

## 3. AASHTO CONTROLLING DESIGN CRITERIA

### 3.1 Introduction

The existing design features of US 93 between SR 89 and the Santa Maria River (MP 193.5 to 161.5) were examined and evaluated relative to the American Association of State Highway and Transportation Officials (AASHTO) Controlling Criteria outlined in *A Policy on Geometric Design of Highways and Streets* (1990 edition), commonly referred to as the “AASHTO Green Book”. ADOT’s *Procedural Guide for Review of the AASHTO Controlling Design Criteria on Existing ADOT Roadways*, dated May 1997, was also used to evaluate the existing design features on US 93. ADOT’s *Roadway Design Guidelines* (1996 edition) was utilized for additional design reference. A complete presentation of the data and evaluation is available in the *AASHTO Controlling Design Criteria Report, US 93 – Wickenburg to Santa Maria River*, Contract No. 99-12, TRACS No. 093 YV 161, H 4871 01 L (October 2001). Horizontal and vertical data summaries are provided in Appendix B. *These are not intended to be the design criteria applied to new roadway designs, but rather only a review of established guidelines for retaining existing roadways. All criteria for new improvements are shown in Chapter 5.*

### 3.2 Design Speed

The study route’s classification, use, and terrain determine the appropriate design speed to be used for evaluating the existing and proposed roadway. The existing facility is a rural principal arterial highway in both level and rolling terrain. The AASHTO Green Book and ADOT Roadway Design Guide suggest a design speed of 60 to 70mph in level terrain and 50 to 60 mph in rolling terrain. A design speed of 60 mph in level terrain, and 50 mph in rolling terrain, was used to evaluate the existing alignment.

### 3.3 Lane Width and Shoulder Width

US 93 is primarily a two-lane roadway with 12-foot lanes and paved shoulders varying from 0.5 to 8 feet. A short 4-lane divided roadway section is located at the beginning of this study section, through the SR 89/US 93 intersection, as well as at the end of the study, where it ties to the existing Santa Maria Bridge improvements. Several passing lanes are located through the study area, such as:

- Northbound passing lane from MP 181.8 to 180.8.
- Southbound passing lane from MP 180.0 to 178.9.
- Southbound passing lane from MP 175.6 to 174.3.
- Northbound passing lane from MP 173.5 to 172.7.
- Northbound/Southbound passing lanes from MP 169.2 to 167.7.

The lane widths on this study route meet AASHTO recommendations. However, the minimum recommended shoulder width is not satisfied for more than half of the route (MP 161.5 – 177). Roadways with narrow shoulders provide poor service and may experience higher accident rates due to the absence of recovery areas for errant vehicles and refuge areas for disabled vehicles. The AASHTO Green Book suggests that a two-lane rural arterial highway have 12-foot travel lanes with 8-foot paved shoulders when the projected design hourly volumes exceed 200 vph for all design speeds.

If the recommended roadway improvements are implemented, most of the existing roadway provides for both the desired travel lane widths and two-lane, one-way shoulder widths (4-foot inside and 8-foot outside shoulders). Only the following segments of the existing roadway may require two- to three-feet of minor widening to provide the full, desired shoulder widths:

MP 161.5 – 167.7  
 MP 169.2 – 172.7  
 MP 173.5 – 174.3  
 MP 175.6 – 177.1

All lane and shoulder widths used in developing typical sections for the new roadway to be constructed will conform to current design recommendations.

### 3.4 Vertical Alignment and Stopping Sight Distance

75 vertical curves are located within the study route. All of these vertical curves meet AASHTO recommendations for stopping sight distance when evaluated relative to the AASHTO recommended minimum design speed of 60 mph for level terrain and 50 mph for rolling terrain.

A listing of the vertical curve analysis is provided in Appendix B.

### 3.5 Horizontal Alignment

The existing alignment contains 13 horizontal curves, all of which meet the AASHTO recommendation for maximum degree of curve. A listing of the horizontal curve analysis is included in Appendix B. Based on as-built plans, the following generally describes the horizontal alignment:

- All 13 curves meet the AASHTO recommendation for maximum degree of curve (5 degrees, 15 minutes) for 60-mph design speed in level terrain and (8 degrees, 15 minutes) for 50-mph design speed in rolling terrain.
- Five curves have superelevation rates less than the of AASHTO recommended minimum.

### 3.6 Grades

The AASHTO Green Book and ADOT Roadway Design Guidelines recommend a 3% maximum grade for rural arterial highways in level terrain with 60-mph design speeds and a 5% maximum grade for rural highways in rolling terrain with 50-mph design speeds. Grades at 2 existing vertical curves located near MP 183 and MP 173 exceed the maximum value.

### 3.7 Cross Slopes

Cross slopes are 1.5% throughout the study route and conform to current design recommendations.

### 3.8 Vertical Clearance

The AASHTO Green Book recommends that existing structures provide a minimum 14-foot clearance over the entire roadway width. The SR 71 Traffic Interchange Overpass has a vertical clearance of 15-feet, 2-inches over SR 71, which meets the requirement for an existing structure to remain. If the structure is reconstructed, or if a new structure is constructed over the highway, a 16-foot clearance is required. Consideration could be given to lowering the crossroad grade by 10-inches to provide the required vertical clearance.

In addition to roadway structures, there is a railroad crossing over the Burlington Northern Santa Fe railroad near MP 192.9. The AASHTO Green Book recommends that structures provide a minimum 23-foot clearance over the entire railway width. The existing structure exceeds this clearance. The new structure required parallel to the existing must be constructed over the railroad with a minimum 23-foot clearance.

### 3.9 Bridge Structures

Four bridges are located within the project limits. The description and evaluation of each are shown in Table 3-1.

**Table 3-1. Bridge Evaluation Summary**

Structure Name	Struct. No.	US 93 MP	Year Built	Suff. Rate*	Bridge Structure		Bridge Rail		
					Width, Curb To Curb ( ft)	Capacity	Type	Geom. OK	Struct. OK
Matthie Railroad Overpass	00780	192.88	1963	96.5	40.4'	HS 26.7	Std. - Conc. Barrier	Yes	Yes
Highway 71 Overpass	00842	182.88	1964	F 93.7	52'	HS 21.7	Std. - Conc. Barrier	No	No
Date Creek Bridge	02366	174.20	1995	80.0	44'	HS 20	Std. - Conc. Barrier	Yes	Yes
Big Jim Wash Bridge	00548	165.54	1959	S 49.3	30'	HS 12.2	Std. - Conc. Barrier	No	No

Source: ADOT Bridge Management Section Bridge Evaluation Data, May 1999.

\* In the Suff. Rate column: Numbers preceded by an "S" indicate Structurally Deficient bridges, while numbers preceded by an "F" indicate Functionally Obsolete bridges.

The AASHTO Green Book recommends a bridge structure capacity of HS 20.0. The Big Jim Wash Bridge (Struct. No. 00548) is deficient in capacity. The vertical clearance of the SR 71 Overpass (Struct. No. 00842) is also listed as deficient, although it meets AASHTO Criteria for a bridge to remain. The AASHTO Green Book recommends a minimum of 28 feet bridge width for bridges to remain in place.