

## **Low-Profile Barrier Design Alternatives**

*Requested by*

Doug Brown, Division of Design, Landscape Architecture

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## **Executive Summary**

### **Background**

Caltrans is receiving an increasing number of requests from local agencies, regulatory bodies, and other stakeholders to provide low-profile barrier options for conventional highways. In 2011, Caltrans completed crash testing of an 18-inch low-profile barrier design and determined that it meets the crash worthiness criteria of National Cooperative Highway Research Program (NCHRP) Report 350 Test Level 2, and the barrier design was approved for use by the FHWA in July 2012. Caltrans does not have a variety of other low-profile barrier designs for use in conventional highway median sections with posted speeds of 45 mph or less, but feedback from District stakeholders indicates that additional design alternatives are needed.

This Preliminary Investigation assembles low-profile barrier options—defined here as barriers with heights of 24 inches or less—that can be used in conventional highway medians. Both U.S. and international examples are included. Also included is a selection of end treatments that transition from low-profile barriers to curb height, and an overview of tree setback regulations.

### **Summary of Findings**

We gathered information in the following three areas:

- Barrier examples (Non-proprietary Options, Commercial Options and End Treatments)
- Related barrier resources (interviews and documents)
- Tree setback regulations

Following is a summary of findings by topic area.

### **Barrier Examples**

Through a literature search and interviews or emails with experts, we found several examples of low-profile barriers currently available for use. We compiled characteristics of these barriers into a single table for comparison. Below are highlights of these barriers that may be of particular interest to Caltrans.

- In the United States, there are only a **few widely known low-profile barrier options**. The versions developed or tested by Caltrans, Florida DOT, Texas Transportation Institute, and the Midwest Roadside Safety Facility are by far the examples most commonly cited by industry professionals. These have been tested and passed crash tests at TL-2.
- **Texas Transportation Institute's** 20-inch low-profile barrier was originally designed as a precast barrier but was cited as having permanent application by FHWA Safety Engineer Dick Albin and Midwest Roadside Safety Facility Interim Director Ron Faller.
- **Washington DOT's** 20-inch low-profile barriers meeting TL-2 standards are often cited for their installation in Des Moines, Washington. While developed as a precast barrier, in Des Moines they were cast in place, according to Dick Albin.
- **Florida DOT's** low-profile barrier was also developed as a precast barrier. Dick Albin and Ron Faller cited it as having permanent applications.
- **Midwest Roadside Safety's** bridge rail was tested as a precast barrier joined to the concrete with an epoxy resin, although Dick Albin said that it could be cast in place in permanent applications. Midwest Roadside Safety also produced a rough stone masonry guardrail designed for scenic highways.
- The **Arizona SR 69 Barrier** is installed in Prescott, Arizona. Arizona DOT Assistant District Engineer Bob LaJeunesse said the barrier is the same as in use on California Highway 99; given the design differences between the Caltrans barrier and this one, that seems unlikely.
- **Advantage Precast's** barrier has been installed in several locations in Keizer, Oregon, according to the company's Rick Day. While a precast barrier, it can be pegged down for permanent installation. Due to its extremely low height, it is primarily intended as a divider rather than redirecting vehicles in crashes.
- **ProTec** is a German manufacturer of barriers. While the company's materials market its low-profile barrier for mobile applications, Zoltan Rado of the Pennsylvania Transportation Institute said that the barrier is used for both temporary and permanent installations.
- **Duo-Rail** is a modular barrier system from Heintzmann Gruppe in Germany that is marketed for both permanent and temporary applications. The system has a 21-inch tall base that can be installed as-is, or extended with elements that would raise the barrier height above low-profile specifications.
- The **West Virginia Timber Curb** is a bridge railing tested to TL-1 standards.
- **End treatments** tend to be specific for a given barrier. The Armttec, MRSF, FDOT, TTI, and Washington barriers each have associated terminals.
- **Unsuccessful Barriers.** A few experts shared examples of barriers that were developed but never successfully passed crash tests. According to Dick Albin, Washington DOT attempted to develop berm options with a 2/1 slope, but vehicles went over the top. Washington DOT also attempted to create a vertical wall made of concrete blocks connected by a fiberglass pin. These walls collapsed, and vehicles went over the top and rolled, under TL-2 conditions.

## **Tree Setback Regulations**

A recent Caltrans investigation surveyed state DOTs on tree setback requirements. While it focused on controlled-access freeways and conventional highways, it includes details on tree setback requirements for urban roads for many states. Additionally, Maria Ruppe of Ohio DOT has compiled state practices for urban clear zones and medians. Requirements from both sources are summarized below.

## **Gaps in Findings**

There are a number of low-profile barrier examples included in this report. The difference between temporary and permanent barriers is often not clear-cut; many experts consulted cited barriers that are marketed for temporary applications as suitable for permanent installation. Additionally, some of these barriers were tested to European rather than U.S. standards.

## **Next Steps**

Interviews of experts with national organizations revealed a limited number of well-known low-profile barriers. A survey of states may find more variety in barriers that are installed only in particular municipalities.

## Contacts

### U.S. Transportation Agencies

**Richard Albin**

Safety Engineer, FHWA  
Chair, TRB Roadside Safety Design Committee  
[dick.albin@dot.gov](mailto:dick.albin@dot.gov)  
303-550-8804

**Eduardo Arispe**

Operations Research Analyst, Federal Outdoor Impact Laboratory, Turner-Fairbank Highway Research Center  
[eduardo.arispe@dot.gov](mailto:eduardo.arispe@dot.gov)  
202-493-3921

**Nicholas Artimovich**

Highway Engineer, Office of Safety Technologies, FHWA  
[nick.artimovich@dot.gov](mailto:nick.artimovich@dot.gov)  
202-366-1331

**Bob LaJeunesse**, Assistant District Engineer, Prescott District, Arizona

[rlajeunesse@azdot.gov](mailto:rlajeunesse@azdot.gov)  
928-777-5867

### Universities

**Ron Faller**

Interim Director and Research Assistant Professor, Midwest Roadside Safety Facility, University of Nebraska-Lincoln  
[rfaller1@unl.edu](mailto:rfaller1@unl.edu)  
402-472-6864

**Zoltan Rado**

Managing Director, Pennsylvania Transportation Institute  
[zrado@engr.psu.edu](mailto:zrado@engr.psu.edu)  
814-863-7925

### International

**Mark Ayton**

Senior Engineer, Ontario Ministry of Transportation  
[mark.ayton@ontario.ca](mailto:mark.ayton@ontario.ca)  
905-704-2295

**Jan Wenäll**

Research Engineer, VTI, Sweden  
[jan.wenall@vti.se](mailto:jan.wenall@vti.se)

## Barrier Examples

The tables below summarize low-profile barrier options. The first includes barriers generally developed by state DOTs and tested by US test facilities. The second includes barriers developed by private companies, often European; they have a wider range of applications and crash test status. The third table lists end treatments. These terminals generally match specific barriers.

### Low-Profile Barriers Examples—Nonproprietary Options

Barrier	Size	Material	Footing	Crash testing	Additional information
<b>Arizona SR 69 Barrier</b>	20 in. tall, 15 in. wide at top; barrier has a 5% negative slope and is 1 inch narrower at base.	Class S concrete	Footing is 1 foot deep and 38 in. wide.	TL-3, per Bob LaJeunesse, although documentation is not available.	LaJeunesse suggested that this barrier was the same as used on California Highway 99; given the difference in designs, that seems unlikely. See <a href="#">Appendices B to E</a> for drawings, photos, and public comments.
<b>Caltrans Low-Profile Barrier</b>	18-in. tall, 20-in. deep, 100-ft. long. Curb is 6-in. tall, with 12-in. posts and a 3 in. x 8 in. x 3/8 in. structural steel rail.	Concrete footing, structural steel rail.	12 in. x 40 in. below ground; 6 in. x 20 in. above ground.	TL-2; see FHWA Acceptance Letter B-235, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b235.pdf">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b235.pdf</a>	This barrier was designed to meet crash tests while being aesthetically pleasing. A barrier with openings that could be seen through was the leading aesthetic request considered in the barrier's development. Testing soil was in fine sandy silt, 90% relative compaction, optimum moisture content of 12.3%, and maximum dry density of 114.6 pcf. For documentation, photos and technical drawings, see <a href="http://www.dot.ca.gov/newtech/research_reports/reports/2012/california_low_profile_barrier_final_report.pdf">http://www.dot.ca.gov/newtech/research_reports/reports/2012/california_low_profile_barrier_final_report.pdf</a>
<b>Florida DOT Low-Profile Barrier</b>	457 mm (18 in.) tall. 3.66 m (12 ft.) long. Total width is 686 mm (27 in.); back side is angled with a tension rod embedded. 5,000 lbs. per precast section.	Concrete with steel tension rod.	No mechanical anchoring.	TL-2; see FHWA Acceptance Letter B-115, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b115.pdf">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b115.pdf</a>	Installation links are 3-in. diameter shear keys. This barrier is designed for temporary applications, and is suitable for forming curvilinear shapes. A concrete-and-steel end treatment has been developed. For documentation, photos and specifications see <a href="http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_RD/FDOT_BD545_33_rpt.pdf">http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_RD/FDOT_BD545_33_rpt.pdf</a>

Barrier	Size	Material	Footing	Crash testing	Additional information
<b>Midwest Roadside Safety Bridge Rail</b>	508 mm (20 in.) tall, 356 mm (14 in.) wide at top, 279 mm (11 in.) wide at bottom. Segments are 6.1 m (20 ft.) long.	Reinforced concrete (Nebraska 47-BD Mix Type 3) with No. 3 longitudinal, vertical dowel, vertical hoop, and vertical U stirrup reinforcement bars.	N/A	TL-2; see FHWA Acceptance Letter B-116, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b116.pdf">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b116.pdf</a>	This concrete barrier was designed to be a nonproprietary bridge rail. Vertical dowel bars spaced 610 mm apart were attached to concrete apron using an epoxy resin in crash test; in a reinforced concrete deck, they would be bent into an L-shape and tied to transverse deck bars.
<b>Midwest Roadside Safety Rough Stone Masonry Guardrail</b>		Reinforced concrete foundation slab and supporting aggregate base, reinforced concrete core wall, and stone masonry facade.		TL-2; see FHWA Acceptance Letter B-202, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b202.cfm">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b202.cfm</a>	recommended 22-in. height. Installation
<b>Southwest Research Institute Stone Masonry Guardwall</b>	Variable height.	N/A	N/A	N/A	This guardwall was tested in 1994 according to TL-1 and TL-2 impact conditions, as well as non-compliant impact conditions, but an 18-inch barrier failed to safely contain and redirect the 2,000-pound vehicle at TL-2 tests. See the report from the 2010 TRB meeting for details: <a href="http://docs.trb.org/prp/10-0087.pdf">http://docs.trb.org/prp/10-0087.pdf</a> .
<b>Texas Transportation Institute Low-Profile Barrier</b>		Precast reinforced concrete.	None as tested; could be anchored to roadway.	TL-2; see FHWA Acceptance Letter B-36, <a href="http://safety.fhwa.dot.gov">http://safety.fhwa.dot.gov</a>	

Barrier	Size	Material	Footing	Crash testing	Additional information
	slope. Segments are 6,100 mm (20 ft.) long segments.			<a href="#">v/roadway_dept/policy_guide/road_hardware/barriers/pdf/b-36.pdf</a>	developed as a portable barrier, this example is also suitable for permanent applications. The study authors also suggested that a 24-in. tall version of this barrier might be suitable for applications with speeds up to 60 mph, although it appears no testing of such a barrier has taken place. For more information, see <a href="http://d2dtl5nmlpfr0r.cloudfront.net/tti.tamu.edu/documents/990-4F.pdf">http://d2dtl5nmlpfr0r.cloudfront.net/tti.tamu.edu/documents/990-4F.pdf</a>
<b>Texas Transportation Institute Low-Profile Barrier with TL-3 Adaptation</b>	Modification of TTI's TL-2 barrier with a stabilizing rail on the top of the barrier. There are two designs; the roadside version uses a 4-inch, schedule 40 steel pipe supported by a splice plate and 3/4-inch grade eight carriage bolts. A median version uses two pipe rails positioned symmetrically around the barrier's center line. With the rails, the overall height is 39 inches; concrete barrier portion remains 20 inches tall.	Precast reinforced concrete with steel pipe	N/A	TL-3 tests passed, although investigators recommend further testing before field application.	No end treatment was developed for this barrier, but the investigators suggested that a combination of concrete wedge and telescoping tube might prove to be acceptable under TL-3 testing. For documentation, drawings and photos see <a href="http://docs.trb.org/prp/10-2303.pdf">http://docs.trb.org/prp/10-2303.pdf</a>
<b>Washington DOT Low-Profile Traffic Curb, Type 1</b>	20 in. (508 mm) tall. Width is 8 in. (203 mm) at top and 12 in. (305 mm) at bottom; the roadside has a 5% negative slope so the top extends 1 in. (25 mm.) past the bottom.	Reinforced concrete	Feet extend 12 in. below ground at the barrier's full width	N/A	Washington has reportedly installed barriers as low as 18 inches in urban locations where the speed limit is less than 45 mph; those barriers do not appear among the state's plan sheets. For details, see <a href="http://www.fhwa.dot.gov/publications/publicroads/05jul/03.cfm">http://www.fhwa.dot.gov/publications/publicroads/05jul/03.cfm</a> Technical drawings are available at <a href="http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf">http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf</a>

Barrier	Size	Material	Footing	Crash testing	Additional information
<b>Washington DOT Low-Profile Traffic Curb, Type 2</b>	20 in. (508 mm) tall. Width is 9.5 in. (241 mm) at top and 14 in. (356 mm) at bottom. The roadside is not sloped but the top has a projection 1.5 in. wide and 3.5 in. tall.	Reinforced concrete	Feet extend 12 in. below ground at the barrier's full width	N/A	Technical drawings are available at <a href="http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf">http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf</a>
<b>Washington DOT Low-Profile Traffic Curb, Type 3</b>	20 in. (508 mm) tall. Width is 8.5 in. (215 mm) at top and 17 in. (431 mm) at bottom; the roadside has a 5% negative slope so the top extends 1 in. (25 mm.) past the bottom. Back side has a complicated geometry; see drawings for details.	Reinforced concrete	Cement mortar joins barrier to the roadway and joins barrier sections. 1-in. diameter, 3-ft. long steel anchor pins embedded at least 18 in. into the ground also anchor barrier to ground.	N/A	Technical drawings are available at <a href="http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf">http://www.wsdot.wa.gov/publications/fulltext/Standards/psl/GD-3/GD-3.pdf</a>
<b>West Virginia Timber Curb Bridge Railing</b>	19.75 in. tall (502 mm)	Gluelam timber rails (Combination No. 48 Southern Yellow Pine treated with pentachlorophenol in heavy oil), steel H-splice plates, sawn lumber scupper block post assemblies (Grade 1 Southern Yellow Pine)		TL-1; see FHWA Acceptance Letter B-198, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b198.cfm">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b198.cfm</a>	Installation links: H-splice plates with six 1-in. diameter by 14-in. long ASTM A307 galvanized dome-head bolts. For more information, technical drawings and photos, see "Development of a TL-1 Timber, Curb-Type, Bridge Railing for Use on Transverse, Nail-Laminated, Timber Bridges," available on request from Midwest Roadside Safety Facility.

## Low-Profile Barriers Examples—Commercial Options

Barrier	Size	Material	Footing	Crash testing	Additional information
<b>Advantage Precast</b>	100 mm (4 in.) tall, 300 mm (12 in.) wide, 1.8 m (72 in.) long. The shape tapers at each side.	Reinforced concrete	None	The barrier is primarily intended as a divider; due to its low height and tapered shape, cars and emergency vehicles can cross over the top.	Installation links: #4 x 16-in. rebar pins placed 12 in. from each end. These barriers have been installed in Keizer, Oregon. See technical drawing at <a href="http://advantageprecast.com/pdf/Low%20Profile%20Median%20Barrier.pdf">http://advantageprecast.com/pdf/Low%20Profile%20Median%20Barrier.pdf</a> .
<b>Armtec Product 7-0076-2</b>	450 mm (18 in.) tall, 600 mm (24 in.) wide in a triangular shape. 3 m (10 ft.) long.	Sulphate-resistant concrete	N/A	N/A	For technical drawings, see <a href="http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf">http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf</a> .
<b>Armtec Product SP35410</b>	450 mm (18 in.) tall and 450 mm (18 in.) wide, in a triangular shape. 3 m (10 ft.) long.	Sulphate-resistant concrete	N/A	N/A	Installation links: 220 mild steel bar at each end for product SP35410. For technical drawings, see <a href="http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf">http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf</a> .
<b>Armtec 400 mm wide barrier</b>	450 mm (18 in.) tall and 400 mm (16 in.) wide. This version is vertical for the first 219 mm (9 in.) and triangular at the top. 3 m (10 ft.) long.	Sulphate-resistant concrete	N/A	N/A	For technical drawings, see <a href="http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf">http://files.armtec.com/Downloads/Categories/Highway-Safety/Barriers.pdf</a> .
<b>Duo-Rail</b>	538 mm (21 in.) tall, 608 mm (24 in.) wide, 5.85 m (19 ft. 2 in.) long. 510 kg	Steel	N/A	EN 1317-2; Containment Level T3, Working Width Level W4, Impact Severity Level A	Duo-Rail is a modular barrier system offered by Heintzmann Gruppe in Germany. It consists of a base element that measures 538 mm (21 in.) tall, with mounting elements that can be added to increase the height and performance level. Mounting elements are 280 mm (11 in.) tall each, so any applications including them would not be considered low profile for the purposes of this investigation. For documentation, drawings and photos, see <a href="http://www.heintzmann.eu/fileadmin/Dateien/Unternehmen/SGGT_STA/PDF/Duo-Rail_engl..pdf">http://www.heintzmann.eu/fileadmin/Dateien/Unternehmen/SGGT_STA/PDF/Duo-Rail_engl..pdf</a> .

Barrier	Size	Material	Footing	Crash testing	Additional information
<b>ProTec 100</b>	560 mm (22 in.) tall, 120 mm (4.7 in.) wide, 6 m (20 ft.) long, 744 kg	Concrete and steel	Foot width is 250 mm (9.8 in.)	EN 1317-2; Containment Level T3, Working Width Level W2, Impact Severity Level A. At Containment Level T1, meets Working Width Level W1. *	The company's materials market this barrier for mobile applications. Zoltan Rado of the Pennsylvania Transportation Institute said that the barrier is used for both temporary and permanent installations, however. For documentation of the system, including photos and specifications, see <a href="http://www.protec-schutzwandsysteme.de/fileadmin/user_upload/PDF/protec_100/Prospekt_ProTec_100_English.pdf">http://www.protec-schutzwandsysteme.de/fileadmin/user_upload/PDF/protec_100/Prospekt_ProTec_100_English.pdf</a> .

\* See [http://www.volkmann-rossbach.com/en\\_1317\\_eng.html](http://www.volkmann-rossbach.com/en_1317_eng.html) for an overview of EN-1317-2 requirements and [http://www.rrs.erf.be/index.php?option=com\\_content&view=article&id=11&Itemid=2](http://www.rrs.erf.be/index.php?option=com_content&view=article&id=11&Itemid=2) for definitions of terms.

### End Treatment Examples

End treatment	Size	Material	Footing	Crash testing	Additional information
<b>Arizona SR 69 End Treatment</b>	Height tapers from 20 in. to 6 in. Width tapers from 14 in. to 6 in. Length of transition segment is 12 ft.	Class S concrete	Footing is 1 foot deep and 38 in. wide.	TL-3, per Bob LaJeunesse, although documentation is not available.	LaJeunesse suggested that this barrier was the same as used on California Highway 99; given the difference in designs, that seems unlikely.
<b>Armtec Product Number 7-0076-2</b>	2 m (6.5 ft.) long and connects to the 600 mm x 450 mm triangular low-profile barrier. It maintains the triangular shape for the first 500 mm (20 in.), before tapering to 76 mm (3 in.) tall by 600 mm (24 in.) wide.	Sulphate-resistant concrete	N/A	N/A	N/A
<b>Armtec Product number SP35411</b>	1.2 m (4 ft.) long and connects to the 450 mm (18 in.) x 450 mm (18 in.) triangular low-profile barrier. It maintains the triangular shape for the first 300 mm (12 in.), before tapering to 150 mm (6 in.) tall and 450 mm (18 in.) wide at the terminal end.	Sulphate-resistant concrete	N/A	N/A	N/A

End treatment	Size	Material	Footing	Crash testing	Additional information
<b>Florida DOT Low-Profile Barrier End Treatment</b>	Tapers from 457 mm (18 in.) to 50 mm (2 in.) tall over the 6 m (20 ft.) length of the end treatment. The end treatment has two sections: a 3.6 m (12 ft.) concrete section that attaches to the barrier and a 2.4 m (8 ft.) steel segment that terminates the barrier.	Concrete and steel	None	TL-2; see FHWA Acceptance Letter CC-106, <a href="http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/cc106.pdf">http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/cc106.pdf</a>	Two 1 1/4-in. diameter high-strength threaded bars connect the concrete segment to the barrier. This end treatment's nearly symmetric shape makes it reversible. For more information see the report "Temporary Low-Profile Barrier for Roadside Safety: Phase II" at <a href="http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_CN/FDOT_BC976.pdf">http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_CN/FDOT_BC976.pdf</a>
<b>Midwest Roadside Safety Bridge Rail End Treatment</b>	The end section starts with a 1,524-mm (5-ft.) long transition section that retains the full 508 mm (20 in.) height and 356 mm (14 in.) top width of the bridge rail, but tapers out at the bottom from 279 mm (11 in.) wide at the rail to 356 mm (14 in.) wide at the start of the terminal. The terminal is 4,572 mm (15 ft.) long and tapers from 508 mm (20 in.) tall to 102 mm (4 in.) tall at the end, while retaining the 356 mm (14 in.) width throughout.	Reinforced concrete (Nebraska 47-BD Mix Type 3) with No. 3 longitudinal, vertical dowel, vertical hoop, and vertical U stirrup reinforcement bars.	N/A	Because the end treatment was similar to the Texas Transportation Institute's end treatment (see below), investigators believed testing of this end treatment was unnecessary.	Vertical dowel bars spaced 610 mm apart were attached to concrete apron using an epoxy resin in crash test; in a reinforced concrete deck, they would be bent into an L-shape and tied to transverse deck bars. For documentation, technical drawings and photos, see <a href="http://guides.roadsafellc.com/Documents/SBC53b/OtherDocs/TRP-03-109-02.pdf">http://guides.roadsafellc.com/Documents/SBC53b/OtherDocs/TRP-03-109-02.pdf</a> .
<b>Texas Transportation Institute Low-Profile Barrier End Treatment</b>	Overall length is 6.1 m (20 ft.). The barrier's height (510 mm/20 in.) and width (710 mm/28 in. at the top, 660 mm/26 in. at the bottom) are maintained for 1.5 m (5 ft.) at the connection end. Over the last 4.6 m, the height tapers to 102 mm (4 in.). The width tapers to 365 mm (14.4 in.) at the top and 356 mm (14 in.) at the bottom, maintaining the 5% negative slope that appears throughout the barrier.	Precast reinforced concrete	None as tested; could be anchored to roadway.	TL-2	Two ASTM A36 Steel bolts, which pass through bulkheads at the end of troughs in each segment end, connect end treatment to barrier. For more information, see <a href="http://workzone.eng.wayne.edu/compendium/Research_Reports/11-15.pdf">http://workzone.eng.wayne.edu/compendium/Research_Reports/11-15.pdf</a> .

End treatment	Size	Material	Footing	Crash testing	Additional information
<b>Washington DOT Low-Profile Traffic Curbs, Type 1</b>		Reinforced concrete	Feet extend 12 in. below ground at the barrier's full width.	TL-2	N/A
<b>Washington DOT Low-Profile Traffic Curbs, Type 2</b>	Tapers over the 11 ft., 4 in. (3.454 m) length of the transition to 6 in. (152 mm) tall with widths of 6 in. (152 mm) at the base and 5.5 in. (140 mm) wide at the top.	Reinforced concrete	Feet extend 12 in. below ground at the barrier's full width.	TL-2	N/A

## Related Barrier Resources

### Interviews

**Richard Albin**, Safety Engineer, FHWA. Chair, TRB Roadside Safety Design Committee

[dick.albin@dot.gov](mailto:dick.albin@dot.gov)

303-550-8804

Albin cited three tested low-profile barriers: TxDOT's 20-inch precast barrier, FDOT's 18-inch precast barrier, and Midwest Roadside Safety's 20-inch barrier. He is not aware of any research to develop new barriers.

When he was working for Washington DOT, there was some testing of berm options with a 2/1 slope. Testing was unsuccessful; vehicles went over the top of the berm. Washington DOT also tested a vertical wall made of concrete blocks with a fiberglass pin connection. That design also failed; the top blocks collapsed and the vehicle went over the top and rolled at TL-2 crash conditions.

The low-profile barrier used in the Des Moines case study was developed as a precast barrier, but the Des Moines implementation was cast in place. Under those conditions, plantings are permitted. The state has used the barrier design in other places, particularly where left turns needed to be restricted and to permit trees in the median.

The AASHTO Roadside Design Guide is based on [NCHRP Report 612](#) on roadside treatments in urban areas. 80% of crashes into fixed objects occur when those fixed objects are less than 4 ft. from the curb, and 90% of crashes occur when the fixed objects are within 6 ft. of the curb. As a result, 4 ft. is the minimum tree setback, and 6 ft. is recommended.

Albin also cited a Caltrans study, "Safety of Median Trees with Narrow Clearances on Urban Conventional Highways," that found that there are more pedestrian crashes when there are trees in the median. Phase III of the study is available at

<http://cdm16255.contentdm.oclc.org/cdm/singleitem/collection/p266401coll4/id/2684/rec/11>.

**Eduardo Arispe**, Operations Research Analyst, Federal Outdoor Impact Laboratory, Turner-Fairbank Highway Research Center

[eduardo.arispe@dot.gov](mailto:eduardo.arispe@dot.gov)

202-493-3921

The Federal Outdoor Impact Laboratory has done limited research on low-profile barriers. Typically they have involved a low-profile concrete barrier with something mounted on top. What research they have done has been on behalf of the Department of State, so further details cannot be divulged.

**Nicholas Artimovich**, Highway Engineer, Office of Safety Technologies, Federal Highway Administration

[nick.artimovich@dot.gov](mailto:nick.artimovich@dot.gov)

202-366-1331

The low-profile barriers he is aware of are the Caltrans Low-Profile Barrier, the Midwest Roadside Safety Low-Profile Bridge Rail, the Midwest Roadside Safety Rough Stone Masonry Guardwall, and the West Virginia Timber Curb Type Bridge Railing, as well as the non-fixed work zone barriers designed by Texas and Florida.

**Mark Ayton**, Senior Engineer, Ontario Ministry of Transportation  
[mark.ayton@ontario.ca](mailto:mark.ayton@ontario.ca)  
905-704-2295

In Ontario, there is no provincial direction for municipalities in road design, and also no federal requirements. Municipalities can choose their own options.

Several municipalities use a raised curb with planters for median islands in areas with speeds of 50 km/hour or less. They are primarily for aesthetics and traffic calming purposes rather than shielding trees or deflecting vehicles in crashes.

Windsor has installed a raised island on the arterial road through town to the Ambassador Bridge. This has a similar purpose - aesthetics and pedestrian control. See photos, via Google Earth, in [Appendix A](#).

**Ron Faller**, Interim Director and Research Assistant Professor, Midwest Roadside Safety Facility, University of Nebraska-Lincoln  
[rfaller1@unl.edu](mailto:rfaller1@unl.edu)  
402-472-6864

In addition to the Texas, Florida, Caltrans, and Midwest low-profile barriers that are widely known, the Midwest Roadside Safety Facility has tested two wood low-profile bridge rails, one for West Virginia and one for the Forest Products Lab. The MRSF has also tested a lower-height aesthetic masonry wall for parks. The masonry wall is an expensive option and primarily for aesthetic purposes.

**Bob LaJeunesse**, Assistant District Engineer, Prescott District, Arizona  
[rlajeunesse@azdot.gov](mailto:rlajeunesse@azdot.gov)  
928-777-5867

Arizona DOT installed a low-profile barrier on the median of Highway 69 in Prescott. The design was the same as the one used in California Highway 99. (However, drawings of the barrier provided by LaJeunesse indicate that the barrier is 20 inches tall with a 5% negative slope like the Washington or Texas Transportation Institute examples, although with an anchoring foot significantly wider than the barrier below ground.) He believes that it was TL-3 tested, per Arizona's criteria. See [Appendices B to E](#) for drawings of the barrier and curb, photos and an overview of public comments on the barrier.

The median has no trees. One small portion of the median does have some bushes. Arizona has no tree setback requirements in medians.

The barrier is located in a dark area, so the state wanted to add reflectors. Because of concern that they would be scraped off if positioned on the side of the barrier, these reflectors were mounted on the top. Thus far, that positioning has been successful.

The end of the barrier transitions to a 6-inch curb height.

**Zoltan Rado**, Managing Director, Pennsylvania Transportation Institute  
[zrado@engr.psu.edu](mailto:zrado@engr.psu.edu)  
814-863-7925

He has been in contact with manufacturers and patent holders in Europe and the Middle East; they are generally not public, however. They were never tested at PTI, he is aware of them from initial discussions he had.

He did have one public option, the ProTec 100. While marketed as a mobile barrier in the company's documents, Rado said it is used for both temporary and permanent installations.

**Jan Wenäll**, Research Engineer, VTI, Sweden

[jan.wenall@vti.se](mailto:jan.wenall@vti.se)

VTI has tested several barriers, although generally between 700 and 1000 mm in height (27.5 to 39.4 in.).

On behalf of the Swedish Transport Administration, Wenäll conducted crash tests on steel beam barriers installed too low, to simulate the effect of asphalt restorations when the proper barrier height adjustment is not done. Results of this testing have not yet been presented. However, he shared that if a standard W-beam barrier (700 mm/27.6 in. tall) is lowered 4 to 6 inches, it will fail crash test EN1317-2 TB32, which entails a 1,500 kg vehicle impacting at 110 km/hour at a 20-degree angle; the vehicle ran over the barrier with nearly no redirection.

End treatments are a problem, and EN1317 has no internationally accepted procedure for terminal testing. As a result, only a few manufacturers have tested according to preliminary ENV1317-4 or prEN1317-7 standards. He has tested three products with good results, but as documentation is not finished there is no formal acceptance. He expects product development to take off once the EN1317 series is published, likely in early 2014.

For concrete barriers, he has only seen sloped down terminals successfully. One attempt used grout-foamed crushable concrete block to create a yielding absorbing end terminal, but it failed.

## **Literature**

**"ADOT kicks off construction on Hwy. 69 median barrier project" by Cindy Barks, *The Daily Courier*, October 2010**

<http://www.dcourier.com/main.asp?TypeID=1&ArticleID=86570&SectionID=1&SubSectionID=1&Page=2>

A newspaper report on the installation of low-profile barriers on Highway 69 in Arizona.

**Mitigation Strategies for Design Exceptions, FHWA, July 2007**

[http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter7/7\\_lowbarrier.htm](http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter7/7_lowbarrier.htm)

Chapter 7 of this FHWA document provides a case study of Des Moines, Washington, which had installed the WSDOT Low-Profile Barriers detailed above on State Route 99.

# Tree Setbacks

## Trees and Highway Safety Preliminary Investigation

“Trees and Highway Safety,” a 2010 Preliminary Investigation conducted by CTC & Associates on behalf of Caltrans, included a survey of state DOTs on tree setback requirements for roadways and medians. While that survey focused on controlled-access freeways and conventional highways, several states included details on requirements for urban roads with lower speed limits.

That report also includes a spreadsheet from Maria Ruppe of Ohio DOT, who had compiled state practices for urban clear zones and medians. Some states do not have a well-defined policy or use the *Roadside Design Guide*, while others have strict standards.

“Trees and Highway Safety” Preliminary Investigation is available at:  
[http://www.dot.ca.gov/research/researchreports/preliminary\\_investigations/docs/tree\\_safety\\_pi\\_3-18-10.pdf](http://www.dot.ca.gov/research/researchreports/preliminary_investigations/docs/tree_safety_pi_3-18-10.pdf).

States with noteworthy requirements include:

**Arizona:** 1.5-foot offset from curbed median, according to Maria Ruppe's findings. According to Bob LaJeunesse, Assistant District Engineer for the Prescott District, Arizona has no tree setback requirements.

**Delaware:** Medians can be planted if there is sufficient space to maintain plantings. Trees of more than 4 inches caliper at maturity are not planted in medians unless there is a barrier curb and sufficient driver recovery space. Trees may be planted 2 feet behind 8-inch or taller barrier curbs or 4 feet behind guard rails, if road speed is low enough to prevent cars from mounting the curbing.

**Florida:** Trees are allowed in medians on roadways with speeds of 45 mph or less. Trees must be 6 feet from inside traveled lane.

**Georgia:** In urban areas, trees must be 8 feet from the curb face on roads of 35mph or less; 16 ft. from the curb face on 40 mph roads, and 22 ft. from the curb face on 45mph roads.

**Hawaii:** Trees of more than 4 inches caliper at maturity can be planted only in curbed medians greater than 8 ft. in width on roads of 35 mph posted speed or less.

**Indiana:** 10-foot offset from curbed median.

**Kansas:** 6-foot offset from curbed median.

**Massachusetts:** 19.7 inch offset from curbed median in central business districts or local roads with curbs.

**Nevada:** No trees where speed limits are above 45 mph. On 35–45 mph roads, 4-in. caliper width trees are permitted with 20-ft. widths. Context Sensitive Solutions may be applied on a case-by-case basis.

**South Carolina:** Required setback ranges from 1.5 ft. to 26 ft., depending on features, roadway speed, and traffic volume. A chart is available in chapter 9 of the Access and Roadside Management Manual, available at <http://www.scdot.org/getting/pdfs/roadsideManual.pdf>.

**Virginia:** 8-foot minimum setback for canopy trees; 1.5-foot minimum with a design waiver.

**Wisconsin:** 2-foot setback from face of curb.

The AASHTO *Roadside Design Guide* states that 4 ft. should be the minimum tree setback in urban areas, and 6 ft. is recommended. It is based on *NCHRP Report 612* ([http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_612.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_612.pdf)) on roadside treatments in urban areas. Eighty percent of crashes into fixed objects occur when those fixed objects are less than 4 ft. from the curb, and 90% of crashes occur when the fixed objects are within 6 ft. of the curb.

## **Related Documents**

### **NCHRP Report 612: Safe and Aesthetic Design of Urban Roadside Treatments, 2008**

[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_612.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_612.pdf)

Pages 20–23 of this report include guidelines for roadside plantings, but guidance for medians is also included from two jurisdictions: New South Wales, Australia (minimum of 2.5 m lateral distance between trees and nearest travel ways), and Simi Valley, California (spacing can vary based on tree type).

### **Safety of Median Trees with Narrow Clearances on Urban Conventional Highways, Applied Research and Development Facility for the California Department of Transportation, 2004**

Phase III: <http://cdm16255.contentdm.oclc.org/cdm/singleitem/collection/p266401coll4/id/2684/rec/11>

This study investigated the safety of placing large trees in medians of state highways in urban areas. A review of clearance standards found a wide range, with little empirical evidence to justify standards.

# APPENDIX A





SR 69 Low-Profile Median Barrier Project  
Sundog Ranch Road to Sunrise Boulevard  
Public Meeting Summary  
February 10, 2010

Meeting date: Wednesday, February 10, 2010  
5:00 p.m. to 7:00 p.m.

Meeting Location: Wyndham Garden Hotel, 4499 E. State Route 69, Prescott, 86301

Participants: 110 community members signed in

**Project Overview**

The Arizona Department of Transportation (ADOT) is planning to install a low-profile raised concrete median on State Route 69 between Prescott and Prescott Valley from Sundog Ranch Road to Sunrise Boulevard. Project improvements include:

- Safety improvements resulting from regulation of turn movements.
- Installation of low-profile raised concrete median. Breaks in the median providing left turn access from SR 69 will be located at Baker Street (Victorian Estates), Diamond Drive, Ramada Drive, and Robin Drive.
- Installation of new traffic signals at the intersections of SR 69 and Ramada Drive, Robin Drive, and Diamond Drive.
- Application of a layer of rubberized asphalt.
- Removal and replacement of pavement markers and signs.
- Reduction of posted speed limit to 45 miles per hour.

Construction is scheduled to begin in the summer of 2010 and last approximately six months.

**Public Meeting Notification**

Originally a public meeting was scheduled on Thursday, January 21 which was cancelled and rescheduled to Wednesday, February 10 due to unfavorable weather conditions.

For the meeting originally scheduled on Thursday, January 21, 2010 ADOT:

- Mailed 3,799 postcards to community members and business owners adjacent to the project corridor on January 13, 2010.
- Published a newspaper ad in the Prescott Daily Courier and the Prescott Valley Tribune on Wednesday, January 13, 2010.
- Distributed an electronic email to a list of more than 550 individuals on Wednesday, January 13, 2010.

For the meeting rescheduled on Wednesday, February 10, 2010 ADOT:

- Mailed 3,343 postcards to community members and business owners adjacent to the project corridor on January 27, 2010. The second mailing excluded all postcards returned from the first mailing.
- Published a newspaper ad in the Prescott Daily Courier and the Prescott Valley Tribune on Wednesday, February 3, 2010.
- Distributed electronic emails to a list of more than 550 individuals on Wednesday, January 27, 2010 and Thursday, February 4, 2010.



SR 69 Low-Profile Median Barrier Project  
Sundog Ranch Road to Sunrise Boulevard  
Public Meeting Summary  
February 10, 2010

**Public Meeting Overview**

ADOT hosted a public meeting on Wednesday, February 10 at the Wyndham Garden Hotel. The meeting began with a brief presentation given by Bill Pederson, ADOT Public Information Officer, and Alvin Stump, ADOT Prescott District Development Engineer followed by a question and answer session led by Mr. Pederson and Mr. Stump. Both answered questions and addressed concerns the community expressed about access, funding, traffic signal timing, and construction schedule. ADOT and its representatives were on hand to discuss the project one-on-one with the community. In total, 110 community members attended the meeting and actively participated by asking many questions. All meeting publicity material can be found in Appendix: Publicity and Meeting Materials.

**Comments received in writing**

- Thank you very much. Randy Blake was extremely knowledgeable and approachable. I was late for the presentation because of family obligations; however, I had all my questions answered and walked away feeling good about the project. Keep up the great work. Again thank you for making our community safer. Also keep thinking roundabouts. Thank you to Randy, Alvin, and Bill Pederson.
- Thank you!
- The 20-inch height of the proposed barriers is too low. My Camry headlights are 32-inches. California (Los Angeles) started with shorter barriers and they were worse than nothing. On coming headlights were above the barriers and blinding drivers going against traffic. You should consider barriers at least 36-inches high, otherwise you'll be doing this a second time like California which has now added height to older barriers and new ones. Consider doing it right the first time.
- I would like to be able to make a left turn onto SR 69 at Victorian Estates.
- Thank you for taking the resident's concerns into consideration! The plan described today addresses all my concerns as a resident of Diamond Valley by including:
  1. Three lights
  2. 45 mile per hour speed limit
  3. Left turn lanes at the three new lights.

I didn't think at first the residents would have any input. Thank you for all your ears.

- Three lights with ADOT's timing will bring more pollution. This can be done with one light and local streets used to access that one light. This looks like a highway being turned into an avenue.
- Getting out onto SR 69 using lights concerns me because I have had to wait a long time at other lights when traffic is minimal or none at all.

Additional comments are scanned on the following page.

February 9, 2010

Arizona Department of Transportation and Federal Highway Administration

Re: Low-Profile Median Barrier Project State Route 69 Sundog Ranch Road to Sunrise Boulevard

Gentlemen:

We would like to offer an alternative plan for adjusting traffic flow on route 69 between Sundog Ranch Road and Sunrise Boulevard.

We feel the motorists that use this thoroughfare and the 3 intersecting roads would benefit more from our suggestions without the State spending funds it doesn't have.

The suggestions are as follows:

Drop the speed limit between Sundog Ranch Road and Sunrise Boulevard to 45 mph.

Post that speed every 1/2 to 1/3 mile or at least twice between the 3 intersecting roads within the unincorporated areas.

Increase the road "night time in pavement reflectors" to better illuminate the roadway in this very dark stretch of route 69 between Walker Road and Sundog Ranch Road.

Offer stop and go traffic signals that are only motion activated from the 3 crossing intersections for vehicular traffic that wants to enter onto Route 69.

The turn lanes to leave Route 69, could have pressure sensors in them to activate a turn arrow, stopping east - west traffic so the turn could be made safely. These signals would not impede the flow of traffic that moves through Prescott into Prescott Valley and visa-versa as long as they were motion or pressure activated.

A road divider is not the answer. This is a small community with a few growing pains. The traffic engineers should consider these alternatives so our roadways don't end up looking like the messed up mumbo jumbo of some of the Eastern States. This concept would control the traffic; keep it moving in all weather conditions, and save lives.

If you would like to discuss these ideas with us "down the road", we'd be happy to talk to you.

Mark & Evelyn Ziven  
1029 Sunrise Blvd.  
Prescott, Arizona 86301

928-778-2112



**Question and Answer Session**

QUESTION	ANSWER
<b>Traffic Signals</b>	
How will the new traffic signals be controlled?	The traffic signals will have loop detectors that will detect the presence of vehicles.
Are traffic lights activated?	The traffic signals will have loop detectors that will detect the presence of vehicles.
Can you synchronize the lights from Frontier Village, Walmart, and the mall to the three new lights?	Yes, the traffic signals will be synchronized to the posted speed limit of 45 mph.
Can you synchronize the three new lights to the Prescott Valley Home Depot into Prescott Valley?	Yes, the traffic signals will be synchronized to the posted speed limit of 45 mph.
Will through traffic lights be synchronized toward Prescott?	Yes, the traffic signals will be synchronized to the posted speed limit of 45 mph.
Will we be able to turn right at the lights on red? Or will we have to wait for green to turn?	Yes, you will have the option to turn right when the traffic signals are red, providing the turn is safe.
Will there be left turn arrows at signals?	Yes, there will be protected left turns.
Will the lights be synchronized at 45 mph?	Yes, the traffic signals will be synchronized to the posted speed limit of 45 mph.
Have you considered the delay that the three new signals will create?	If driving the speed limit, these signals will not cause additional delay. All signals are synchronized to 45 mph speed limits.
Why is there no signal at Victorian Estates?	The entrance to Victorian Estates is a private driveway, not a public roadway.
<b>Left turn access</b>	
I live on Rhinestone Drive. How do you justify not having an opening in the barrier to show residents on Rhinestone and/or Turquoise (across SR 69) to access their homes without making u-turns every time? What about emergency services accessing our homes in a reasonable time by making u-turns? I am not opposed to the project if a median break or traffic signal is installed where I live.	The reason for the project is to improve safety. To improve safety this median barrier is being installed to control left turns onto SR 69. The placement of median barrier breaks was determined based upon traffic volumes. Rhinestone drive does not generate as much traffic as other intersections within the project limits.
Can we make left turns from Robin Drive onto SR 69 during construction?	Yes, left turns from Robin Road onto SR 69 will be allowed during construction. This is one reason that traffic signals will be constructed towards the beginning of construction.
Will we be able to make left turns at Old Black Canyon Highway?	Yes, left turns at Old Black Canyon Highway will be allowed.
Can I make a left turn at Robin Drive to go toward Prescott Valley?	Yes, left turns at Robin Drive will be permitted.



SR 69 Low-Profile Median Barrier Project  
 Sundog Ranch Road to Sunrise Boulevard  
 Public Meeting Summary  
 February 10, 2010

QUESTION	ANSWER
Where does the left turn for Prescott bound traffic at Robin Drive go?	There are streets east of SR 69, that will be accessed by turning left at Robin Drive when headed to Prescott. U-turns will be necessary.
<b>Construction</b>	
How loud will the construction equipment be at night?	Construction work at night will depend on the contractor selected for the project as well as their phasing schedule. Project construction updates will be available throughout construction.
Prescott is a tourist community. Can the work be completed prior to the Fourth of July?	Construction will not take place on the Fourth of July and is anticipated to be complete within six months. The project should be complete by Fourth of July 2011.
During construction what kind of impact will it have on the Yavapai Hills Entrance?	During construction, traffic signals will be operational once constructed. Two lanes of traffic will be maintained during daytime hours. Some night work is anticipated, but will reduce impacts during heavy travel times.
When will construction start?	Construction is anticipated to begin in the summer of 2010.
Is it possible to extend the rubberized asphalt from Sunrise Boulevard west to the Costco traffic intersection? The noise pollution is an issue for those of us living parallel to SR 69 west from Sunrise Boulevard. Rubberized asphalt would improve the noise pollution issue among other benefits.	Applying a layer of rubberized asphalt between Sunrise Boulevard and the Costco intersection is not included in this project because of funding. ADOT assess all roadways annually and appropriately allocates funding based upon need. This segment will need to be resurfaced in the near future.
Will ADOT be employing local labor forces and companies to complete the project	ADOT will hire a contractor using a bidding method. Once a contractor is selected, it will be their responsibility to hire subcontractors to perform work.
At any time will Robin, Diamond, or Ramada be closed to traffic or will SR 69 be routed through any of these residential areas?	During construction, ADOT will maintain two lanes of traffic during the day hours. The traffic signals will be constructed first to reduce impacts to residents.
<b>Median Barrier Design</b>	
Is the center filled with colored stones or desert plants?	The center of the median will be concrete; however, the Town of Prescott Valley will provide landscaping for the segment within the town limits.
Is there any color in the concrete such as we find by the beautiful freeways in the Valley?	The concrete will not be colored.
Will the area between curbs be concrete or aggregate?	The center of the median will be concrete; however, the Town of Prescott Valley will provide landscaping for the segment within the town limits.



SR 69 Low-Profile Median Barrier Project  
 Sundog Ranch Road to Sunrise Boulevard  
 Public Meeting Summary  
 February 10, 2010

QUESTION	ANSWER
It appears the low-profile will be even less effective than the SR 101 cable barriers were in Scottsdale. Will it take more deaths to get a real solution?	This is a FHWA approved project. Studies have shown that this type of barrier is effective in reducing vehicles from crossing over into oncoming traffic. This type of barrier is a compromise based upon community input received.
How was the effectiveness of a 20-inch curb determined as to its ability to prevent all vehicles from crossing the curb into oncoming traffic?	The planned 20-inch low profile barrier is highway safety feature recommended by the Federal Highway Administration and the National Cooperative Highway Research Program. These barriers are also used in the state of Washington.
What is the purpose of the ramp at the end of the median?	This ramp is designed to lessen the impact the barrier may have on a vehicle.
Will the ramps at the end of the barriers have reflectors?	Yes, there will be reflectors for drivers to identify these barriers at night.
<b>Speed Limit</b>	
Will the speed limit change to 45 miles per hour (mph) all the way from Prescott Valley to Costco? It is dangerous coming out of Sunrise Boulevard and seeing an immediate 35 mph sign which goes back right away anyway.	The speed limit will be reduced to 45 mph.
Any plans to monitor the 45 mph speed limit? 55 mph is not being recognized at the present time.	Enforcement of the speed limit is an issue for the Department of Public Safety (DPS) and local jurisdictions. ADOT works with DPS to ensure that highways are patrolled by officers.
Once the project is complete and speed limits are lowered, would ADOT consider removing the right turn only movements at Victorian Estates?	ADOT is installing barriers to improve safety through the area. The worst traffic accidents are a result of left turn movements onto highways from side streets. The right turn only will prevent future accidents of this nature.
What will be the speed limit between Old Black Canyon Highway and Costco?	The speed limit between Old Black Canyon Highway and Costco will be reduced from 55 mph to 45 mph.
<b>U-Turns</b>	
Are you looking at no right turns while a u-turn is being made?	No, vehicles turning right at a red light must always yield to traffic.
I see no present turns for homes east of SR 69. Why? Turquoise and Opal can only be accessed from Prescott but not Prescott Valley.	You can access these roads by making a u-turn at Robin Drive.
Will intersections be widened to allow for u-turns?	Yes, the intersections will be wide enough to allow for a u-turn movement.



SR 69 Low-Profile Median Barrier Project  
 Sundog Ranch Road to Sunrise Boulevard  
 Public Meeting Summary  
 February 10, 2010

QUESTION	ANSWER
Will u-turns be allowed?	Yes, u-turns will be allowed at Robin Drive, Ramada Drive, and Baker Street. U-turns at Diamond Drive heading to Prescott will not be allowed.
<b>Emergency Access</b>	
What happens when an accident occurs on a two lane road which usually blocks both lanes? I have seen a three lane road where one lane remains open.	The median wall should reduce severe accidents and fatalities, thus reducing lanes blocked caused by an accident.
Will the lights have pre-emption for emergency response vehicles?	Emergency vehicle signal pre-emption equipment will be available to the local agencies upon their request and agreement to fund the associated costs.
Will there be an emergency lane?	The outside lane is utilized as an emergency lane. Traffic is required by law to pull over and stop when emergency vehicles are approaching.
<b>Miscellaneous</b>	
What is the benefit to our local environment along the project route?	These improvements are focused on safety.
Will property taxes go up?	Highway construction is not funded by general tax revenues such as property taxes, sales taxes, and income taxes. This project will not affect property taxes because it is funded by the federal highway safety program.
When are you going to make this a six lane road as it should have been years ago?	The roadway will become six-lanes once traffic volumes increase enough to warrant additional lanes. ADOT would like to widen the roadway sooner rather than later.
How much will the project cost?	The project will cost \$3.1 million.
Is rubberized asphalt "quiet" pavement?	Rubberized asphalt is a quieter type of pavement.
What about a frontage road between Onyx and Turquoise?	A frontage road would be outside of ADOT right-of-way. Yavapai County would be responsible for a frontage road.
What is the length between Diamond Drive and Robin Drive?	The distance between Diamond Drive and Robin Drive is approximately one mile.
Is this project fully funded?	The project is fully funded through a federal Highway Safety Enhancement grant.
Victorian Estates has access with a median break, what about that option on Onyx or other Diamond Valley roads?	In Diamond Valley, median breaks and traffic signals will be provided at Diamond Drive, Ramada Drive, and Robin Drive.
Will you please reconsider a left at Onyx Drive?	Due to high traffic volumes, it was determined that a protected u-turn at a signal would be safer than unprotected turns at Onyx Drive.



SR 69 Low-Profile Median Barrier Project  
Sundog Ranch Road to Sunrise Boulevard  
Public Meeting Summary  
February 10, 2010

Appendix: Publicity and Meeting Materials

ARIZONA DEPARTMENT OF TRANSPORTATION  
AND FEDERAL HIGHWAY ADMINISTRATION

# PUBLIC MEETING

## State Route 69 Low-Profile Median Barrier Project

Join ADOT to learn more about the  
improvement project and discuss  
with team members.

### Wyndham Garden Hotel

(formerly Prescott Inn and Suites)

**Thursday, January 21, 2010 • 5 p.m. to 7 p.m.**

A brief presentation will begin at 5:15 p.m.

Representatives of ADOT and the project team  
will be available at the meeting to provide  
information, answer questions, and discuss the  
project with the community.

For more information regarding the improvement  
project please contact Bill Pederson, ADOT  
Prescott District Public Information Officer at  
**602.712.8069** or **bpederson@azdot.gov**.

More information regarding all projects in the  
Prescott District can be found at  
**[www.azdot.gov/PrescottProjects](http://www.azdot.gov/PrescottProjects)**.

SR 69 Median Barrier Project  
c/o KDA Creative  
4545 E. Shea Blvd., Ste. 210  
Phoenix, AZ 85028



Federal Highway  
Administration



ADOT

ARIZONA DEPARTMENT OF TRANSPORTATION AND FEDERAL HIGHWAY ADMINISTRATION



# PUBLIC MEETING

Thursday, January 21, 2010 • 5 p.m. to 7 p.m.

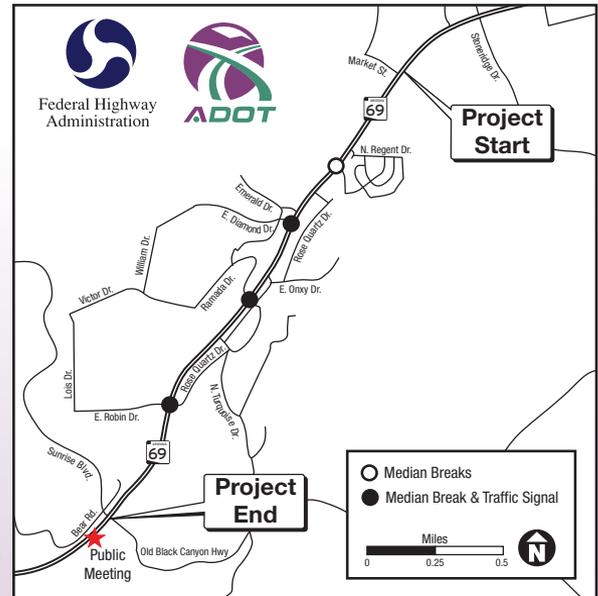
Wyndham Garden Hotel • 4499 E. State Route 69 • Prescott, AZ 86301  
(formerly Prescott Inn and Suites)

## STATE ROUTE 69 Low-Profile Median Barrier Project

The Arizona Department of Transportation is planning to install a low-profile raised concrete median on State Route 69 between Prescott and Prescott Valley from Sundog Ranch Road to Sunrise Boulevard. Construction is scheduled to begin in 2010 and last approximately six months.

### Project improvements include:

- Safety improvements resulting from regulation of turn movements.
- Installation of a low-profile raised concrete median. Breaks in the median providing left turn access from SR 69 will be located at Baker Street (Victorian Estates), Diamond Drive, Ramada Drive, and Robin Drive.
- Installation of new traffic signals at the intersections of SR 69 and Ramada Drive, Robin Drive, and Diamond Drive.
- Application of a layer of rubberized asphalt.
- Removal and replacement of pavement markings and signs.
- Reduction of posted speed limit to 45 miles per hour.



Persons with a disability may request a reasonable accommodation such as a sign language interpreter by contacting Amy Rosar at (602) 368-9644 or email at amy@kdacreative.com. Requests should be made as early as possible to allow time to arrange the accommodation.

ARIZONA DEPARTMENT OF TRANSPORTATION AND FEDERAL HIGHWAY ADMINISTRATION

ARIZONA

69

# State Route 69 Low-Profile Median Barrier Project

## PUBLIC MEETING

5 p.m. to 7 p.m. • Thursday, January 21, 2010

Wyndham Garden Hotel

(formerly Prescott Inn and Suites)

4499 E. State Route 69 • Prescott, AZ 86301

A brief presentation will begin at 5:15 p.m.

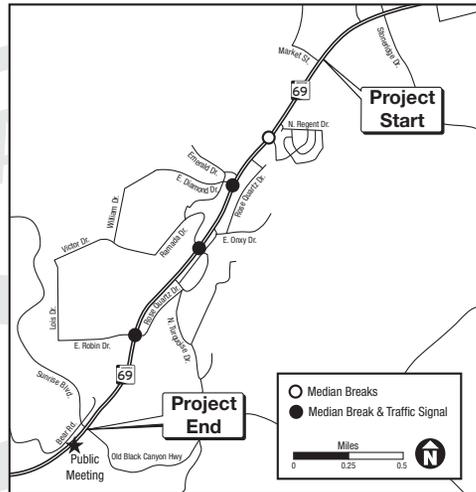


Federal Highway  
Administration

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- Reduction of posted speed limit to 45 miles per hour.



Representatives of ADOT and the project team will be available at the meeting to provide information, answer questions, and discuss the project with the community.

For more information regarding the improvement project please contact Bill Pederson, ADOT Prescott District Public Information Officer at 602.712.8069 or [bpederson@azdot.gov](mailto:bpederson@azdot.gov).

More information regarding all projects in the Prescott District can be found at [www.azdot.gov/PrescottProjects](http://www.azdot.gov/PrescottProjects).

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ARIZONA DEPARTMENT OF TRANSPORTATION  
AND FEDERAL HIGHWAY ADMINISTRATION

SR 69 Median Barrier Project  
c/o KDA Creative  
4545 E. Shea Blvd., Ste. 210  
Phoenix, AZ 85028

# PUBLIC MEETING RESCHEDULED

## State Route 69 Low-Profile Median Barrier Project Sundog Ranch Road to Sunrise Boulevard

Join ADOT to learn more about the improvement project and discuss with team members.

### Wyndham Garden Hotel

(formerly Prescott Inn and Suites)

**Wednesday, February 10, 2010 • 5 p.m. to 7 p.m.**

A brief presentation will begin at 5:15 p.m.

Representatives of ADOT and the project team will be available at the meeting to provide information, answer questions, and discuss the project with the community.

For more information regarding the improvement project please contact Bill Pederson, ADOT Prescott District Public Information Officer at **602.712.8069** or **bpederson@azdot.gov**.

More information regarding all projects in the Prescott District can be found at **[www.azdot.gov/PrescottProjects](http://www.azdot.gov/PrescottProjects)**.



Federal Highway  
Administration



**ADOT**

ARIZONA DEPARTMENT OF TRANSPORTATION AND FEDERAL HIGHWAY ADMINISTRATION

# STATE ROUTE 69 Low-Profile Median Barrier Project Sundog Ranch Road to Sunrise Boulevard



# PUBLIC MEETING RESCHEDULED

**Wednesday, February 10, 2010 • 5 p.m. to 7 p.m.**

Wyndham Garden Hotel (formerly Prescott Inn and Suites)  
4499 E. State Route 69 • Prescott, AZ 86301

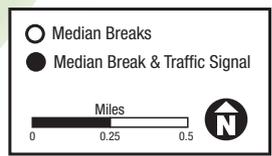
Due to unfavorable weather conditions on January 21, The Arizona Department of Transportation (ADOT) has rescheduled the public meeting to Wednesday, February 10, 2010.

ADOT is planning to install a low-profile raised concrete median on State Route 69 between Prescott and Prescott Valley from Sundog Ranch Road to Sunrise Boulevard. Construction is scheduled to begin in 2010 and last approximately 6 to 8 months.

A brief presentation will begin at 5:15 p.m.

**Project Start**

**Project End**



Federal Highway Administration



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ARIZONA DEPARTMENT OF TRANSPORTATION AND FEDERAL HIGHWAY ADMINISTRATION



# State Route 69

## Sundog Ranch Road to Sunrise Boulevard Low-Profile Median Barrier Project

# PUBLIC MEETING RESCHEDULED

5 p.m. to 7 p.m. • Wednesday, February 10, 2010

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# STATE ROUTE 69

## Sundog Ranch Rd. to Sunrise Blvd.

### Low-Profile Median Barrier Project



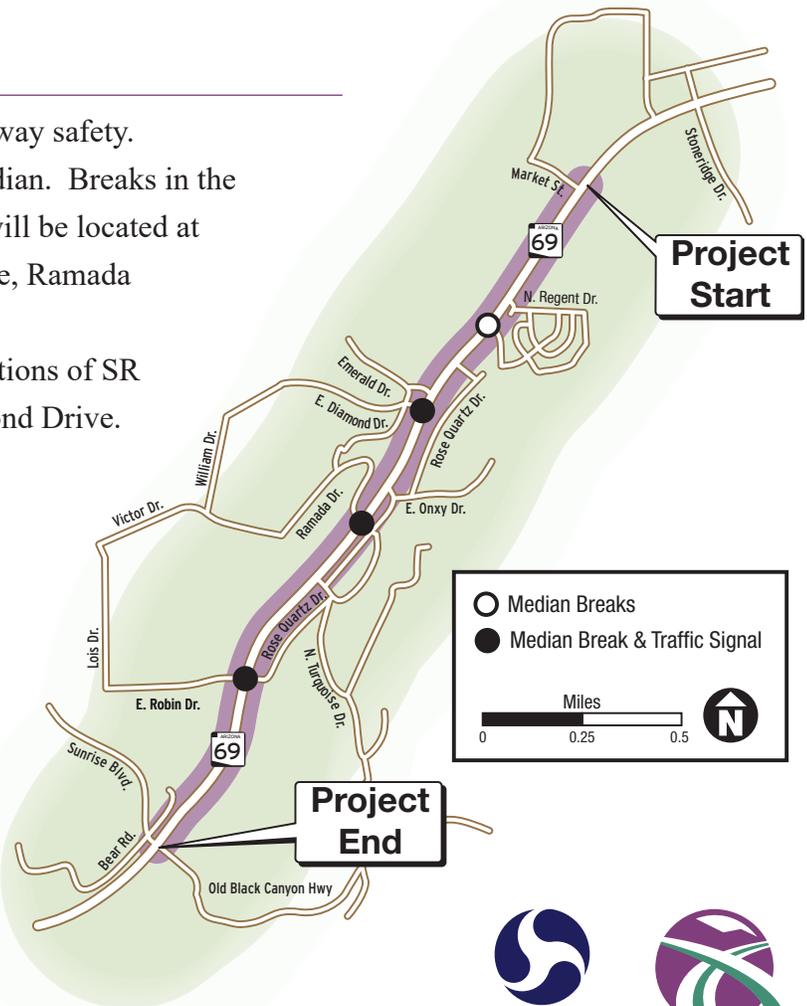
The Arizona Department of Transportation is planning to install a low-profile raised concrete median on State Route 69 between Prescott and Prescott Valley from Sundog Ranch Road to Sunrise Boulevard. Construction is scheduled to begin in 2010 and last approximately 6 to 8 months.

#### Project improvements include:

- Regulation of turn movements to improve roadway safety.
- Installation of a low-profile raised concrete median. Breaks in the median providing left turn access from SR 69 will be located at Baker Street (Victorian Estates), Diamond Drive, Ramada Drive, and Robin Drive.
- Installation of new traffic signals at the intersections of SR 69 and Ramada Drive, Robin Drive, and Diamond Drive.
- Application of a layer of rubberized asphalt.
- Removal and replacement of pavement markings and signs.
- Reduction of posted speed limit to 45 miles per hour.

For more information regarding the improvement project please contact Bill Pederson, ADOT Prescott District Public Information Officer at **602.712.8069** or [bpederson@azdot.gov](mailto:bpederson@azdot.gov).

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## **State Route 69 Sundog Ranch Rd to Sunrise Blvd Low-Profile Median Barrier Project**

Greg Gentsch, Prescott District Engineer  
February 10, 2010  
Public Meeting



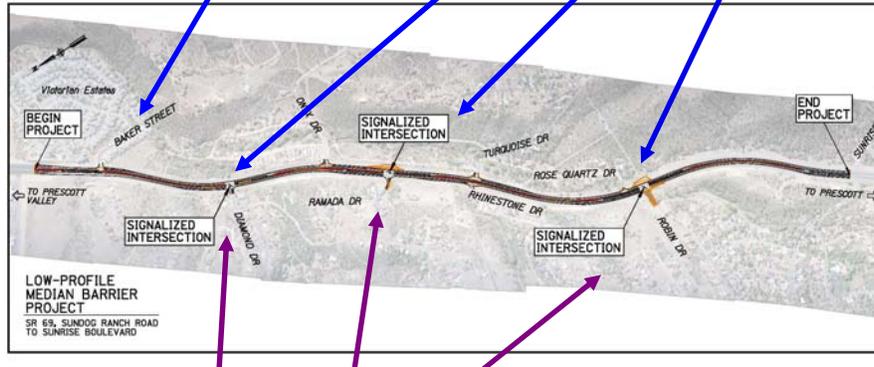
## **Project Overview**

- Low-profile raised concrete median to reduce possibility of crossover crashes
- Regulation of turn movements to improve roadway safety
- Median breaks for left turn access
- Three new traffic signals
- New pavement, pavement markings, and signs
- New speed limit 45 miles per hour



## Overview Map

**Median Breaks:** Baker St (Victorian Estates), Diamond Dr, Ramada Dr, Robin Dr



**Traffic signals:** Diamond Dr, Ramada Dr, Robin Dr (ADOT is realigning Robin Drive to accommodate new intersection)

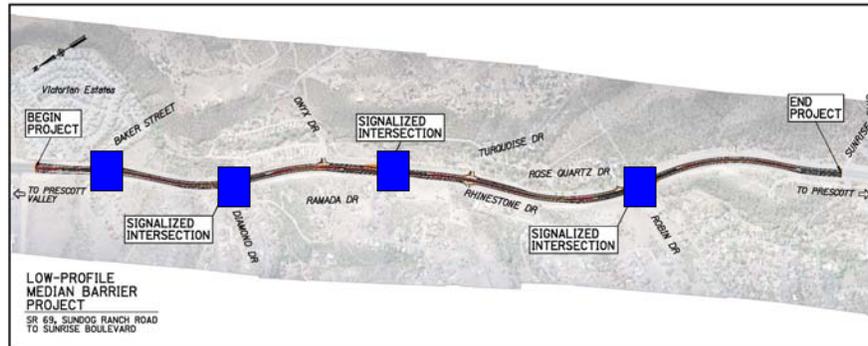


## Project History

- 2005-2006 Safety concerns expressed by community, highlighted by numerous accidents including fatalities from crossover traffic
- 2006-2007 Original ADOT proposal for a continuous median barrier prompted community concerns of unsightliness and access restrictions
- 2007-2009 **Based on community input**, ADOT revised design to a low profile median barrier with strategically placed median breaks and signals



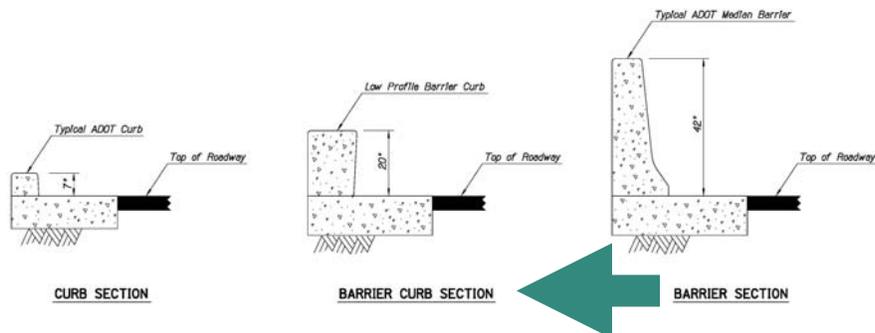
## Increased Number of Access Points from One to Four



*Revised based on community input*



## Lowered Barrier Profile



*Revised based on community input*

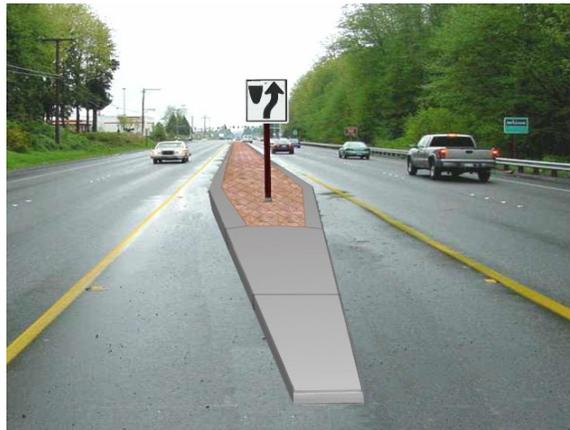


## U-Turns

- U-turns are legal on state highways unless they are signed for no u-turns
- U-turns will be allowed at Robin Drive and Ramada Drive for cars going to and from Turquoise Drive



## Photo Simulation of Planned Low Profile Barrier





## Photo Simulation of Planned Low Profile Barrier



## Next Steps: Project Schedule



- Advertise for construction bids in Spring 2010
- Construction start Summer 2010
- 6 to 8 month construction schedule
- May need to come back in Spring 2011 and complete paving and striping due to temperature constraints for rubberized asphalt
- Median work and paving will occur at night to minimize traffic impacts

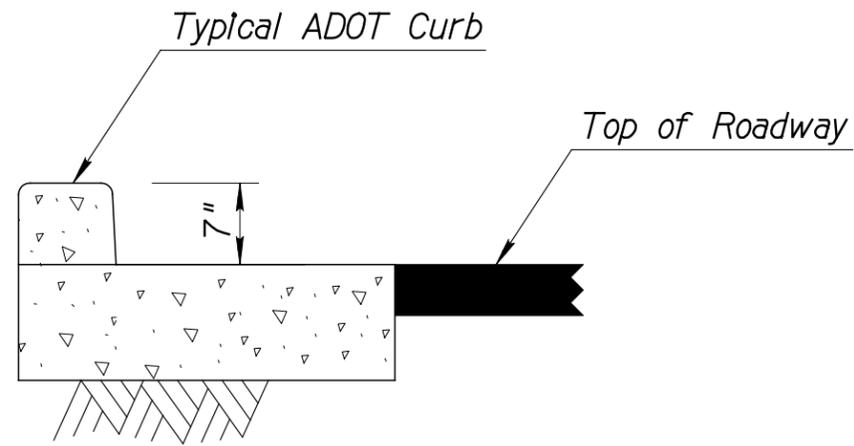


## **Thank You for Coming!**

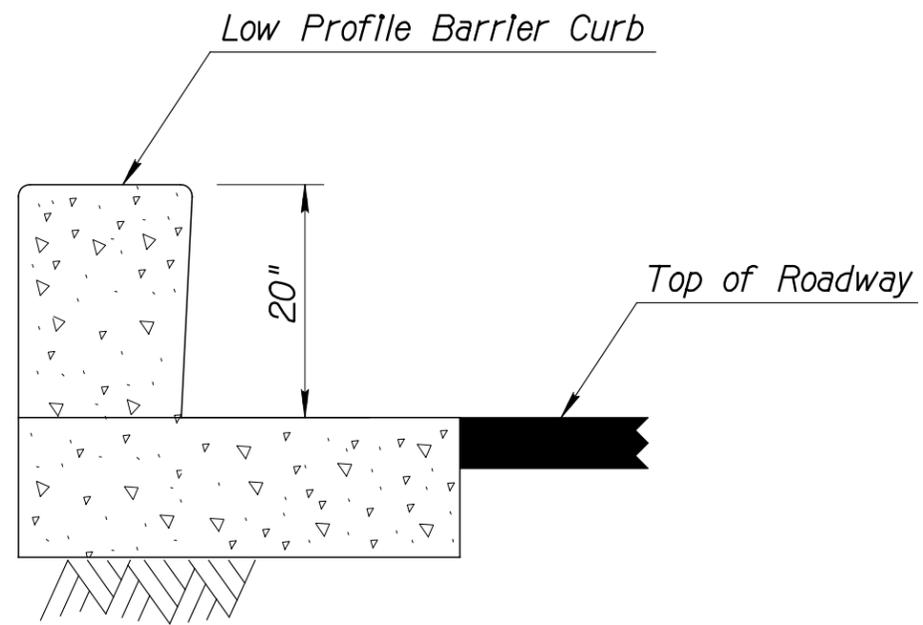
Please feel free to view project maps and speak  
with team members

Contact: Bill Pederson  
ADOT Prescott District Public Information Officer  
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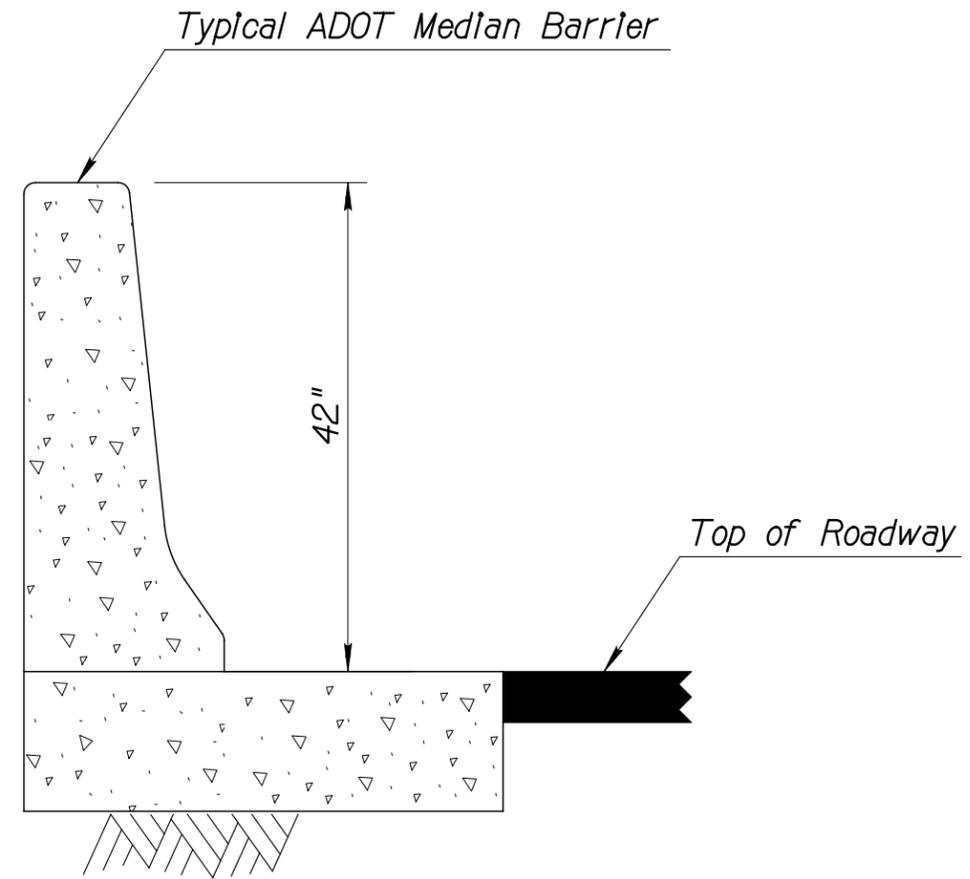
APPENDIX C - Arizona SR 69 Sections



CURB SECTION

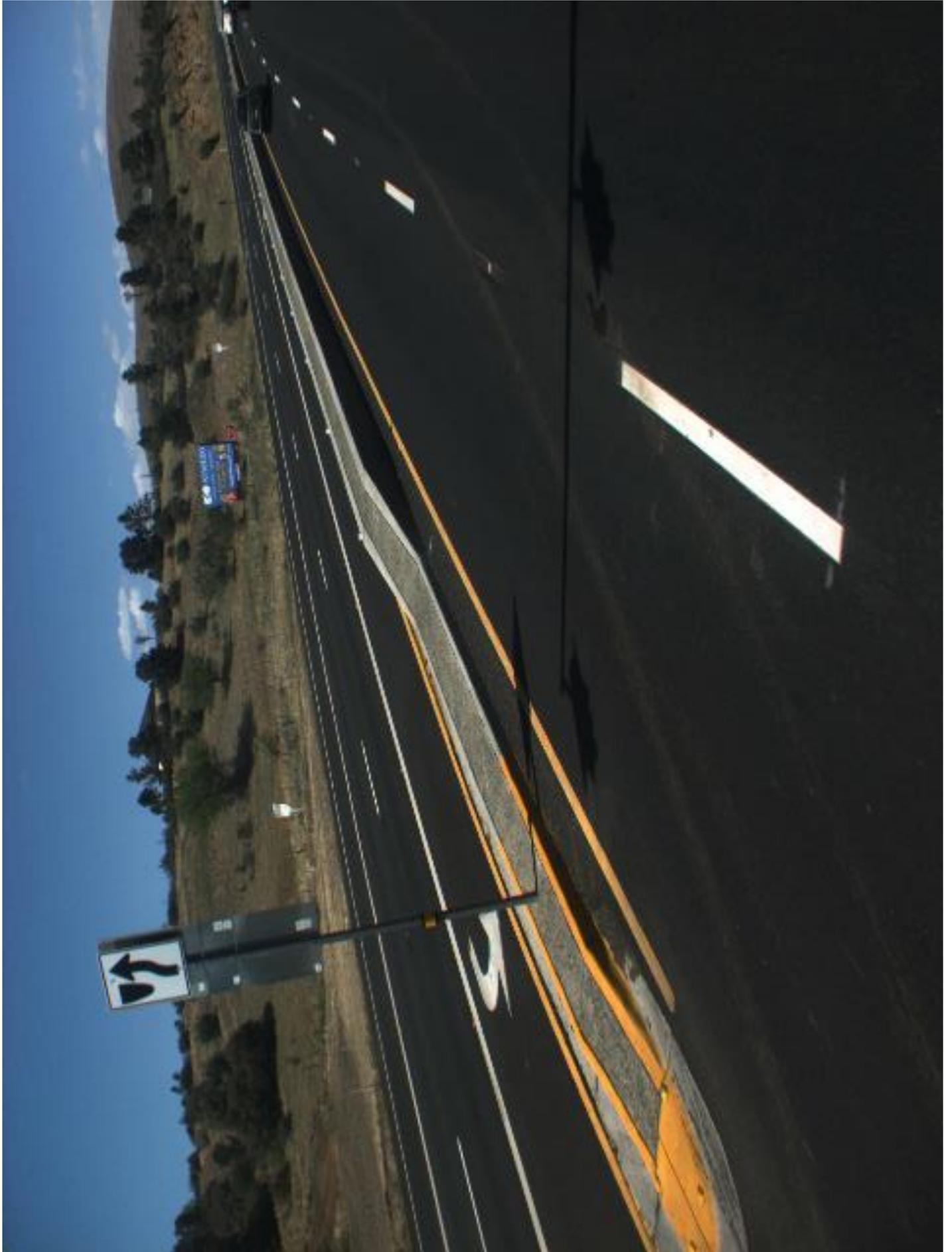


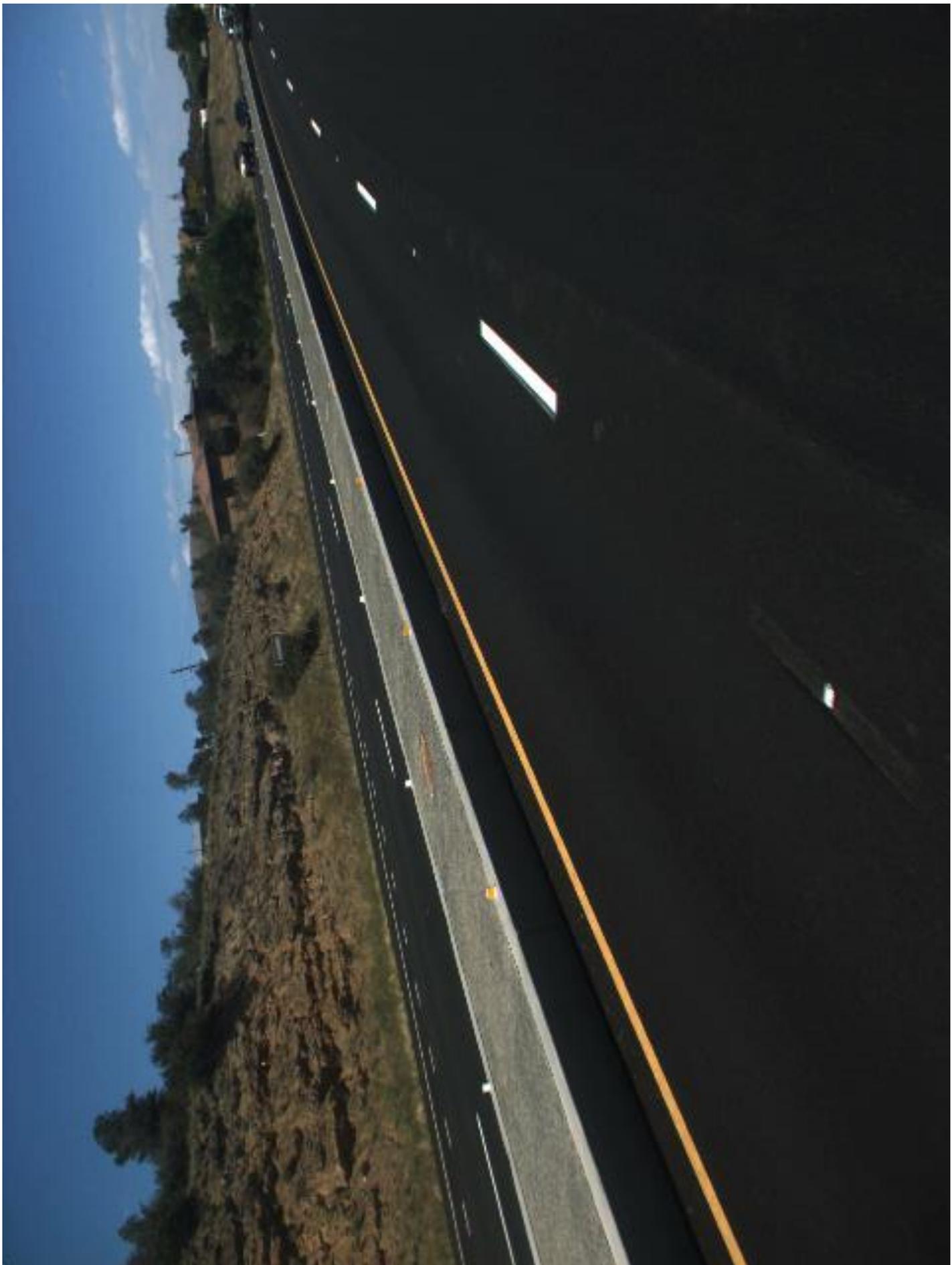
B-RRIER CURB SECTION



B-RRIER SECTION

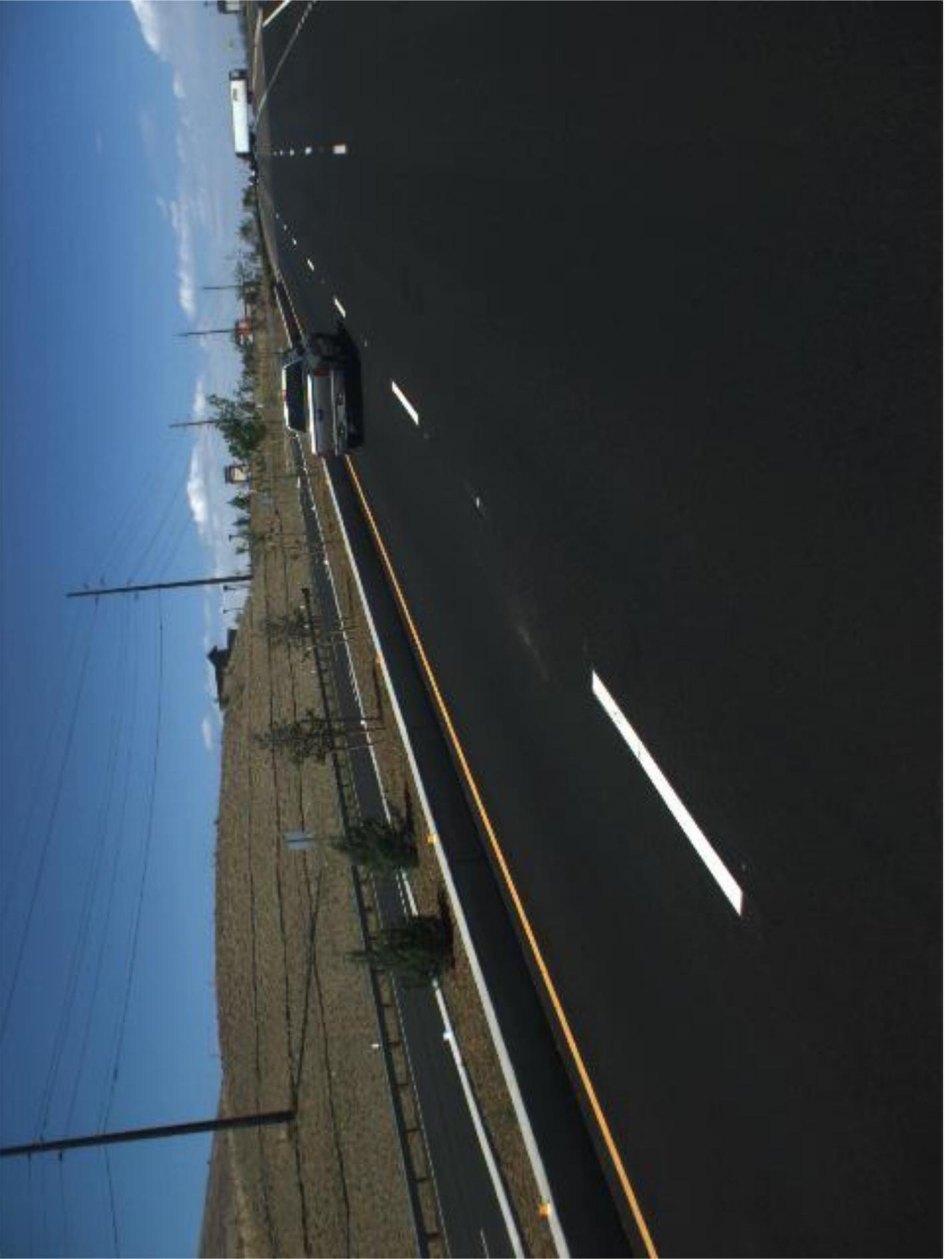
APPENDIX D





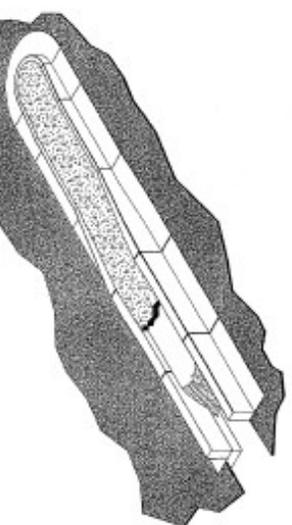
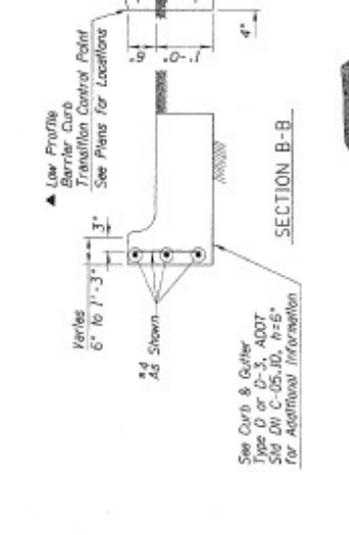
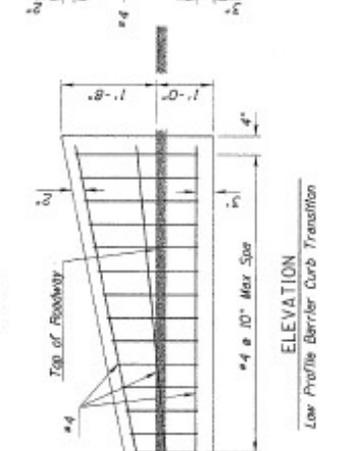
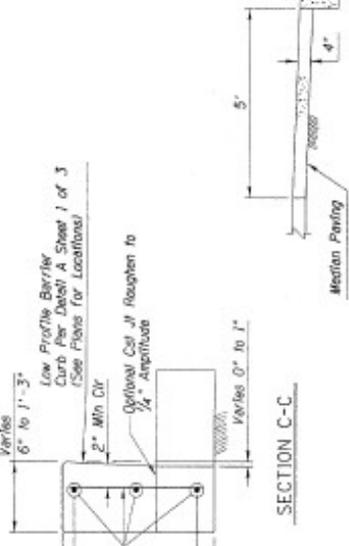
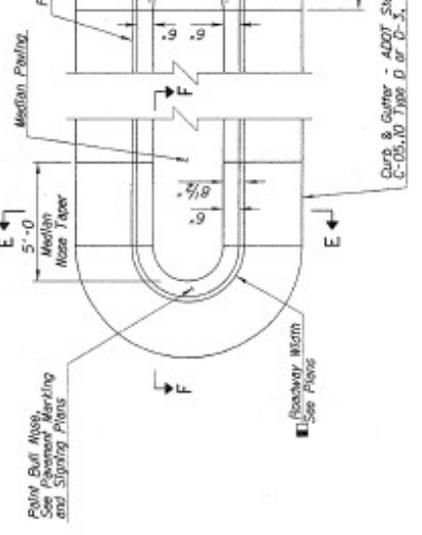
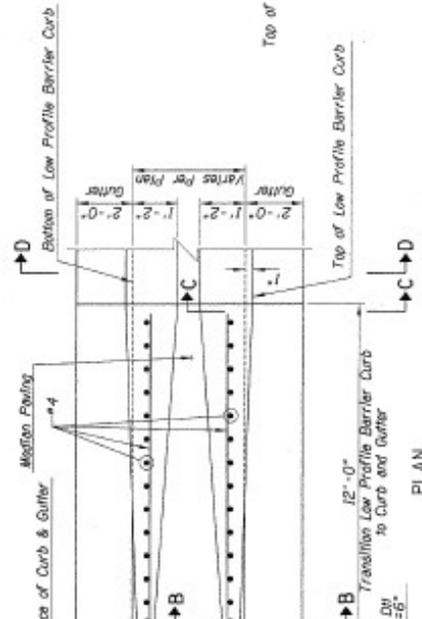
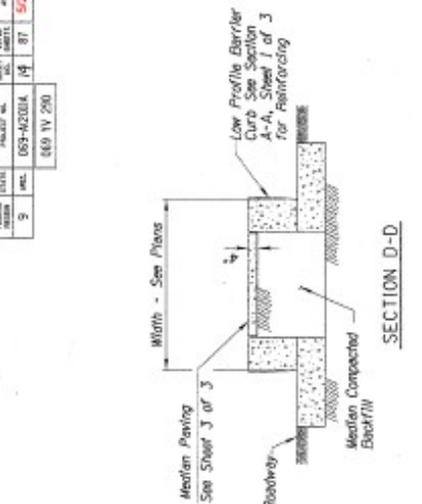








DATE	ISSUED	BY	SCALE
5	069-A2001A	14	AS SHOWN
PROJECT NO.	DATE	BY	SCALE
069-A2001A	14	BT	AS SHOWN
NO.	REV.	DATE	BY
069 IV 200			



# DETAIL A

LOW PROFILE BARRIER CURB AND GUTTER SHEET 2 OF 3

REDUCED SIZE  
DO NOT SCALE

NO.	DATE	BY	SCALE
1	069-A2001A	14	AS SHOWN
PROJECT NO.	DATE	BY	SCALE
069-A2001A	14	BT	AS SHOWN
NO.	REV.	DATE	BY
069 IV 200			

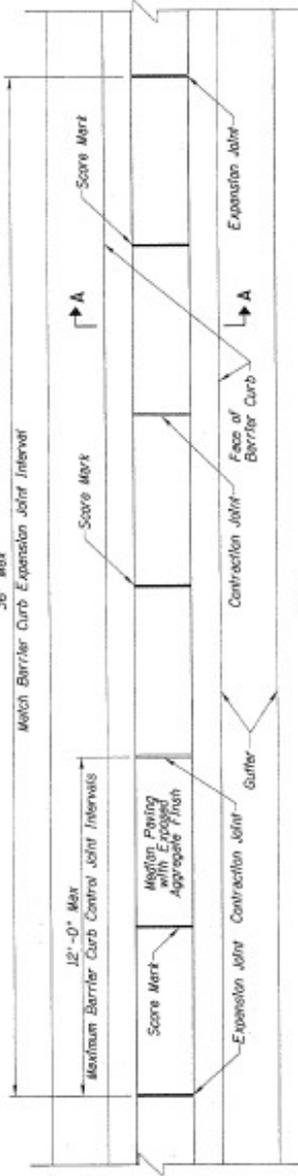
ADOT DEPARTMENT OF TRANSPORTATION  
ROADWAY DESIGN SERVICES  
LOW PROFILE BARRIER CURB AND GUTTER  
DETAIL A

SR 69 SUNDG RANCH RD TO SUNRSE BLVD  
TRACKS NO. H7128 01C  
069-A2001A  
19 OF 92

LOW PROFILE BARRIER CURB TRANSITION TO CURB AND GUTTER  
ISOMETRIC

DATE	ISSUE	NO.	DESCRIPTION
9	1	063-42700A	15
063	VI	230	

PROJECT NO.	063-42700A
DATE	063 VI 230



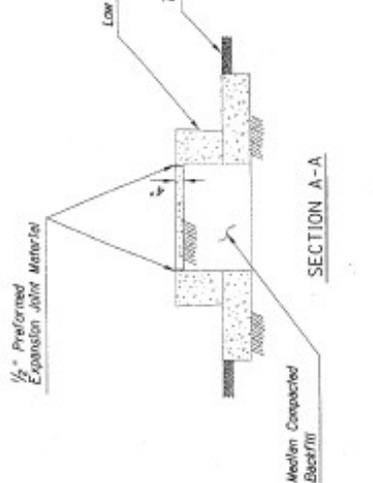
PLAN  
Median Paving



CONTRACTION JOINT DETAIL



EXPANSION JOINT DETAIL



GENERAL NOTES

- Median paving shall be class B concrete with an exposed aggregate finish, 4" thick and placed on a prepared backfill. See special provisions for additional information.
- One-inch deep transverse contraction joints shall be placed in the median paving at intervals that will give adjacent barrier-curb control joints for the median paving is over 7'. In width, a 2" deep longitudinal contraction joint shall be placed in the center of median paving. The maximum area of median paving without contraction joints or score lines shall be approximately 36 square feet. Joints shall be either formed or sawn. Formed joints shall be finished with a 1/4" radius.
- Score marks shall be 1/4" in depth and be placed at 6' spacing between the contraction joint interval of 12'.
- Median paving expansion joints shall match the adjacent barrier-curb expansion joints. The maximum longitudinal length of median paving without an expansion joint shall be 36 feet. The 1/2" expansion joint material shall extend the full depth of the median paving concrete.
- The median paving shall be placed on backfill material compacted to a density of not less than 95% as described in ADOT 516, Spec. Sect. 203, Embankment Materials.

DETAIL A  
LOW PROFILE BARRIER CURB  
AND CURB AND GUTTER  
SHEET 3 OF 3

NO.	DATE	BY	CHK.	DESCRIPTION
1	5-13-03	...	...	...
2	5-13-03	...	...	...
3	5-13-03	...	...	...

SR 69  
TRAFFIC NO. 11228 DIC  
SUNDOG RANCH RD TO SUNRISE BLVD  
063-42700A

REDUCED SIZE  
DO NOT SCALE