><u>MP 160 to MP 166</u>: Additional R/W varying in width from 30-feet to 124-feet is required. From MP 160 to MP 164 the property is not developed. From MP 164 to MP 166 most of the adjacent property on the north side of SR 86 is divided into small acreages, some of which have residential development. The impact on properties could be significant.</li> </ul> <p>An adobe block manufacturing plant that is shown on the plan sheets on the north side of SR 86 at approximately MP 164.2 has been removed in its entirety. The R/W line for Alternative A is located within the limits of the property where the adobe block manufacturing plant was located.</p> <p>A residence is located adjacent to SR 86 at approximately MP</p>	<p>Alt. B will construct the new roadway on the south side of the existing roadway.</p> <p>Impact to Property – South side of SR 86:</p> <ul style="list-style-type: none"> <li><u>MP 156.88 to MP 159.3</u>: An additional 50-foot of R/W will be required to contain the new EB roadway, the drainage dikes and the utility lines.</li> <li><u>MP 159.3 to MP 160.1</u>: The width of additional R/W needed varies from 50-feet to approximately 124-feet.</li> <li><u>MP 160.1 to MP 160.7</u>: The width of additional R/W needed varies from approximately 74-feet to approximately 14-feet.</li> <li><u>MP 160.7 to MP 165.9</u>: The width of additional R/W needed is approximately 64-feet.</li> <li><u>MP 165.9 to MP 166.2</u>: The width of additional R/W needed varies from approximately 64-feet to 20-feet.</li> <li>Additional drainage easements will also be required on the south side in several locations along this section of the project.</li> </ul> <p>Most of the adjacent property on the south side of SR 86 is undeveloped. However, a gas station/convenience store is located at approximately MP 164.6; a potable water pump station and an electric power substation are located at approximately MP 165.2; a Baptist Church and School, a feed store, several residential properties and a storage facility are located between MP 165.2 and MP 166.1. All of the improved properties would be adversely affected by the required R/W take on the south side of SR 86 for Alternative B.</p> <p>Impact to Property – North side of SR 86:</p> <ul style="list-style-type: none"> <li><u>MP 156.88 to MP 160.0</u>: No additional R/W is required. Property adjacent to the north side of the existing SR 86 roadway within these limits will not be impacted. Several drainage easements would be widened by 40-feet at culvert outlets due to increases in the size of box culverts.</li> <li><u>MP 160.0 to MP 161.4</u>: An additional 30-foot of R/W will be required to contain utility lines along SR 86. The adjacent property is undeveloped.</li> <li><u>MP 161.4 to MP 164.1</u>: No additional R/W is required. Property adjacent to the north side of the existing SR 86 roadway within these limits will not be impacted.</li> <li><u>MP 164.1 to MP 165.4</u>: An additional 50-foot of R/W will be required for a drainage channel and utility lines.</li> <li><u>MP 165.4 to MP 165.6</u>: Additional R/W varying in width from 30-feet to 20-feet would be required for a drainage channel and</li> </ul>	<p>Alt. C will construct the new roadway on the south side of the existing roadway from the beginning of project at MP 156.88 to MP 160.1. From MP 160.1 to MP 164.2 the alignment transitions back and forth between the south side and the north side. From MP 164.2 to the east the alignment transitions to the north and a new four-lane roadway will be approximately symmetrical around the existing roadway.</p> <p>Impact to Property – South side of SR 86:</p> <ul style="list-style-type: none"> <li><u>MP 156.88 to MP 159.3</u>: An additional 50-foot of R/W will be required to contain the new EB roadway, the drainage dikes and the utility lines.</li> <li><u>MP 159.3 to MP 160.36</u>: The width of additional R/W needed varies from 0-feet to 124-feet. Drainage easements are required from MP 160.1 easterly. The property is undeveloped. Impact should be minimal.</li> <li><u>MP 160.36 to MP 161.4</u>: No additional R/W is needed. Drainage easements are needed for flood control dikes. The property is undeveloped. Impact should be minimal except that the area of land being included in the drainage easements is approximately 20 acres.</li> <li><u>MP 161.4 to MP 163.3</u>: No additional R/W is required. Property adjacent to existing SR 86 will not be impacted.</li> <li><u>MP 163.3 to MP 166</u>: The width of additional R/W needed varies from 64-feet to 0-feet. The developed property includes a gas station/convenience store, a potable water pump station, an electric power substation, a Baptist Church and School, a feed store, and several residential properties. The taking will be less than for Alt. B, but the improved properties will be adversely impacted.</li> <li><u>MP 166 to MP 166.3</u>: No additional R/W is needed from MP 166 to MP 166.1. From MP 166.1 to MP 166.2 the width of additional R/W required is approximately 28-feet. A 20-foot wide drainage easement is needed for the extension of a RCBC at MP 166.3.</li> </ul> <p>Impact to Property – North side of SR 86:</p> <ul style="list-style-type: none"> <li><u>MP 156.88 to MP 160.2</u>: No additional R/W is required. However, several drainage easements have been widened by 40-feet where RCBC's have been enlarged. Property adjacent to the north side of the existing SR 86 roadway will be minimally affected.</li> <li><u>MP 160.2 to MP 163.5</u>: The width of additional R/W varies from 0' to 94'. Several 50' wide drainage easements are needed at the outlet ends of box culverts. The property is undeveloped. Impact should be minimal.</li> </ul>

TABLE 4-1, EVALUATION OF ALTERNATIVES

Design Evaluation Factors	Alternative A	Alternative B	Alternative C
Minimize Impact to Adjacent Properties (Continued)	<p>165.4. The R/W boundary passes through the main building.</p> <ul style="list-style-type: none"> <li>MP 166 to MP 166.4: A drainage easement varying in width from 85-feet to 240-feet is required from MP 166 to MP 166.2. A 30-foot wide drainage easement is required from MP 166.25 to MP 166.4.</li> </ul>	<p>utility lines.</p> <ul style="list-style-type: none"> <li>A drainage easement varying in width from 75-feet to approximately 240-feet is required from MP 165.8 to MP 166.2. A 30-foot wide drainage easement is required from MP 166.25 to MP 166.4.</li> <li>East of MP 164 most of the adjacent property is divided into small acreages, some of which have residential development. An adobe block manufacturing plant that is shown on the plan sheets on the north side of SR 86 at approximately MP 164.2 has been removed in its entirety.</li> </ul>	<ul style="list-style-type: none"> <li>MP 163.5 to MP 164.1: No additional R/W is required. Property adjacent to the north side of existing SR 86 will not be impacted.</li> <li>MP 164.1 to MP 164.5: The width of additional R/W varies from 50' wide to approximately 60' wide for a drainage channel and utility lines. The new R/W would cross property that was previously the site of an adobe manufacturing plant. The adobe block manufacturing plant has been removed in its entirety.</li> <li>MP 164.5 to MP 165.8: The width of additional R/W needed varies from approximately 20' to 77' which includes width for a drainage channel and utility lines. Three improved residential properties will be impacted. One residential structure will be taken. Other properties affected are unimproved. Impact would likely be moderate.</li> <li>A drainage easement varying in width from 75-feet to approximately 240-feet is required from MP 165.8 to MP 166.2. A 30-foot wide drainage easement is required from MP 166.25 to MP 166.4.</li> </ul>
Minimize Additional R/W Needed	<ul style="list-style-type: none"> <li>Total Acres for SR 86 mainline R/W: 81.43</li> <li>Total Acres for local road R/W: 12.90</li> <li>Total Acres for SR 86 Mainline Drainage Easements: 36.92</li> <li>Total Acres for local road Drainage Easements: 1.58</li> </ul> <p>Total R/W and Drainage Easements: 132.83</p>	<ul style="list-style-type: none"> <li>Total Acres for SR 86 mainline R/W: 76.35</li> <li>Total Acres for local road R/W: 12.90</li> <li>Total Acres for SR 86 Mainline Drainage Easements: 51.81</li> <li>Total Acres for local road Drainage Easements: 1.58</li> </ul> <p>Total R/W and Drainage Easements: 142.64</p>	<ul style="list-style-type: none"> <li>Total Acres for SR 86 mainline R/W: 79.14</li> <li>Total Acres for local road R/W: 12.90</li> <li>Total Acres for SR 86 Mainline Drainage Easements: 35.03</li> <li>Total Acres for local road Drainage Easements: 1.58</li> </ul> <p>Total R/W and Drainage Easements: 128.65</p>
Drainage Dikes	<ul style="list-style-type: none"> <li>Approximately 13,200 lin. ft. of new dike would be required.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 25,650 lin. ft. of new dike would be required.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 25,550 lin. ft. of new dike would be required.</li> </ul>
Existing Utility Lines	<p>Impact on utility lines that cross SR 86 is approximately the same for Alts. A, B &amp; C.</p> <p>Utility lines that are currently located within the ADOT R/W on the north side of SR 86 would have to be relocated but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Gas – MP 157 to MP 161.4 and MP 166.3 to MP 166.5.</li> <li>Buried telephone – (2-lines) MP 157 to MP 161.4; (1-line) MP 163.4 to MP 164.4; MP 165.4 to MP 165.7.</li> <li>Overhead telephone – MP 164.7 to MP 165.1; MP 165.4 to MP 165.9.</li> <li>Overhead power – MP 161.7 to MP 162.1; MP 164.4 to MP 166.58.</li> <li>Sewer line – MP 165.8 to MP 166.3 (May not have to be relocated depending on location of drainage channel.)</li> </ul> <p>Tucson water lines located within the existing R/W from MP 165.3 to MP 166.58 would have to be relocated but could be accommodated within the existing R/W on the south side of SR 86.</p> <p>Alternative A would require new R/W on the south side of SR 86 along Ryan Airfield. Approximately 500' of 42" water line, TRICO overhead power line and TV cable would have to be relocated at</p>	<p>Impact on utility lines that cross SR 86 is approximately the same for Alts. A, B &amp; C.</p> <p>Utility lines that are currently located within the ADOT R/W on the south side of SR 86 would have to be relocated but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Tucson Water –MP 156.88 to MP 159.6, MP 164.4 to MP 165.8, MP 165.8 to MP 166.3 and MP 166.0 to MP 166.58.</li> <li>TRICO power – MP 156.88 to MP 159.6.</li> <li>TV cable – MP 156.88 to MP 159.6 – located on TRICO power poles.</li> <li>Buried telephone – (2 lines) MP 164.2 to MP 164.8 and MP 166.3 to MP 166.58.</li> <li>Overhead telephone – MP 164.8 to MP 166.3.</li> </ul> <p>Alternative B would require new R/W on the north side of SR 86 from approximate MP 160 to MP 161.4. Existing utilities within the existing R/W in this area would be able to remain.</p> <p>Alternative B would also require new R/W on the north side of SR 86 from approximate MP 164.1 to MP 165.6. Existing utilities within the existing R/W in this area would be relocated but could be accommodated within the new R/W. The existing Fiber Optic line</p>	<p>Impact on utility lines that cross SR 86 is approximately the same for Alts. A, B &amp; C.</p> <p>Following are utility lines currently located within the ADOT R/W on the south side of SR 86 that would have to be relocated but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Tucson Water –MP 156.88 to MP 159.6, MP 164.4 to MP 165.8, 165.8 to MP 166.3 and MP 166.0 to MP 166.58.</li> <li>TRICO power – MP 156.88 to MP 159.6.</li> <li>TV cable – MP 156.88 to MP 159.6 – located on TRICO power poles.</li> <li>Buried telephone – (2 lines) MP 164.2 to MP 164.8 and MP 166.3 to MP 166.58.</li> <li>Overhead telephone – MP 164.8 to MP 166.3.</li> </ul> <p>Following are utility lines currently located within the ADOT R/W on the north side of SR 86 that would have to be relocated but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Gas – MP 160.3 to MP 161.4 and MP 166.3 to MP 166.5.</li> <li>Buried telephone – MP 160.3 to MP 161.4, MP 163.4 to MP 164.4 and MP 165.4 to MP 165.7.</li> <li>Overhead telephone – MP 161.7 to MP 162.1 and MP 165.4 to MP 165.9.</li> </ul>

TABLE 4-1, EVALUATION OF ALTERNATIVES

Design Evaluation Factors	Alternative A	Alternative B	Alternative C
Existing Utility Lines (con't)	<p>approximate MP 159.6 but could be accommodated within the new R/W.</p> <p>Utility lines located outside existing R/W, but within new R/W on the north side of SR 86 may have to relocate but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Tucson Water, 12" line – MP 159.5 to MP 160.0; 72" line vicinity of Tucson Estates Pkwy. (May be able to remain, depending on depth).</li> <li>Fiber Optic line – vicinity of Tucson Estates Pkwy.</li> <li>CAP Water, 96" line – vicinity of Tucson Estates Pkwy. Depth shown by potholing indicates 96" water line can remain.</li> </ul>	<p>located outside the existing R/W in the vicinity of Tucson Estates Pkwy. would be relocated but could be accommodated within the new R/W.</p> <p>Utility lines located outside existing R/W, but within new R/W on the south side of SR 86 may have to relocate but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Gas – MP 165.8 to MP 166.5 – May not need new R/W depending on configuration of SR 86/Kinney Road intersection improvements.</li> </ul>	<ul style="list-style-type: none"> <li>Overhead power – MP 161.7 to MP 162.1 and 164.4 to MP 166.58.</li> <li>Sewer line – MP 165.8 to MP 166.3 (May not have to be relocated depending on location of drainage channel).</li> </ul> <p>Utility lines located outside existing R/W, but within new R/W on the north side of SR 86 may have to relocate but could be accommodated within the new R/W.</p> <ul style="list-style-type: none"> <li>Tucson Water, 12" line – MP 159.5 to MP 160.0; 72" line vicinity of Tucson Estates Pkwy. (May be able to remain, depending on depth).</li> <li>Fiber Optic line – vicinity of Tucson Estates Pkwy.</li> <li>CAP Water, 96" line – vicinity of Tucson Estates Pkwy. Depth shown by potholing indicates 96" water line can remain.</li> </ul>
Threatened or Endangered Species	<p>The Pima Pineapple Cactus (PPC) is the only Federally listed threatened or endangered species within the study area. The Cactus Ferruginous Pygmy-owl (Pygmy-owl) has recently been delisted, but is being considered as a threatened or endangered species by ADOT.</p> <ul style="list-style-type: none"> <li>PPC: Need to relocate one PPC. Need to relocate or protect in place two PPC.</li> <li>Pygmy-owl: Disturbance to habitat components for the Pygmy-owl may vary among the three alternatives; however, the differences in impacts are expected to be minimal and are unlikely to result in a trend toward federal listing or loss of viability.</li> </ul>	<p>The Pima Pineapple Cactus (PPC) is the only Federally listed threatened or endangered species within the study area. The Cactus Ferruginous Pygmy-owl (Pygmy-owl) has recently been delisted, but is being considered as a threatened or endangered species by ADOT.</p> <ul style="list-style-type: none"> <li>PPC: Need to relocate four PPC. Need to relocate or protect in place two PPC.</li> <li>Pygmy-owl: Disturbance to habitat components for the Pygmy-owl may vary among the three alternatives; however, the differences in impacts are expected to be minimal and are unlikely to result in a trend toward federal listing or loss of viability.</li> </ul>	<p>The Pima Pineapple Cactus (PPC) is the only Federally listed threatened or endangered species within the study area. The Cactus Ferruginous Pygmy-owl (Pygmy-owl) has recently been delisted, but is being considered as a threatened or endangered species by ADOT.</p> <ul style="list-style-type: none"> <li>PPC: Need to relocate one PPC. Need to relocate or protect in place two PPC.</li> <li>Pygmy-owl: Disturbance to habitat components for the Pygmy-owl may vary among the three alternatives; however, the differences in impacts are expected to be minimal and are unlikely to result in a trend toward federal listing or loss of viability.</li> </ul> <p>Formal consultation on the proposed improvements to SR 86 between Sandario Road and Kinney Road has been concluded and was signed by Jason M. Douglas for Steven L. Spangle, Field Supervisor for the USFWS, Arizona Ecological Services Field Office. The final consultation was sent to Mr. Robert Hollis, Division Administrator, U.S. Department of Transportation, Federal Highway Administration with a stamped date of July 02, 2008.</p> <p>The biological opinion (BO) lists actions that the applicant must take. The determination indicates the loss of at least one to two PPC and 60.77 acres of habitat, as well as the long-term temporary alteration of 81.23 acres of habitat, comprise less than one percent of the known population and extant suitable habitat.</p>
Air Quality	<ul style="list-style-type: none"> <li>This project conforms to the State Implementation Plan (SIP) and is therefore in conformity.</li> </ul>	<ul style="list-style-type: none"> <li>This project conforms to the State Implementation Plan (SIP) and is therefore in conformity.</li> </ul>	<ul style="list-style-type: none"> <li>This project conforms to the State Implementation Plan (SIP) and is therefore in conformity.</li> </ul>
Constructability and Maintenance of Traffic During Construction	<ul style="list-style-type: none"> <li>The existing roadway would continue to be used for both eastbound and westbound traffic on SR 86.</li> <li>The new 2-lane roadway would be constructed on the north side of the existing roadway from approximately MP 157.29 to approximately MP 165.77.</li> <li>Roadway tapers would be constructed to transition westbound traffic from the existing roadway to the new westbound</li> </ul>	<ul style="list-style-type: none"> <li>The existing roadway would continue to be used for both eastbound and westbound traffic on SR 86.</li> <li>The new 2-lane roadway would be constructed on the south side of the existing roadway from approximately MP 157.29 to approximately MP 165.77.</li> <li>Roadway tapers would be constructed to transition eastbound traffic from the existing roadway to the new eastbound roadway</li> </ul>	<ul style="list-style-type: none"> <li>The existing roadway would continue to be used for both eastbound and westbound traffic on SR 86 to the extent feasible.</li> <li>The new roadway will transition as follows with respect to the existing roadway:                         <ul style="list-style-type: none"> <li>From MP 157.2 to MP 160.1 the new roadway will be constructed on the south side of the existing road.</li> <li>The new roadway will transition from the south side of the</li> </ul> </li> </ul>

TABLE 4-1, EVALUATION OF ALTERNATIVES

Design Evaluation Factors	Alternative A	Alternative B	Alternative C
Constructability and Maintenance of Traffic During Construction (con't)	<p>roadway at the east end of the project, and to transition westbound traffic from the new westbound roadway back to the existing westbound lane on the existing 2-lane roadway at the west end of the project.</p> <ul style="list-style-type: none"> <li>When the new roadway is completed both westbound and eastbound traffic will be moved to the new roadway and work on existing roadway will be done.</li> <li>Interruptions to traffic will be minor since most construction will be done when the traffic is moved off the roadway.</li> </ul>	<p>at the west end of the project, and to transition eastbound traffic from the new eastbound roadway to the eastbound lanes of the existing divided roadway at the east end of the project.</p> <ul style="list-style-type: none"> <li>When the new roadway is completed both eastbound and westbound traffic will be moved to the new roadway and work on existing roadway will be done.</li> <li>Interruptions to traffic will be minor since most construction will be done when the traffic is moved off the roadway.</li> </ul>	<p>existing to the north side of existing between MP 160.1 and MP 160.5. The existing roadway will be removed and new westbound and eastbound roadways will be constructed.</p> <ul style="list-style-type: none"> <li>From MP 160.5 to MP 163.2 the new roadway will be constructed on the north side of the existing road.</li> <li>The new roadway will transition from the north side of existing to the south side of existing between MP 163.2 and MP 163.6. The existing roadway will be removed and new westbound and eastbound roadways will be constructed.</li> <li>From MP 163.6 to MP 164.2 the new roadway will be constructed on the south side of the existing road.</li> <li>From MP 164.2 to MP 165.8 the existing roadway will be removed and new eastbound and westbound roadways will be constructed.</li> <li>From MP 165.8 to MP 166.1 the tapered roadway that is constructed under the JPA between ADOT and PIMA County will be widened to complete the 4-lane divided highway.</li> <li>During construction of the transitions above, both eastbound and westbound traffic will be maintained on SR 86. However, traffic may be reduced to a single lane with traffic flaggers or temporary signals controlling the flow of traffic.</li> <li>Alternative C will disrupt traffic more than either Alt. A or B.</li> </ul>
Cost	<ul style="list-style-type: none"> <li>SR 86 Construction = \$58,547,000</li> <li>SR 86 Design = \$4,684,000</li> <li>SR 86 R/W &amp; DE = \$4,988,000</li> <li>Utility Relocation = \$1,200,000</li> <li>Env. Mit. = \$800,000</li> <li>Local Roads = <u>\$7,816,000</u></li> <li>Total Cost = \$78,035,000</li> </ul>	<ul style="list-style-type: none"> <li>SR 86 Construction = \$59,643,000</li> <li>SR 86 Design = \$4,771,000</li> <li>SR 86 R/W &amp; DE = \$4,058,000</li> <li>Utility Relocation = \$1,200,000</li> <li>Env. Mit. = \$800,000</li> <li>Local Roads = <u>\$7,816,000</u></li> <li>Total Cost = \$78,288,000</li> </ul>	<ul style="list-style-type: none"> <li>SR 86 Construction = \$62,570,000</li> <li>SR 86 Design = \$5,005,000</li> <li>SR 86 R/W &amp; DE = \$3,956,000</li> <li>Utility Relocation = \$1,200,000</li> <li>Env. Mit. = \$800,000</li> <li>Local Roads = <u>\$7,816,000</u></li> <li>Total Cost = \$81,347,000</li> </ul>

## 4.4 Conclusions

### 4.4.1 Discussion

Using the evaluation of alternatives, a comparative analysis of the alternatives was made which lead to specific conclusions about the most appropriate alternative for each roadway segment. The analysis revealed that only a few evaluation factors were significant enough for determining which alternative was preferred.

The following summary of the comparative analysis describes the key factors and differences used in arriving at a conclusion for the Build vs. No-Build Alternative, and the options studied within Alternatives A, B and C.

- No Build vs. Build Alternatives**

The No-Build Alternative involves no expenditure of funds and no apparent change to the environmental factors along SR 86. However, the No-Build Alternative:

- Will require continuing expenditures to rehabilitate and maintain the existing, aging roadway;
- Will not fulfill the purpose and need of improving the capacity, safety, and traffic operational characteristics of the route.

Therefore, the No-Build Alternative is not recommended.

**Conclusion: The No-Build Alternative is not recommended** and has been eliminated from consideration.

- Alternative A**

While Alternative A meets the safety and capacity requirements for SR 86, the adverse impact on Ryan Airfield is significant. SR 86 was realigned to the south along Ryan Airfield as part of an improvement of SR 86 in the 1990's. Alternative A would move SR 86 back to the north which would impact the improvements on Ryan Airfield and would adversely affect the flight patterns. Alternative A also has an adverse impact on three improved residential properties on the north side of SR 86.

Alternative A would result in a cut slope approximately 20-feet high adjacent to the westbound roadway along Snyder Hill, which would have a negative visual impact.

A total of approximately 118.4-acres of new R/W and Drainage Easement are required for Alternative A, which is less than Alternative B, but greater than Alternative C.

The length of new dikes required for Alternative A is less than the other two alternatives, but the area of drainage easement required is greater than Alternative C.

The impact on the Pima Pineapple Cactus is the same for Alternatives A and C, and less than the impact for Alternative B. Impact on Pygmy-owl habitat is similar for all alternatives.

Through traffic will be maintained on SR 86 during construction Alternative A will utilize the existing roadway more than Alternative C will during construction.

The estimated Construction Cost for Alternative A is less than either Alternative B or Alternative C. The estimated cost of R/W and Drainage Easements for Alternative A are more than either Alternative A or Alternative C; however, the total cost for Alternative A is slightly less than Alternative B and \$3.3-million less than Alternative C.

- **Alternative B**

Alternative B meets the safety and capacity requirements and does not have an adverse impact on Ryan Airfield. However, Alternative B has an adverse impact on several improved commercial and residential properties adjacent to the south side of SR 86.

- Alternative B has the most severe impact on the Shell station/convenience store located on the south side of SR 86 near Tucson Estates Pkwy. The gasoline island is located within the property that would be acquired for the project.
- A potable water pump station and an electric substation located on the south side of SR 86 at MP 165.2 will be partially within the required R/W.
- The Baptist Church and School, a feed store, a storage facility and residential properties will be more severely impacted by Alternative B than Alternative A or C.

Visual impacts along Snyder Hill will be less than Alternative A.

A total of approximately 128.2-acres of new R/W and Drainage Easement are required for Alternative B, which is more than the acreage required for either Alternative A or Alternative C.

The length of new dikes required for Alternative B is greater than for Alternative A and approximately the same as for Alternative C.

The impact on the Pima Pineapple Cactus is greater than the impact for Alternative A or C.

Through traffic will be maintained on SR 86 during construction Alternative A will utilize the existing roadway more than Alternative C will during construction.

The estimated construction cost for Alternative B is more than the construction cost of Alternative A and less than the construction cost of Alternative C. When R/W and Drainage Easements are added, the total cost for Alternative B is slightly more than Alternative A and approximately \$3.0-million less than Alternative C.

- **Alternative C**

Alternative C meets the safety and capacity requirements and does not have an adverse impact on Ryan Airfield. The impact on improved commercial and residential properties on the south side of SR 86 and on improved residential properties on the north side of SR 86 is reduced substantially but is not eliminated.

The alignment of Alternative C provides a “best fit” with respect to impacts on adjacent property through the length of the project.

A total of approximately 114.2-acres of new R/W and Drainage Easement are required for Alternative C, which is the least amount of the three alternatives.

The length of new dikes required for Alternative C is greater than for Alternative A and approximately the same as for Alternative B.

The impact on the Pima Pineapple Cactus is the same as for Alternative A and less than the impact for Alternative B.

Through traffic will be maintained on SR 86 during construction Alternative C will utilize temporary connections between the existing roadway and new construction more than Alternatives A and B will.

The estimated construction cost for Alternative C is more than for either Alternative A or Alternative B. When R/W and Drainage Easements are added the total cost for Alternative C remains more than either Alternative A or Alternative B.

The increased construction cost for Alternative C is primarily caused by the increased amount of reconstruction of the existing

roadway required to shift the alignment to the north and south of the existing alignment to reduce impacts to adjacent properties.

#### 4.4.2 Public Opinion

A Public Scoping Meeting was held on November 14, 2005 (Section 1.4.1), to provide information about the study process to the general public and to provide an opportunity to gather public input on ICOs for the proposed study. Thirty-five people attended the meeting. Those in attendance indicated that SR 86 needs to be improved throughout the study corridor. Issues, concerns, and opportunities discussed at the scoping meetings generally focused upon roadway safety, access control, drainage issues, adjacent development and economic impacts to the area. Comments received from the public were in favor of constructing a four-lane divided roadway in the study area and focused on building improvements as soon as possible.

A Public Hearing was conducted on February 2, 2010 (Section 1.4.3) to present the alternative options including the Preferred Option and the No Action Option. Comments and questions submitted by the public indicated continuing support for the project. Comments and questions along with ADOT responses are included in the Final EA errata.

#### 4.4.3 Summary and Conclusions

Three alternative alignments have been developed and evaluated for improvement of SR 86 between Sandario Road and Kinney Road to enhance safety and traffic operational characteristics of the roadway and to meet current and future traffic needs.

- A four-lane divided roadway is recommended throughout the study area from Sandario Road to Sunset Blvd. From Sunset Blvd. through Kinney Road the eastbound mainline roadway will be three lanes. The westbound roadway will be three lanes through the Kinney Road intersection westerly to Sheridan Avenue.
- Relocation outside of the existing highway corridor is not viable, nor necessary.
- Much of the existing roadway can be utilized if the pavement surface is maintained.
- The project will provide a significant upgrade to the drainage facilities in the project area. Overtopping of the highway at Kinney Road, Camino Verde and the area west of Black Hills Wash will be eliminated by enlarging cross drainage structures, adding drainage channels and constructing new dikes to channelize sheet flooding.

- Acquisition of the proposed R/W will provide space for additional travel lanes in the future for traffic in excess of the 2030 design year traffic volumes.
- The biological determination indicates the loss of at least one to two Pima Pineapple Cactus and 60.77 acres of habitat, as well as the long-term temporary alteration of 81.23 acres of habitat. These comprise less than one percent of the known population and extant suitable habitat.

### **Conclusions:**

**Alternatives A and B** are not recommended and are eliminated from further consideration.

**Alternative C** has significantly less impact on adjacent improved properties than Alternatives A and B. The cost of Alternative C is approximately 4.2% higher than Alternative A and 3.7% higher than Alternative B. The slightly higher cost is more than offset by the reduced impact on adjacent properties and the lesser amount of new R/W and Easements required. **Alternative C** is the preferred alternative to be carried forward for further development.

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