ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL TRANSPORTATION DIVISION

GUIDELINES FOR SCOPING PAVEMENT PRESERVATION PROJECTS

November 2008

Revisions: August 2011

ROADWAY ENGINEERING GROUP

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* Section Titles are active hyperlinks

Purpose

This guide was developed to promote and clarify the work items to be addressed with pavement preservation funds and to establish a consistent approach to safety work within the termini of pavement preservation projects. The Guidelines provide full recognition that funding resources for pavement preservation are limited; implementation of full AASHTO safety criteria related to slopes, guardrail, and clear zone to the standards applied to new construction or major reconstruction is not normally a feasible alternative for pavement preservation projects. Nevertheless, Federal guidelines require a reasonable degree of safety enhancement. The guidelines herein are presented to address safety enhancements to a degree based upon the type and level of usage of the facility. Although it is recognized that all safety improvements may not be feasible or reasonable, efforts to incorporate appropriate safety measures are encouraged since construction opportunities may be limited for several years. The AASHTO Controlling Design Criteria are addressed under separate documents and are not a part of this Guide.

Background

Pavement preservation funding is provided to extend the usable life of the pavement structure and also to address and include safety improvements which can be accomplished within the work scope of pavement preservation projects. Work items normally found in pavement preservation projects are divided into two categories; those dependent on the facility functional classification and traffic (AADT), and those which tend to be more site specific and independent of AADT and roadway classification. The AADT to be used in these guideline tables is for a design year 10 years after the construction year (use the anticipated construction year +10 if not yet programmed). Multilane facilities are roadways with four or more through lanes, divided or undivided.

Foreword

The distance to a potential hazard is measured from the edge of the through travel lane; the travel lane is defined as the as-built lane width which is predominately 12'. Therefore the normal method for measurement for clear zone is from the roadway centerline to the potential hazard and subtract the travel lane width.

Safety enhancement treatments may be warranted by supportive accident history (as referred to throughout the text and tables of this guide). The Traffic Engineering Group HES Section will review the crash history to determine if there are specific locations within the project limits that may warrant a spot safety enhancement. The Project Team, in coordination with Traffic HES Section, will evaluate the locations identified and determine any remedial treatment to be included with the project. Development of the Project Assessment scoping document should be coordinated with any ongoing studies or Road Safety Assessments in the area.

There are certain roadway features normally included with pavement preservation work that are evaluated for conformance with current design guidelines:

- Shoulder build-up (see Shoulder Build-up Design Guidelines in Appendix A)
- Pavement marking and striping
- Rumble strips
- Turnout paving
- Delineators and object markers
- Embankment curb, spillway and downdrain inlets
- Ramp gore curbing

Implementation of these guidelines may not always be practicable. When the guidelines contained herein cannot be achieved, the Project Team shall achieve consensus and document decisions with justification. Issues needing resolution should be escalated in a timely manner to avoid delays.

The following items are addressed within these guidelines:

SAFETY ITEMS

- Slope Flattening
- Guardrail
  - Reconstruction
  - Placement review
  - Guardrail/Barrier Transitions
  - New location for fixed object
  - New location for slope protection
- Embankment Curb
- Crash Attenuators
- Pipe Culvert and Headwalls
- Sidewalk and Sidewalk Ramps (ADA)
- Cut Ditches
- Tree Removal
- Chain Link Cable Barrier
- “L” Headwall Removal
- Rock Cuts

OTHER WORK ACTIVITIES

- Erosion
- Culvert Replacement or Relining
- Approach Slabs
- Rock Fall
- Drainage
- Intersection Turning Radii
- Signs
- Additional Special Purpose Lanes
- Shoulder Widening
- Curb/Gutter and/or Sidewalk
- Fencing
- Cattle Guards

SAFETY ENHANCEMENTS

EMBANKMENT SLOPE FLATTENING

A. **Where no Guardrail exists, slope flattening may be considered when all of the following apply:**

1. New R/W is not required.
2. Fill not higher than 12′.
3. No fixed objects at bottom of fill slope within 10’ of toe.
4. Economical fill material is available.
5. Existing slope is steeper than 4:1.
6. If pipes >36″ or box culverts exist, first evaluate Culvert Criteria. Flatten if the culvert is to be extended. If no extension, then no flattening.
7. New fill slope will achieve a 4:1 rate or flatter within existing R/W.

B. **Where Guardrail exists, slope flattening may be considered to replace guardrail when all of the following apply:**

1. Guardrail reconstruction is required per the following section.
2. The criteria in A above is met

GUARDRAIL

A. Existing guardrail on all classes of roadways will be reconstructed to current standards to correct a deficiency in any of the following conditions: post spacing, block out, lack of structure attachment, height less than minimum acceptable after overlay, rail element (type), flare, BCT end treatment, or without end treatment (blunt end). If reconstruction is required due to any of the described deficiencies, length of need shall be evaluated based upon a design speed no less than the posted speed. Reference the August 7, 2001 Roadway Design Memo "Guard Rail Minimum Height after Overlay".

B. For existing guardrail not being reconstructed under A:
Existing guardrail placement should be reviewed by visual observation to determine if adjustments should be made in the placement of terminal locations due to existing gaps or other terrain features. These adjustments may be implemented using good engineering judgment and are not necessarily supported by length of need calculations.

A review of the posted speeds for the project should be made to determine if any changes have been implemented since previous projects with guardrail have been completed. If posted speeds have been increased 10 mph or greater, the guardrail length of need should be evaluated and updated as needed using a design speed no less than the posted speed. A decrease in posted speed may be treated in the same manner. Revisions to existing guardrail lengths of less than 50 ft are generally not warranted.

C. Guardrail/Barrier Transitions: Existing guardrail to concrete barrier transitions should be evaluated for upgrading in accordance with the June 25, 2002 Design Memorandum entitled Guardrail to Bridge Rail Transitions. The November 2, 2006 Summary Form should be completed for each transition location.

Posted Speed Note:

Posted speeds for the State Highway System can be reviewed at the ADOTNet Information Data Warehouse on the Speed Limit Report. In addition to reviewing on-site, posted speeds may be reviewed on the Photo Log Viewer (date shown).

EMBANKMENT CURB

Embankment curb and associated spillways and downdrains are normally placed where needed with guardrail. Locations in high speed areas may be encountered where embankment curb was installed without guardrail. First, an evaluation should be made with District whether the curb can be removed and not result in excessive erosion problems for maintenance. Addition of new guardrail to protect curbing and spillway is an option that may be undertaken after a review of pertinent factors including traffic volume, speed, sideslopes, roadway alignment, shoulder width. Crash history should also play a role in the final decision.

Existing embankment curb, downdrains, and spillways should be evaluated based upon the overlay or pavement treatment and its impact on existing system. Coordinating with District, the designer should determine whether removal and replacement, modification, or elimination is appropriate. Where slopes have been established, curbing may no longer be necessary.

CRASH ATTENUATORS

Existing Crash Attenuators in high speed (45 mph and higher) locations that are not NCHRP 350 compliant should be replaced with NCHRP 350 compliant attenuators. Crash attenuators located in lower speed areas may be considered for replacement when practical to do so. The Roadway Design Memo “Crash Cushion Selection Procedure” should be followed in selecting the replacement.

The following chart is provided for determination of guardrail placement where no guardrail is presently in place:

GUARDRAIL CRITERIA FOR NEW LOCATIONS

	For Fixed Object	Fill Slope Protection
I. Freeways	Yes, if within 25' of travel lane - relocate or shield	Yes, in accord with Roadway Design Guidelines (ADOT)
II. Multilane	Yes, if within 12' of travel lane - relocate or shield	Yes, where embankment slopes are steeper than 3:1
III. 2-Lane AADT>5000 (1)	Same as Multilane	Same as Multilane
IV. 2-Lane AADT 2500-5000 (1)	No. Mark objects if within 12' (2)	Yes, on outside of curves $\geq 3^{o}$ with embankment slopes steeper than 3:1
V. 2-Lane AADT <2500 (1)	No. Mark objects if within 12' (2)	Crash history

Notes:

(1) 2-lane, 2-way traffic - do not add guardrail to both sides of narrow roadways 28′ wide and less without due consideration for additional guardrail offset. Consideration should also be given to accident history, horizontal curvature, sight distance, and delineation of one or both sides of roadway.

(2) If crash history – relocate or shield. Do not mark trees.

General Note: Traffic Engineering Group HES Section will provide crash history and evaluation.

SAFETY TREATMENTS FOR UNSHIELDED PIPES, CULVERTS, AND HEADWALLS

Item Facility	Pipe/Culvert Size	Distance from Travel Lane	Extension from Edge of Travel Lane	Marking
Freeways (1)	>36″ pipe and Culvert Headwalls	>25′ ---------- <25′	No ---------- Economic Analysis to extend or shield (5)	Mark headwalls (4)
Freeways (1)	≤36″ pipe	20′ - 30′ ---------- < 20′	No. Include end sections for pipes 24”-36” ---------- Extend to toe of slope or clear zone per Roadway Design Guidelines. Add end sections.	Mark headwalls if present (4)

Notes:

(1) Ramps will be treated the same as the mainline except the clear zone will be based on reasonable operating speed.

(2) Median pipe culverts treated the same. If culvert is within 20′ of another roadway culvert, consider connecting.

(3) Parallel pipe culverts within 20’ of through traffic lane may be considered for safety end sections.

(4) Mark unshielded headwalls within the clear zone in accordance with Headwall Marking details provided by Traffic Engineering. (Applies to high speed roadways having posted speed >45 mph)

(5) A comparison of costs associated with structure extension is compared to the cost of shielding with barrier. The barrier alternative is multiplied by a factor of 3 for comparison purposes. Consider the use of safety end sections in locations where it is not practical to extend the pipe culvert.

SAFETY TREATMENTS FOR UNSHIELDED PIPES, CULVERTS, AND HEADWALLS (continued)

Item Facility	Pipe/Culvert Size	Distance from Travel Lane	Extension from Edge of Travel Lane	Marking
Multilane Highways (2) and 2-Lane Highway with AADT >5000 (3)	> 36″ pipe and Culvert Headwalls	0’ - 12′ ---------- >12′	Economic Analysis to extend or shield (5) For very narrow shoulders, barrier may not be practical. ---------- No	Mark headwall. (4)
Multilane Highways (2) and 2-Lane Highway with AADT >5000 (3)	≤ 36″ pipe	<3′ ---------- 3′ -12′ ---------- >12’	Extend to 12′ or Clear Zone. Extend to side slope (if already extends beyond side slope, no extension necessary). Include end sections with extensions. ---------- No, if end at side slope. If end is within side slope, extend to side slope. Include end sections with extensions ---------- No	Mark headwalls if present (4)

Notes:

(1) Ramps will be treated the same as the mainline except the clear zone will be based on reasonable operating speed.

(2) Median pipe culverts treated the same. If culvert is within 20′ of another roadway culvert, consider connecting.

(3) Parallel pipe culverts within 20’ of through traffic lane may be considered for safety end sections.

(4) Mark unshielded headwalls within the clear zone in accordance with Headwall Marking details provided by Traffic Engineering. (Applies to high speed roadways having posted speed >45 mph)

(5) A comparison of costs associated with structure extension is compared to the cost of shielding with barrier. The barrier alternative is multiplied by a factor of 3 for comparison purposes. Consider the use of safety end sections in locations where it is not practical to extend the pipe culvert.

SAFETY TREATMENTS FOR UNSHIELDED PIPES, CULVERTS, AND HEADWALLS (continued)

Item Facility	Pipe/Culvert Size	Distance from Travel Lane	Extension from Edge of Travel Lane	Marking
2-Lane Hwys. AADT 2500-5000	> 36″ pipe and Culvert headwalls	< 3′ ---------- 3’ to 12’ ---------- >12’	Extend to 12’ ---------- No ---------- No	Mark headwalls (4)
2-Lane Hwys. AADT 2500-5000	≤ 36″ pipe	<12’	No	Mark headwalls if present (4)
2-Lane Hwys. AADT <2500	> 36″ pipe and Culvert headwalls ≤ 36″ pipe	<12’	No No	Mark headwalls if present (4)

Notes:

(1) Ramps will be treated the same as the mainline except the clear zone will be based on reasonable operating speed.

(2) Median pipe culverts treated the same. If culvert is within 20′ of another roadway culvert, consider connecting.

(3) Parallel pipe culverts within 20’ of through traffic lane may be considered for safety end sections.

(4) Mark unshielded headwalls within the clear zone in accordance with Headwall Marking details provided by Traffic Engineering. (Applies to high speed roadways having posted speed >45 mph)

(5) A comparison of costs associated with structure extension is compared to the cost of shielding with barrier. The barrier alternative is multiplied by a factor of 3 for comparison purposes. Consider the use of safety end sections in locations where it is not practical to extend the pipe.

SIDEWALK AND SIDEWALK RAMPS

Public rights-of-way and facilities are required to be accessible to persons with disabilities through: Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act of 1990 (ADA).

Existing sidewalks and sidewalk ramps within curb and gutter limits shall be reviewed to achieve feasible conformance to Americans with Disabilities Act (ADA) requirements.

In general, existing sidewalk ramps constructed to previous standards may be left in place if they meet ADA slope, width and landing requirements. Where detectable warning devices are not present, they may be added to existing ramps where practical in accordance with current standards. Sidewalk bypasses (Std. C-05.20) may be added at existing driveways where practical within existing right-of-way and when consistency of treatment for a pedestrian area can be achieved. Due to the complex nature of applying ADA requirements to existing facilities, additional research/review may be required to resolve treatments for special conditions. Reference also the Roadway Design Memo November 25, 2005 "Sidewalk Ramp Treatment".

CUT DITCHES

Cut ditches on all classes of roadways will generally remain as is, however, cut ditches may be considered for widening if there is a demonstrated problem with any of the following:

a) Inadequate drainage capacity with water having flowed onto roadway.

b) Inadequate width for snow removal in a long narrow cut.

c) Shading of roadway resulting in an icing problem.

Design personnel should consult with District representatives to verify the existence of problem ditches; maintenance personnel must be able to cite or convey the specific problem area.

Cut ditches may be considered for erosion protection treatment if the condition jeopardizes the integrity of the adjacent pavement and the scope of the corrective work is beyond the capability of maintenance forces.

Where embankment material is needed as determined under EMBANKMENT SLOPE FLATTENING, cut ditches may be uniformly widened to obtain the needed material.

SAFETY TREATMENTS

Item Facility	Tree Removal	Chain Link Cable Barrier	"L" Head Wall Removal	Rock Cuts
Freeway	(1) (2) Yes > 4″dia. within clear zone or 30′ max.	Yes See following Section.	Yes	Yes See Appendix B Guideline for Rock Cuts
Multilane Highways	(1) (2) Same as Freeway	Yes See following Section	Yes	Yes Use Shy Distance Warrants from Table
2-Lane Hwys. AADT >5000	(1) (2) Yes > 4" dia. and within 12′ of travel lane	Not applicable	Yes	No Unless crash history
2-Lane Hwys. AADT 2500-5000	(1) (2) Yes > 4" dia. and within 12′ of travel lane	Not applicable	No	No Unless crash history
2-Lane Hwys. AADT<2500	No Unless crash history	Not applicable	No	No Unless crash history

Notes:

(1) Concurrence of BLM/ U.S. Forest Service or other owner agency is required when ADOT operates the highway right-of-way by easement agreement. Trees that are expected to grow to greater than 4" in diameter within the clear zone should also be removed. On scenic highways, tree removal should be coordinated with Roadside Development Section to consider potential mitigation needs.

(2) Where trees are being removed in areas identified as having an accident history, removal beyond the clear zone may be considered. Also, where trees are being removed on the outside of curves, the clear zone curve correction factors may be applied. See Roadway Design Guidelines Table 303.2B. Trees will not normally be removed in urban areas with curb and gutter unless there are maintenance issues or crash history. Trees restricting sign visibility or intersection sight triangles should be removed or trimmed to provide adequate sight distance.

General Note: Traffic Engineering Group HES Section will provide crash history and evaluation.

CHAIN LINK CABLE BARRIER (Std. C-12.30)

The Chain Link Cable Barrier is normally utilized as a secondary safety measure in addition to guardrail or other barrier.

The Chain Link Cable Barrier is not intended to be utilized for all median situations. A decision must be made regarding the potential consequences of a vehicle traversing the area being considered. Where there is crossroad traffic below, a canal structure or other severe drop-off, the barrier should be installed. Where there is a reasonable chance of traversing the drainageway or coming to a stop, and the length of guardrail need is met, there may not be a need for Chain Link Cable Barrier.

The current Chain Link Cable Barrier (Std. C-12.30) is a two-cable system. This does not require that previous 3-cable versions of the standard already in place be removed and replaced. Each existing situation should be reviewed and a determination made whether the existing installation is appropriate. The fact that all existing site conditions may not meet the current detail does not mean an existing installation is non-functional. Good engineering judgment is required and ultimate disposition can be arrived at through discussions with representatives of District and FHWA. The final resolution, however, rests with the design engineer.

L-HEADWALL REMOVAL

L-shaped headwalls were commonly used to efficiently capture runoff in cut ditches in earlier roadway construction. These headwalls and other similar shaped headwalls (U-shape) located in the ditch can present an obstacle for errant vehicles that may enter the ditch. Current practice is to retrofit this type of culvert inlet to flush type safety inlets connecting with the culvert. Some minor regrading of the ditch is normally required to maintain flow line.

ROCK CUTS

FREEWAYS

See "Criteria for Treatment of Rock Cuts for Interstate Highways" in Appendix B

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OTHER MULTILANE DIVIDED HIGHWAYS

DESIGN SPEED * SHY LINE OFFSET L_s

* Design Speed = Posted Speed + 10 mph	feet
80 and above	12.1
75	10.5
70	9.2
65	8.5
60	7.9
55	7.2
50	6.6
45	5.6

Evaluate the need to widen a cut or place protective barrier as described in the "Criteria for Treatment of Rock Cuts for Interstate Highways" but utilize the above chart for warrants when shy line offset is less than the chart value.

Shy line offset is the distance from the edge of through travel lane beyond which a roadside object will not be perceived as hazardous and result in a motorist reducing speed or changing vehicle position on the roadway.

OTHER ITEMS TO BE CONSIDERED

The following items, which are largely dependent upon specific site conditions, should be considered during the project scoping process to determine if they are necessary or desirable to include in the pavement preservation project. **Some of these items may be included with the pavement preservation funding; these items are identified in bold text.** *However, unless these items are essential to the pavement preservation work, funds from sources other than the pavement preservation budget must be provided to cover the additional cost*.

EROSION -- Correction of major erosion problems may be included in pavement preservation projects if all of the following apply: (1) the corrective work is beyond the capability of maintenance forces, (2) the problems jeopardize the existing pavement structure, (3) the corrective work is compatible with the time schedule for the pavement preservation project, and (4) the corrective work does not require new right-of-way.

CULVERT REPLACEMENT OR RELINING -- Deteriorated culverts and pipes which may threaten the integrity of the pavement structure may be replaced or relined as part of the pavement preservation project. In addition, existing pipes and culverts which are to be extended should be checked to assure that they do not have serious deterioration or structural problems.

APPROACH SLABS -- All bridge approach slabs within the project limits of a proposed pavement preservation project should be checked visually to determine if they are functioning properly and provide a reasonably smooth transition onto and off of the bridge(s). Corrective work may be included in the pavement preservation project when deemed appropriate by District and technical representatives of the project team.

ROCK FALL -- Rock fall areas are normally addressed under a separate program administered by ADOT's Geotechnical Design Section. Major rock fall improvements may be combined with pavement preservation projects, but only if (1) additional funds from sources other than the pavement preservation budget are provided, and (2) the rock fall improvements do not delay the pavement preservation project due to extensive geotechnical analysis and design, new right-of-way, or environmental issues. **Minor rock fall containment improvements, which do not require extensive analysis or cause significant delays in project development, may be considered in pavement preservation projects.**

DRAINAGE -- Drainage problems fall into two categories -- subsurface drainage and surface drainage. **Subsurface drainage problems are usually directly associated with pavement problems and should be thoroughly evaluated and included in the Materials Memo**. Surface drainage problems may also be associated with pavement problems and these situations should be addressed in the same manner as the subsurface drainage problems. However, surface drainage problems often involve other problems not directly associated with pavement structure, such as ponding, missing or poorly located catch basins, curbs and inlets, and even inadequate cross-drainage pipe.

Drainage problems not directly associated with pavement preservation may be included in pavement preservation projects if (1) they do not require an extensive drainage study, (2) the corrective work is compatible with the time schedule for the pavement preservation project, and (3) the corrective work does not require new right-of-way. Funding from an alternate source is required.

INTERSECTION TURNING RADII -- **Where vehicle turning problems are identified, minor pavement widening to improve intersection turning radii may be included in pavement preservation projects if they involve only pavement and related work (base courses, curb or curb and gutter, etc.).** Improvements involving additional right-of-way, significant additional grading and/or drainage, or extensive utility relocations are beyond the scope of pavement preservation projects. Funding from alternate source is required.

SIGNS -- Project wide upgrading of signs may be included, but will require alternate funding source. **Modification or replacement of individual sign installations may be considered with pavement preservation work.**

ADDITIONAL SPECIAL PURPOSE LANES -- Inclusion of new left and right-turn lanes, continuous two-way left-turn lanes, climbing and passing lanes, acceleration lanes, or other auxiliary lanes requires review and inclusion of lane width and shoulder width revisions and clear zone adjustments for fixed objects/slopes. This work may be combined with a pavement preservation project when justified however the funding source must be separate from the pavement preservation program budget.

SHOULDER WIDENING -- Inclusion of continuous shoulder widening is not a part of pavement preservation work. Shoulder widening would include reworking embankment slopes and cut ditches. This work may be combined with a pavement preservation project when justified however the funding source must be separate from the pavement preservation program budget.

CURB/GUTTER and/or SIDEWALKS – In addition to conformance with ADA requirements under SIDEWALK AND SIDEWALK RAMPS, minor spot improvements to curbs, curb and gutter and/or sidewalk may be included in pavement preservation projects. Catch basins located in curb and gutter locations where bicycle traffic is allowed should be checked for the presence of bicycle safe grates and upgraded as needed. Extensive curb, curb and gutter or sidewalk improvements are beyond the general scope of pavement preservation projects. Additional funds from sources other than the pavement preservation program budget should be used for such extensive improvements.

FENCING -- Fencing spot improvements may be included in pavement preservation work. Extensive new fence installations or wholesale replacement or rehabilitation of existing fence are clearly beyond the scope of pavement preservation and should be included only if a separate source of funds is obtained. Addition of fence work should not cause a delay in schedule for the pavement preservation project.

CATTLE GUARD -- Improvements to existing cattle guards, including complete removal where appropriate, should be considered and may be included in pavement preservation projects for all cattle guards located on freeway ramps, interchange crossroads and on other mainline pavements and ramps. Gaps between existing grill units should be reviewed with District Maintenance and corrections made in locations where bicycle traffic is allowed. Improvement or removal of existing cattle guards on non-interchange crossroads, driveways and other entrances, and the installation of additional cattle guards at new locations may also be appropriate, but normally should be funded from sources other than the pavement preservation program budget.

APPENDIX A

SHOULDER BUILD-UP DESIGN GUIDELINES

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL TRANSPORTATION DIVISION

SHOULDER BUILD-UP DESIGN GUIDELINES

AUGUST 2011

ROADWAY ENGINEERING GROUP
ROADWAY DESIGN SECTION

SHOULDER BUILD-UP DESIGN GUIDELINES

Shoulder build-up consists of furnishing, shaping, and compacting material along the edge of pavement. The primary purpose of shoulder build-up is to mitigate the effect of pavement edge drop-off.

During the Project Assessment field trip or the Initial Design field trip for a pavement preservation project, the designer should investigate the site and consult with District to determine whether or not a shoulder build-up design is warranted. A review of the as-built plans for previous pavement treatments will assist in evaluating existing conditions. The designer and District should observe the existing conditions along the edge of pavement so that a determination can be made of the need for shoulder build-up and the width and amount of material that may be required. The following list of roadside conditions is offered for consideration:

- The approximate length, measured along the edge of pavement, of existing drop-off if present
- The average depth of existing pavement drop-off if present
- The approximate slope from pavement edge to slope hinge point
- The distance from pavement edge to existing slope hinge point
- The type of existing material adjacent to the pavement edge and its condition ; i.e., granular, earthen, millings, loose or dense
- The existence of roadside vegetation

The existing condition along with the depth of any proposed pavement overlay should be evaluated by the designer to determine the need for a shoulder build-up design. Pavement Design Services will determine the depth of the overlay. Overlays will normally provide a 1 ft. wide AC wedge along the edge of pavement. In some cases, the AC wedge may be all that is required to mitigate the effect of total pavement edge drop-off. On projects where the pavement treatment consists of only milling and replacing existing AC, the existing shoulder edge should still be evaluated for shoulder build-up based upon the existing condition of the shoulder. All roadways receiving pavement treatment should be evaluated for shoulder build-up including mainline, ramps, crossroads and frontage roads.

The designer, in coordination with the District, will select the type of material for shoulder build-up. Preferably, the material selected to construct shoulder build-up will be project generated: i.e. roadway excavation or millings. Borrow material or stockpiled millings may be specified if adequate on-site material is not available. Materials Group, in coordination with Roadside Development will provide any necessary borrow requirements such as gradation, PI, pH, or percent soluble salts.

“Pulling up” material from adjacent slopes to construct shoulder build-up would damage established vegetation and will not be considered unless approved by Roadside Development Section.

The width of the shoulder build-up wedge should be determined by the designer. The width selected should be the width that will adequately mitigate any drop-off and have adequate existing support width. Extra wide widths to dispose of excess milled material should not be considered. Excess milled AC will be removed from the project as specified in the Final Materials Report.

Shoulder build-up material should be placed directly on the existing ground. Where existing vegetation is dense, mowing the roadside area may be required before placing the material. Grubbing or blading prior to placing the material would damage existing vegetation and should not be specified. Grubbing/blading will only be considered with the approval of Roadside Development.

After placing and shaping the shoulder build-up material, the material shall be compacted to the satisfaction of the Engineer.

When shoulder build-up material is specified on the plans, Environmental Planning Services will need to provide an environmental clearance.

Roadside Development Services will provide seeding requirements for the shoulder build-up areas. Where seeding is specified, shoulder build-up areas are normally tilled 2”, fertilized, seeded and hydro-mulched.

The Safety Edge: The safety edge is a method of constructing the edge of the AC pavement at an approximately 30 degree angle (2.1:1 slope) using a special shoe attachment on the AC laydown machine screed that provides compaction of the AC wedge. When this treatment is specified and shown on the plans, shoulder build-up may still be required to eliminate any edge drop-off. The plans typical section sheet will show the Safety Edge and any required shoulder build-up details. The evaluation of existing conditions by the designer and District will be as previously described.

Specifications: the following Stored Specifications are available from the Contracts and Specifications website: http://azdot.gov/Highways/CNS/index.asp Visit website for current Stored Specification updates.

Item 2030111 – Shoulder Build-up (EARTHEN) (203SHLEA, 5/16/01)

Item 2020112 – Shoulder Build-up (MILLED AC) (203SHLAC, 5/16/01)

Item 2030113 – Shoulder Build-up (COMPACTION) (202SHOLD, 5/16/01)

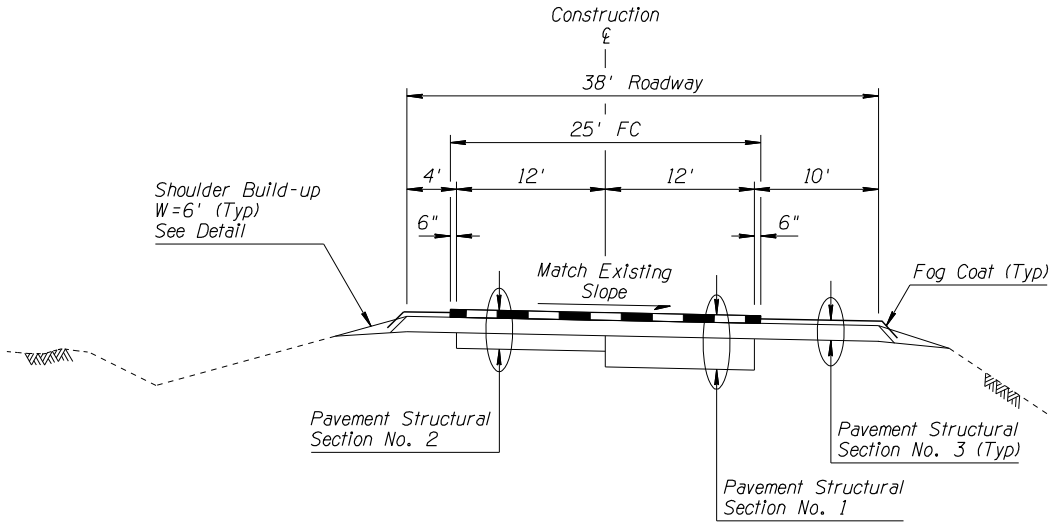
Measurement and Payment is by the lineal foot and the compaction effort is by the hour. The lineal footage should not include lengths along roadside barrier or curb. The estimated compaction production rate will vary depending upon the type of shoulder build-up material.

For informational purposes only, the in-place cubic yard quantity of shoulder build-up material should be shown in the General Notes on the project plans. This quantity is not to be included in the earthwork summary table.

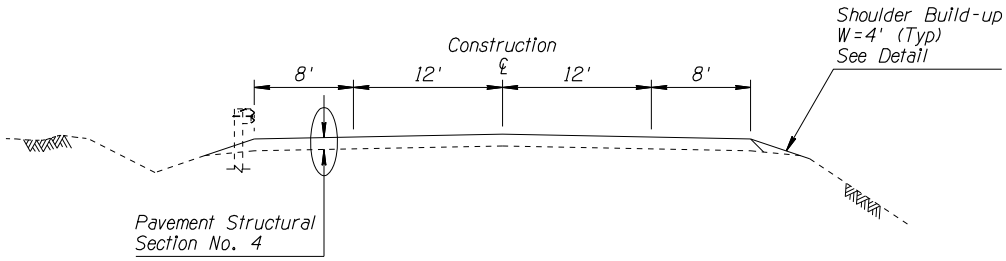
The cubic yard quantity of shoulder build-up material should be calculated based on the area of a right triangle, one leg being equal to the sum of the overlay thickness plus the average depth of any existing pavement drop-off, and the other leg being the average width of the shoulder build-up wedge. This area, multiplied by the length along the pavement edges, should be increased by a factor of 1.25 to adjust for shrinkage and sloughing due to narrow width.

GENERAL NOTES

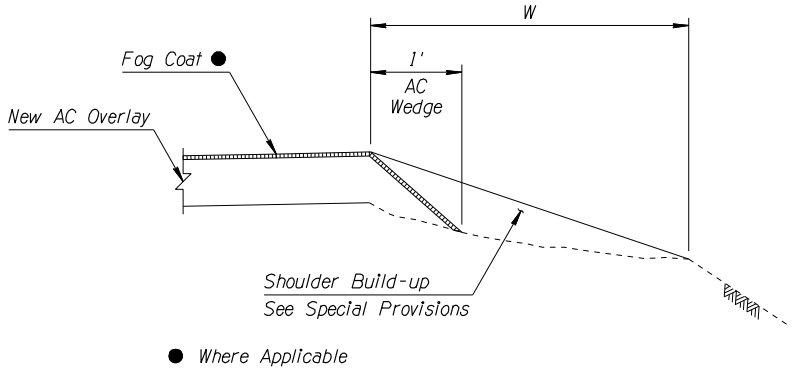
Approximately _____ Cubic Yards of Borrow (in place) is Estimated for Shoulder Build-up.



TYPICAL SECTION
MILL & FILL + OVERLAY



TYPICAL SECTION
AC OVERLAY



SHOULDER BUILD-UP DETAIL

APPENDIX B

CRITERIA FOR DETERMINING TREATMENT OF ROCK CUTS

FOR

INTERSTATE HIGHWAYS

ARIZONA DEPARTMENT OF TRANSPORTATION

OFFICE MEMO

May 4, 1990

TO: DESIGN TEAM LEADERS
Highway Plans Services

FROM: TERRY H. OTTERNESS
Assistant Plans Engineer
Highway Plans Services

RE: "Criteria for Determining Treatment of Rock Cuts for Interstate Highways"

The subject document was developed to serve as a guide in evaluating rock cuts on interstate pavement preservation projects.

The guide is the result of a combined effort with Advance Engineering and has been endorsed by the FHWA. It is intended for use in the preparation of Project Assessments and also by Design personnel during the design phase. Please assure proper consideration of this item during the design of your projects, when participating in PA field review, and when reviewing initial PAs.

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Attachment

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CRITERIA FOR DETERMINING TREATMENT OF ROCK CUTS

FOR INTERSTATE HIGHWAYS

Arizona Department of Transportation

Highway Development Group

Design Section

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INTRODUCTION

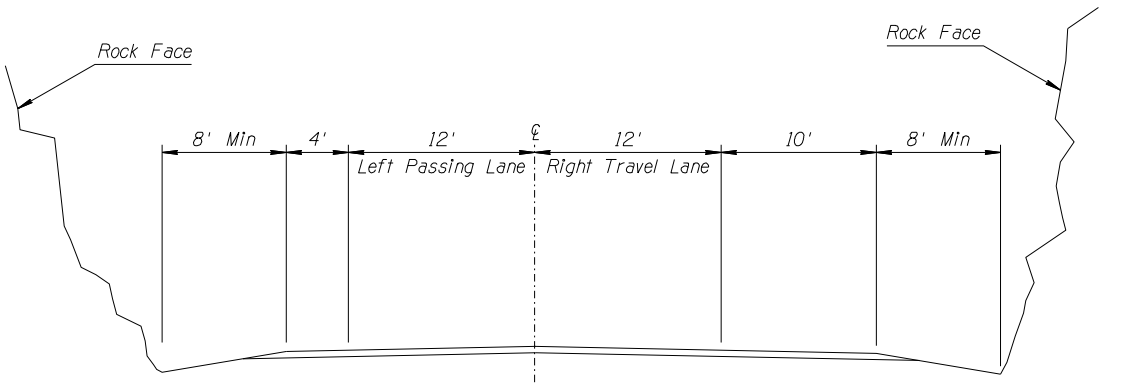
This procedural guide is to be used in evaluating the need to remove and/or protect errant vehicles from rock cuts. This guide is not a substitute for sound engineering judgment. Each rock cut situation will present its own peculiarities that will need to be individually evaluated.

Part I is the criteria to determine if a rock cut should be treated. Part II is a general guide of various treatments and their engineering consideration.

PART I - DETERMINATION IF ROCK CUT SHOULD BE TREATED

During the filed inspection, three features to pay close attention to are the cut ditch width, smoothness of the rock face and rock stability.

The minimum cut ditch width is 8’ minimum for both sides of the roadway as shown below:



If the cut ditch meets the minimum ditch width condition, no treatment is required EXCEPT to review rock fall problems and accident history.

If the cut ditch is less than the minimum ditch width condition, further evaluation is necessary. Rock fall problems and accidents should still be evaluated. Smoothness of the rock face and the feasibility of widening (versus placement of a longitudinal barrier) the rock cut should also be evaluated.

Jagged edges and outcroppings where errant vehicles could snag are the primary criteria for determining smoothness. A smooth rock face closer than the minimum cut ditch width with minimal accidents could be considered acceptable.

PART II - EVALUATION OF TREATMENT ALTERNATIVES

Options for lessening the hazard caused by a rock cut fall into two broad categories; protect errant vehicles from the rock face with a roadside barrier or remove enough rock to establish a sufficient clear zone. Cost is a major consideration in deciding which option to use. The ADOT Construction Costs published every year by Contracts & Specification Services can be used to obtain current bid prices on excavation and barrier costs. During the initial field review, note whether the rock can be removed by equipment or if blasting may be required. Geotechnical Services can also be consulted to determine if blasting is necessary. As a general rule, remove the rock if the cost is less than three times the cost of the barrier. Rock cuts over 25' in height will generally not be considered for widening due to cost restraints unless they are short in length or no other alternatives are available.

When evaluating rock removal versus barrier in higher elevations, the installation of a barrier may hinder snow removal efforts. District Maintenance should be able to provide information if the cut area is susceptible to drifting snow. Piled snow on the high side of a curve in front of a barrier will melt, flow across the pavement and freeze on the roadway at night.

If rock removal is the option chosen, a 15’ ditch width is the minimum width required with the clear zone width being the optimum. Ditch slopes from the edge of pavement should be 6:1 minimum with a flatter 10:1 being desirable if drainage conditions permit. Backslopes shall match existing slope rates or those determined by Geotechnical Services.

Existing approach and departure guardrail to the cut slope will require adjustment. If sufficient useable material is generated from the cut, approach or departure embankments should be flattened sufficiently to eliminate the need for guardrail. Plating material would most likely be required.

BARRIER PLACEMENT

The two common treatments for protecting the rock face are concrete barrier or guardrail.

CONCRETE BARRIER

The concrete barrier is to be backfilled and placed with a constant lateral offset throughout the cut. The cross slope of the shoulder will be extended to the base of the barrier. Attach approach guardrail to the barrier or extend the guardrail past the barrier end if the offset to the barrier is too large.

Backfilling the concrete barrier will fill any existing cut ditch and block runoff from the pavement. On flat grades, pavement flooding could become troublesome and require catchbasins, slotted drain, etc.

The concrete barrier is to be designed to accommodate a future overlay.* Weep holes through the barrier will be placed every 15' ±. Remember to maintain sufficient height of the weep holes to accommodate a future overlay.

If there is a Rockfall problem, consider a removable rock fence.

If there is a rock fall problem in a high narrow cut, barrier may not be the solution since rocks will no longer have a chance to be contained in the cut ditch.

GUARDRAIL

Guardrail should be used only where there is sufficient distance to accommodate the guardrail deflection without a vehicle impacting a rock outcrop. In areas where there is a guardrail embankment requirement of each side of a short rock cut, connect the two ends of the rail through the rock cut. Placing the barrier will make it difficult to get behind the guardrail for maintenance activities.

A determination should be made if the existing rock beneath the roadway will interfere with placement of the guardrail posts. Provisions for drilling guardrail post holes may be needed.

*See Section 6.4.1.8 Concrete Safety Shape, Roadside Design Guide.