

ARIZONA DEPARTMENT OF TRANSPORTATION



GUIDELINES FOR SCOPING PAVEMENT PRESERVATION PROJECTS

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ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

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PURPOSE

These Guidelines were developed to promote and clarify the work items to be addressed with pavement preservation projects and to establish a consistent approach to safety work and other work within the termini of pavement preservation projects. These Guidelines provide full recognition that project resources for pavement preservation are limited and implementation of full AASHTO safety criteria related to slopes, guardrail and clear zones that are applied to new construction or major reconstruction is not normally a feasible alternative for pavement preservation projects. The AASHTO Controlling Design Criteria Process and the Design Exception / Design Variance Process may identify additional safety items that could be addressed with a pavement preservation project and those processes are addressed under separate documents and are not a part of these Guidelines. 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 improvements may not be feasible or reasonable, efforts to incorporate appropriate safety measures are encouraged since construction opportunities may be limited over the next several years.

A holistic approach should be adopted when developing the scope of work for a pavement preservation project. Other work activities may be more economical when included in pavement preservation projects. Cost estimates for other work may be developed, dependent upon the likelihood of securing additional funds. The Project Manager, in conjunction with the Project Team, should determine the extent of the pavement preservation activities (i.e. travel lanes, passing lanes, shoulders, ramps and crossroads, as appropriate), including safety and other work, as early in the project scoping phase as possible.

BACKGROUND

The intent of pavement preservation projects is to extend the usable life of the pavement structure and also to address and include feasible 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. Speed is also a factor which is used throughout these guidelines. The official speed limits for the State Highway System can be obtained from Traffic Engineering Group. In addition to reviewing on-site, posted speeds may be reviewed on the Photo Log viewer (date shown). The AADTs to be used in the tables of these Guidelines should be for a design year 10 years after the construction year (use the anticipated construction year +10 if not yet programmed).

FORWARD

There are certain roadway features, not detailed in these guidelines that are normally included with pavement preservation work which are evaluated for conformance with current design guidelines:

- Shoulder Build-Up (see [Appendix A: Shoulder Build-Up Design Guidelines](#))
- Pavement Marking and Striping
- Rumble Strips
- Minor Signing
- Delineators and Object Markers

Safety enhancement treatments may be warranted by supportive crash history (as referred to throughout the text and tables of this guide). The Traffic Engineering Group's Traffic Safety 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 Safety Section, will evaluate the locations identified and determine any remedial treatment to be included with the project. Development of the Project Assessment should be coordinated with any ongoing studies, the Roadway Departure Safety Implementation Plan and any Road Safety Assessments in the area.

A draft ADA Compliance and Feasibility Report should be prepared in conjunction with the Project Assessment documents. The ADA Compliance and Feasibility Report requirements are addressed under separate documents and are not part of this guideline.

The distance to a potential hazard is measured from the edge of the through travel lane; the travel lane is defined as the record drawings/proposed lane width. Therefore, the normal method for measurement for clear zone is to measure from the roadway centerline to the potential hazard and then subtract the travel lane width(s).

Material or equipment salvaged from Federal-Aid projects require a Salvage Credit, if the salvaged item has a value more than \$5,000 and does not become the property of the contractor. When salvage credit is required, careful attention should be given to the contract provisions for salvage to ensure that the cost of the operation (i.e. removal and salvage) does not exceed the value of the item(s) to be salvaged. Common items that may be salvaged may be unused construction materials, highway appurtenances, equipment or material (millings) for which the useful life is greater than one year.

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 requiring resolution should be escalated in a timely manner to avoid delays.

These guidelines do not apply to ADOT's minor pavement preservation projects. A minor pavement preservation project does not restore or increase the structural capacity and is generally comprised of a preventative maintenance surface treatment or spot repair. Typical minor pavement preservation treatments include crack sealing, fog coats, chip seals, slurry seals, mill and fill projects 1-1/2" or less, spot repairs greater than 1-1/2" that are intended to restore or retard future deterioration, and maintains or improves the functional condition of the pavement without significantly increasing structural capacity.

The following items are addressed within these guidelines:

SAFETY ITEMS

- Embankment Slope Flattening
- Guardrail
- Bridge Barrier and Decks
- Embankment Curb, Downdrains and Spillways
- Crash Attenuators
- Pipe Culverts and Headwalls
- "L" Headwalls
- Trees
- Rock Cuts
- Chain Link Cable Barrier
- Pedestrian Features
- Cut Ditches
- Driveways, Turnouts and Pullouts
- Interstate Median Crossovers
- Gore Curbing

OTHER WORK ACTIVITIES

- Localized Subgrade
- Erosion
- Culvert Replacement or Re-lining
- Approach Slabs
- Rock Fall
- Drainage
- Intersection Turning Radii
- Signs
- Additional Special Purpose Lanes
- Shoulder Widening
- Curb, Gutter and Sidewalks
- 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:

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 pavement treatment, rail element (type), flare, or end treatments not meeting NCHRP 350. If reconstruction is required due to any of the described deficiencies, length of need should be evaluated based upon a design speed no less than the posted speed. Revisions to existing guardrail lengths of less than 50 feet are generally not warranted. Reference the [Roadway Design Memorandum entitled "Guard Rail Minimum Height after Overlay"](#).

B. 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.

C. Guardrail/Bridge Barrier Transitions:

Existing bridge barrier transitions should be reviewed by visual observation and record drawing information to determine if a barrier transition reconstruction or retrofit is required. Existing guardrail to concrete barrier transitions should be evaluated for upgrading in accordance with the [Roadway Design Memorandum entitled "Guardrail to Bridge Rail Transitions."](#) The latest [Guardrail Summary Form](#) should be completed for each transition location.

D. New Guardrail:

The following chart provides guidance for guardrail placement where no guardrail is presently in place:

Table 1: Guardrail Criteria for New Locations

	For Fixed Object ¹	Fill Slope Protection ²
Freeways	Yes, If Within 25' of Travel Lane Relocate or Shield	Yes, In Accordance With Roadway Design Guidelines (ADOT)
Multilane ³	Yes, If Within 12' of Travel Lane Relocate or Shield	Yes, Where Embankment Slopes Are Steeper Than 3:1
2-Lane AADT > 5000 ⁴	Same as Multilane	Same as Multilane
2-Lane AADT 2500-5000 ⁴	No. Mark Objects if Within 12' of Travel Lane ⁵	Yes, On Outside of Curves $\geq 3^\circ$ With Embankment Slopes Steeper Than 3:1
2-Lane AADT < 2500 ⁴	No. Mark Objects if Within 12' of Travel Lane ⁵	Crash History ⁶

BRIDGE BARRIER AND DECKS

Existing non-conforming bridge barrier on all classes of highways shall be reconstructed to current standards. An exception may be made for underpass bridges on rural non-NHS highways, not involved with any other reconstruction activities, such as guardrail upgrades on its associated roadway. The exception shall be based on sound engineering judgment and coordination with the project team.

Existing bridge deck joints should be repaired or reconstructed to current standards if identified as in need of replacement. Bridge deck drainage should be inspected for proper function.

¹ Consideration should be given to removal, relocation and/or redesign of the feature; such that the likelihood of impact/severity of the collision would be less than that of the guardrail.

² Refer to Embankment Slope Flattening Section of the Guidelines.

³ Multilane facilities are roadways with four or more through lanes, divided or undivided.

⁴ 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.

⁵ If crash history – relocate or shield. Do not mark trees.

⁶ Traffic Engineering Group's Traffic Safety Section will provide crash history and evaluation.

Existing bridge decks that are currently overlaid with asphaltic concrete or friction course material, in regions where de-icing chemicals are used and/or those decks exhibiting significant cracks that allow intrusion of corrosives into the bridge deck, may be identified for deck seal treatment. In the event there is an existing asphalt overlay, the overlay will be required to be removed (full depth), bridge deck inspected, spalls repaired (if required) and a deck seal placed on the deck, prior to any overlay being replaced.

The staff from Bridge Group will prepare a Bridge Evaluation Report and a Bridge Repair Listing Report that identifies needed modifications to bridge barriers, barrier/transitions, decks and deck joints within the project limits.

EMBANKMENT CURB, DOWNDRAINS AND SPILLWAYS

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 and curb height. Crash history should also play a role in the final decision.

Existing embankment curb, downdrains and spillways should be evaluated to determine if they function properly and if the proposed pavement treatment will impact the existing drainage features. Coordinating with District, the designer should determine whether removal and replacement, modification, or elimination is appropriate. Where slopes have been stabilized against erosion, 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.

PIPE CULVERTS AND HEADWALLS

The following table provides guidance for safety treatments (pipe extensions, pipes/headwalls marking and pipe end sections installations) to unshielded pipes, culverts and headwalls based on facility type, AADT, distance to obstruction and size of obstruction.

Table 2: 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 ²	Mark headwalls if present ³
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 ³
Multilane Highways ⁴ and 2-Lane Highway with AADT > 5000 ⁵	> 36" pipe and Culvert Headwalls	0' - 12' ----- > 12'	Economic Analysis to extend or shield ² For very narrow shoulders, barrier may not be practical. ----- No	Mark headwalls if present ³
Multilane Highways ⁴ and 2-Lane Highway with AADT > 5000 ⁵	≤ 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 ³

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

² 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.

³ 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.)

⁴ Multilane Highways are roadways with four or more through lanes, divided or undivided. Median pipe culverts treated the same. If the culvert is within 20' of another roadway culvert, consider connecting.

⁵ Parallel pipe culverts within 20' of through traffic lane may be considered for safety end sections.

Table 2: 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 Highways AADT 2500-5000	> 36" pipe and Culvert headwalls	<div>< 3'</div> <div>-----</div> <div>3' to 12'</div> <div>-----</div> <div>> 12'</div>	<div>Extend to 12'</div> <div>-----</div> <div>No</div> <div>-----</div> <div>No</div>	Mark headwalls if present ³
2-Lane Highways AADT 2500-5000	≤ 36" pipe	< 12'	No	Mark headwalls if present ³
2-Lane Highways AADT < 2500	<div>> 36" pipe and Culvert Headwalls</div> <div>-----</div> <div>≤ 36" pipe</div>	< 12'	<div>No</div> <div>-----</div> <div>No</div>	Mark headwalls if present ³

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

² 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.

³ 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.)

⁴ Multilane Highways are roadways with four or more through lanes, divided or undivided. Median pipe culverts treated the same. If the culvert is within 20' of another roadway culvert, consider connecting.

⁵ Parallel pipe culverts within 20' of through traffic lane may be considered for safety end sections.

L-HEADWALLS

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 L-shaped headwalls within the clear zone to flush type safety inlets connecting with the culvert. Some minor regrading of the ditch is normally required to maintain flow line and traversable slopes may be necessary.

TREES

Concurrence of Bureau of Land Management, 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 be removed. On scenic highways, tree removal should be coordinated with Roadside Development Section to consider potential mitigation needs.

Where trees are being removed in areas identified as having a crash 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.

ROCK CUTS

The Geotechnical Services should be consulted regarding proposed rock cuts that meet the requirements below:

Freeways

See ["Criteria for Treatment of Rock Cuts for Interstate Highways"](#) in Appendix B.

Other Multilane Divided Highways

Table 3: Shy Distance Table

Design Speed (Posted Speed +10) mph	Shy Line Offset L _s 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.

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/or FHWA.

Table 4: Various Safety Treatments

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

¹ General Note: Traffic Engineering Group's Traffic Safety Section will provide crash history and evaluation.

PEDESTRIAN FEATURES

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)**. The following link documents when curb ramps must be provided when resurfacing roads. <http://www.ada.gov/doj-fhwa-ta.htm>

Existing pedestrian features such as: sidewalks, crosswalks, curb ramps, ADA railing, bus stops, traffic signals and ramps within the project limits shall be reviewed and documented in a draft ADA Compliance and Feasibility Report. Pedestrian features should conform to Americans with Disabilities Act (ADA) requirements. The ADA Compliance and Feasibility Report requirements are addressed under separate documents and are not part of this guideline.

In general, existing curb ramps may be left in place if they meet ADA slope, width and landing requirements. Curb ramps without detectable warning devices will require the addition of detectable warning devices. A curb ramp should be installed where an existing curb presents a barrier between the crosswalk and the sidewalk. 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. Short segments of new sidewalk may also be considered to enhance accessibility and connectivity when other sidewalk related work is to be performed. However, the installation of new sidewalk may require a new/modified agreement with the local agency for the costs associated with the design, construction and maintenance.

ADOT's Feature Inventory System should be queried to identify pedestrian features and assess ADA compliancy. Due to the complex nature of applying ADA requirements to existing facilities, additional research/review/survey may be required during the design phase to resolve treatments for special conditions.

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.

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 with a flat bottom to obtain the needed material.

DRIVEWAYS, TURNOUTS AND PULLOUTS

Driveways and turnouts provide access to property abutting the state highway. Vehicular access to an abutting property from a curbed highway is a driveway and vehicular access to an abutting property from an uncurbed highway is a turnout. Criteria for paving turnouts can be found in [Appendix A of the ADOT Roadway Design Guidelines](#). It is typically ADOT's practice, in PM10 non-attainment areas, to pave or provide a bituminous treatment to permitted driveways and turnouts within ADOT right of way.

In areas outside of the PM10 non-attainment areas, unpaved driveways and turnouts that are permitted may be paved to the radius returns, if it is determined that they have high to moderate usage. Unpaved permitted driveways with very strong justification may be paved to the right of way line or 100' +/- from the centerline, whichever is less.

District is responsible for the review and implementation of permit actions. Coordination with the District is required to determine which driveways/turnouts are permitted and their recommended surface treatment.

Pullouts may provide access to roadside facilities which are contiguous to non-access controlled highways. Such facilities may include historical markers, vista points, mail boxes, bus stops, safety check areas and weigh-in-motion stations or may allow slow moving vehicles to pull out of through traffic to allow faster vehicles to pass. The scoping document should define the appropriate treatment of the pullout based on District and Pavement Design Section recommendations.

INTERSTATE MEDIAN CROSSOVERS

ADOT maintains the official median crossover list for Interstate crossovers. The surface treatment of official crossovers should be determined within the scoping document. Unofficial median crossovers should be obliterated or they should obtain official median crossover status.

GORE CURBING

Curbing within the gore area of freeway ramps should be removed or may be mitigated by gore pavement surface treatments as approved by the pavement designer.

OTHER WORK ACTIVITIES

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.

LOCALIZED SUBGRADE

Localized subgrade improvements necessary for the structural integrity of the pavement section may be funded with pavement preservation funds.

EROSION

Correction of minor erosion problems adjacent to the edge of pavement and shoulder build-up should be included as needed. Refer to Appendix A: Shoulder Build-Up Design Guidelines.

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.
4. The corrective work does not require new right of way that would jeopardize project schedule.

CULVERT REPLACEMENT OR RE-LINING

Deteriorated culverts and pipes which may threaten the integrity of the pavement structure may be replaced or re-lined 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 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.

A. Subsurface Drainage

Subsurface drainage problems are usually directly associated with pavement problems and should be thoroughly evaluated and included in the Materials Design Report.

B. Surface Drainage

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, clogged or poorly located catch basins, curbs and inlets and even inadequate cross-drainage pipes.

C. Other Drainage

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.
3. The corrective work does not require new right of way that would jeopardize project schedule.

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 sources is required.

SIGNS

Project wide upgrading of signs may be included, but will require alternate funding sources. **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 SIDEWALKS

In addition to conformance with ADA requirements under PEDESTRIAN FEATURES, 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, exclusive of ADA 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 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 GUARDS

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

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL TRANSPORTATION DIVISION

SHOULDER BUILD-UP DESIGN GUIDELINES

AUGUST 2011

**ROADWAY ENGINEERING GROUP
ROADWAY DESIGN SECTION**

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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)

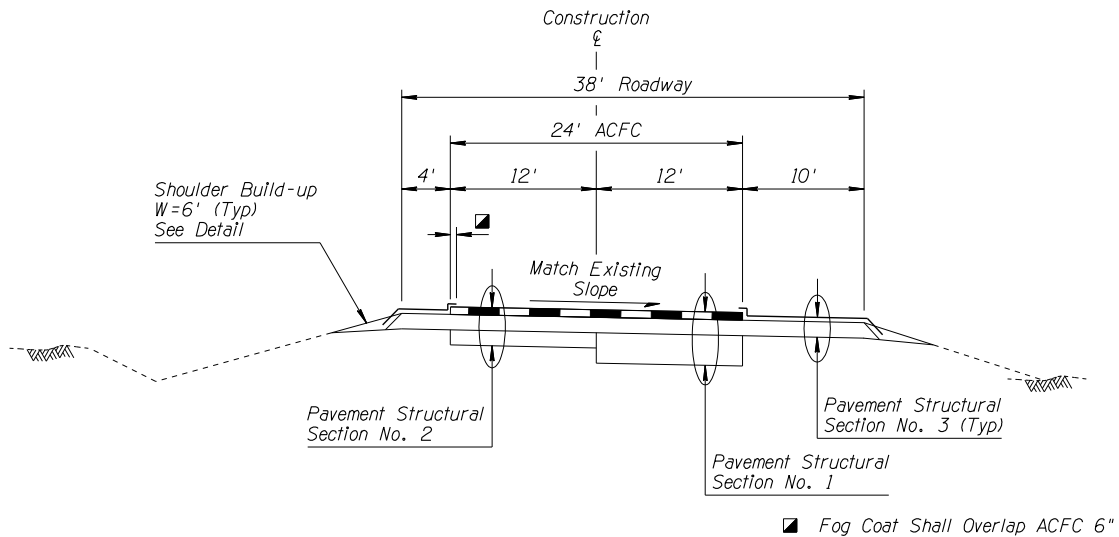
Measurement and Payment is by the lineal foot and the compaction effort is by the hour. The lineal footage should not include lengths along roadside barrier or curb. The estimated compaction production rate will vary depending upon the type of shoulder build-up material.

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.

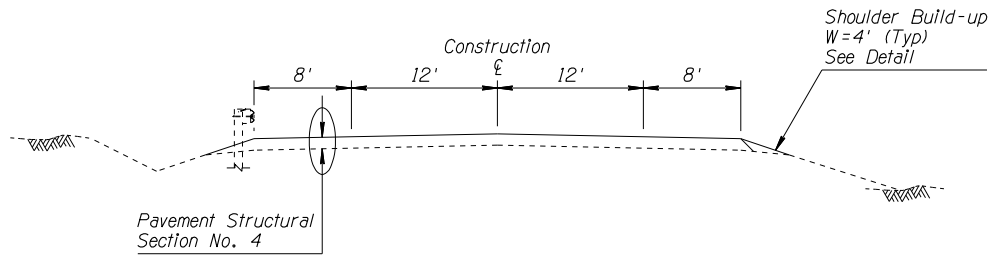
The cubic yard quantity of shoulder build-up material should be calculated based on the area of a right triangle, one leg being equal to the sum of the overlay thickness plus the average depth of any existing pavement drop-off, and the other leg being the average width of the shoulder build-up wedge. 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

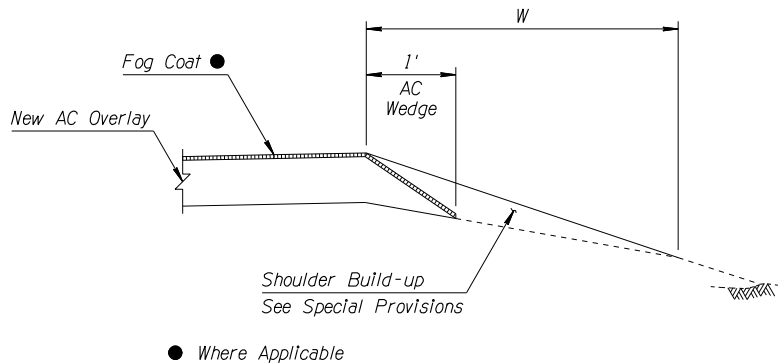
Approximately ----- Cubic Yards of Borrow
(In place) is Estimated for Shoulder Build-up.



TYPICAL SECTION
MILL & FILL + OVERLAY



TYPICAL SECTION
AC OVERLAY



SHOULDER BUILD-UP DETAIL

APPENDIX B

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.

THO: as
28940

Attachment

c: G. Hale
M. Viparina
P. Lowe
B. Kinney
H. Mozart

CRITERIA FOR DETERMINING TREATMENT OF ROCK CUTS

FOR INTERSTATE HIGHWAYS

Arizona Department of Transportation

Highway Development Group

Design Section

May 1990

INTRODUCTION

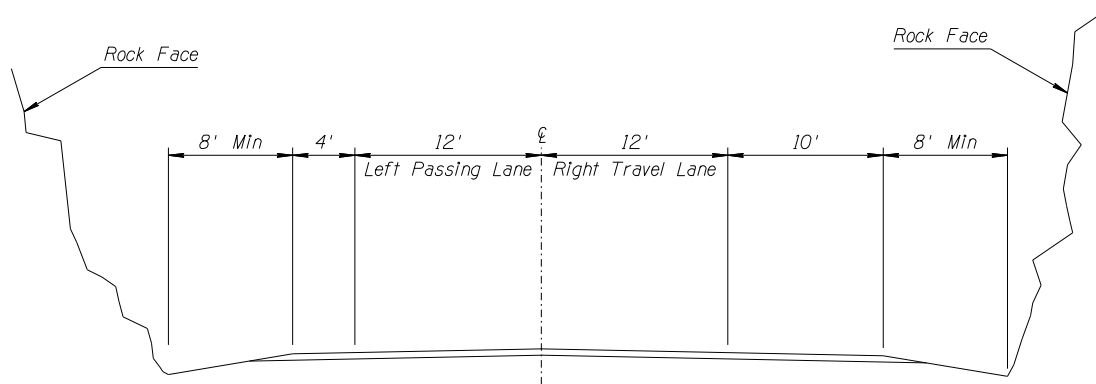
This procedural guide is to be used in evaluating the need to remove and/or protect errant vehicles from rock cuts. This guide is not a substitute for sound engineering judgment. Each rock cut situation will present its own peculiarities that will need to be individually evaluated.

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 field 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.

ROCK REMOVAL

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.