



# Pavement Tech Notes

## Shoulder Backing

Updated: September 30, 2006

*Note: Dimensions shown in parenthesis are in metric units.*

### **1.0 - GLOSSARY:**

1. **CAPM:** Capital Preventive Maintenance
2. **Drop off:** Height from top of pavement to OG at EP
3. **DME:** District Materials Engineer
4. **EP:** Edge of Pavement
5. **HM:** Highway Maintenance
6. **HMA:** Hot Mixed Asphalt (formerly known as Asphalt Concrete or AC)
7. **HW:** Hinge Width, horizontal distance from edge of shoulder (ES) to hinge point (See Figure 1)
8. **HDM:** Highway Design Manual
9. **SSP:** Standard Special Provisions

### **2.0 - GENERAL:**

Shoulder Backing [known formally as Imported Material (Shoulder Backing)] is a common design item for paving projects. The information in this guideline applies to any project where shoulder backing is being considered including rehabilitation, capital preventive maintenance (CAPM), and Highway Maintenance (HM) projects.

Shoulder Backing, as defined for State projects, is a thin course of granular material that is used to protect the outside edge of the pavement by providing support that prevents edge cracking and pavement edge loss. Shoulder Backing also minimizes drop-off heights for overlays. The specifications for shoulder backing material and workmanship can be found in Standard Special Provision (SSP) 19-720. In the past, shoulder backing has typically failed due to inappropriate use of the Shoulder Backing material or poor compaction. This has led to erosion problems and issues for both construction and maintenance personnel. Issues include additional exposure for road maintenance crews to repair eroded Shoulder Backing and use of unconventional construction practices to build Shoulder Backing on steep slopes.

### **3.0 - APPLICATION:**

Shoulder Backing is designed to provide edge support for thin overlays placed on existing roadways. Shoulder Backing (as specified in SSP 19-720) is not designed to be embankment material and should not be used as embankment material in the following locations:

- a. To repair erosion or subsidence in existing slopes (See Figure 3)
- b. For side slope reconstruction (See Figure 3)
- c. For backfill behind dikes (See Figure 4)
- d. To construct the required minimum HW for guardrails, dikes, and barriers



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Also, Shoulder Backing should not be used in the following locations:

- a. For overlays greater than 0.50 ft (150 mm) in thickness (See Figure 3)
- b. In roadside ditches or gutters (See Figure 5)<sub>1</sub>

Shoulder Backing should not be used in the locations listed above because the material and/or compaction specifications found in SSP 19-720 will not provide the desired results. When shoulder backing is used in these locations, it could create constructability and/or maintainability issues, can increase the Department's long-term costs, and in some cases follow-up projects may be required to repair shoulder backing that has failed. For these reasons, in these locations, alternative engineering solutions should be utilized. Alternative engineering solutions may include slope reconstruction, compacted fill, or stabilized material. Some alternatives to Shoulder Backing may require developing a nonstandard special provision. For information on obtaining approval for nonstandard special provisions, see "Pavement Specifications" under the Pavement website (<http://www.dot.ca.gov/hq/oppd/pavement/specs.htm>).

### **4.0 - ALTERNATE MATERIALS:**

Imported borrow or native material shall not be used as Shoulder Backing unless it meets the specifications set forth in SSP 19-720 for Shoulder Backing material. The Deputy Directive on Recycling Asphalt Concrete allows the use of HMA grindings for Shoulder Backing; however, there are some limitations to where HMA grindings can be used. For information on where HMA grindings cannot be used see SSP 19-720 or consult the District Environmental unit<sub>2</sub>.

### **5.0 - ADMIXTURES**

Admixtures must not be used unless recommended by the District Materials Engineer and if their use is permitted in the environmental document and regulatory permits. District Environmental can assist in determining if and where admixtures can be used. Three types of admixtures (lime, cement, and seal coat with an asphaltic emulsion) are approved for use with shoulder backing. Lime and cement are uniformly mixed into the shoulder backing material prior to application. These materials are added by editing SSP 19-720 and are paid for as part of Imported Material (Shoulder Backing). Seal coats are applied on top of placed material and are paid for separately from shoulder backing. Seal coats are included by placing the appropriate seal cost special provisions into the project special provisions.



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### **6.0 - DESIGN CONSIDERATIONS:**

Because field conditions vary from project to project and because of contract administration requirements, the limits, slopes, and other design details need to be shown on the contract plans. In designing Shoulder Backing details, the following is offered:

- a. Shoulder backing should be placed from the edge of pavement (EP) to hinge point (HP). However, where the horizontal distance from EP to HP is greater than 3 ft (1 meter), Shoulder Backing should be placed on a width of at least 3 feet (1 meter) from EP (See Figures 1 and 2)
- b. Shoulder Backing cross slope should be 10:1 (1:10) or flatter where possible. Where there is insufficient width for a 10:1 (1:10) slope, a steeper cross slope can be used but should not be steeper than 6:1 (1:6) (See Figure 1)
- c. The minimum HW should be 2 ft (0.6 meters<sub>3</sub>). Where the existing Hinge Width is less than 2 ft (0.6 meters), slope reconstruction or some other strategy should be used instead of Shoulder Backing (See Figure 3)
- d. Shoulder backing should not be placed on existing side slopes where it cannot achieve at least a 6:1 (1:6) cross slope and a HW of at least 2 ft (0.6 meters<sub>3</sub>) (See Figure 2)
- e. Where the combined distance for HW and side slope will exceed two meters in order to comply with the slope requirement specified in this document, side slope reconstruction is recommended in lieu of Shoulder Backing (See Figure 3)
- f. The maximum thickness for shoulder backing is 0.50 ft (150 mm). Where the thickness will exceed 0.50 ft (150 mm), alternative strategies that use a combination of more stringent material and compaction requirements need to be used (See Figure 3)
- g. Shoulder Backing should be placed to the top of the pavement, even when the top layer is open graded friction course (OGFC). This reduces future maintenance needs to maintain the shoulder backing as it subsides.
- h. At the option of the District, Shoulder Backing can be placed, up to 0.50 ft (150 mm), to cap new slopes or slope reconstructions (See Figure 3)

The attached Figures 1 through 5 show some examples of what should and should not be done when using Shoulder Backing.



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### 7.0 - MEASUREMENT & PAYMENT

Shoulder Backing is measured by the ton (metric tonne). The project engineer is responsible for obtaining sufficiently accurate measurements for the calculations. To compute the weight, multiply the volume measurements by 0.0725 ton/ft<sup>3</sup> (2.32 tonnes/m<sup>3</sup>). Occasionally, requests are received from designers to measure and pay for shoulder backing by the station. Although this method may appear easier for the designer to calculate, it requires very accurate details on plans such as the width, lengths, and thickness, which often vary in the field. Its use can increase construction claims or have insufficient material being placed. For these reasons, measuring and paying for shoulder backing by the station is no longer permitted. Note that even if the amount of shoulder backing does not vary on a project, converting from station to weight only requires one or two additional calculations.

#### Footnotes:

1. The material used for shoulder backing can be erodible. Designers should use nonerodible materials or stabilized bases. Material used should meet the requirements for the clear recovery zone [see HDM 309.1(2)]
2. Chapter 8 of the PDPM shows that there is a Memorandum of Understanding (MOU) dated January 12, 1993, that outlines the interim agreement between DFG and Caltrans regarding the use of asphaltic material.
3. Consult with DME for conditions where the distance from ES to HP is less than 3 feet (0.9 meters) and there are minimum HW requirements for dike, MBGR and barriers.
4.  $145 \text{ lbs/ft}^3 * 1 \text{ ton}/2000 \text{ lbs}$  ( $35.31 \text{ ft}^3/\text{m}^3 * 145 \text{ lbs/ft}^3 * 1 \text{ tonne}/2204.59 \text{ lbs}$ ) = 2.32tonne/m<sup>3</sup>, if you need a more accurate factor of conversion determine the actual dry density of the Shoulder Backing material being used and substitute its value in the equation for conversion.

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### TYPICAL (MOST COMMON) APPLICATION

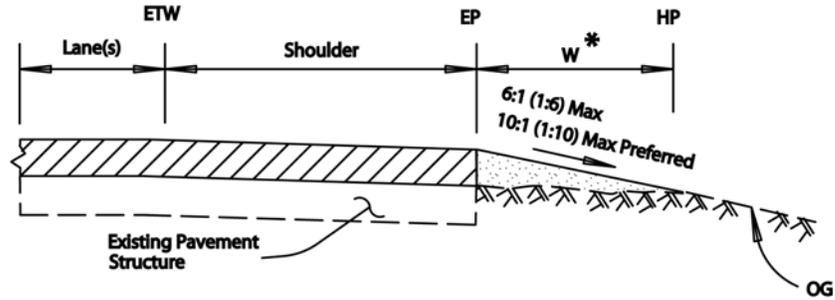


Figure 1

### ALTERNATIVE PLACEMENT FOR EXIST SLOPES STEEPER THAN 6:1 (1:6)

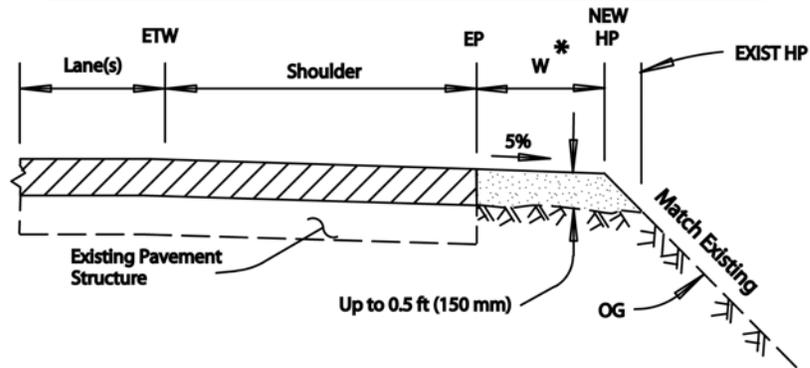


Figure 2

\* 2 ft (0.6 m) min. When W is less than 3 ft (0.9 m), District Materials should be consulted regarding the pavement structural stability due to width reductions. Min width requirements also exist for dikes, MBGR, & concrete barriers. For further information see Standard Plans & Traffic Manual (Ch. 7)

### LEGEND



Overlay (thickness varies)



Shoulder Backing

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### THICK PLACEMENTS >0.50 ft (150 mm) OR FOR SLOPE REPAIR

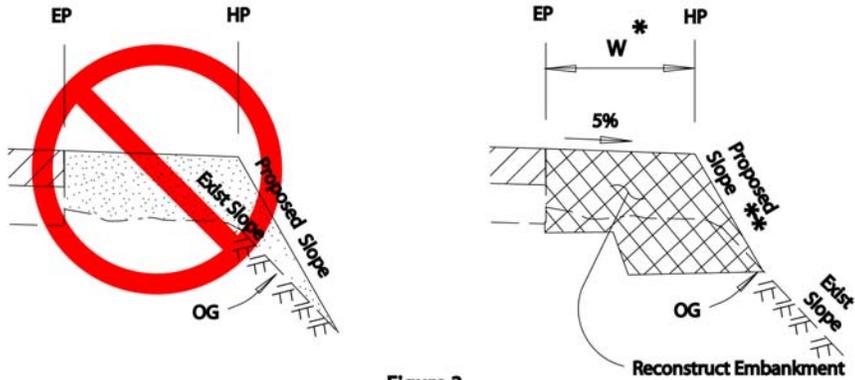


Figure 3

\* 2 ft (0.6 m) min. When W is less than 3 ft (0.9 m), District Materials should be consulted regarding the pavement structural stability due to width reductions. Min width requirements also exist for dikes, MBGR, & concrete barriers. For further information see Standard Plans & Traffic Manual (Ch. 7)

\*\* See HDM Topic 304 for additional information on side slopes. See Std Specifications, Sec. 19-6 for additional information on side slope construction. See District Materials for material recommendations. (Roadway Geotechnical also needs to be consulted for proposed slopes steeper than 2:1 (1:2.)

### PLACEMENT BEHIND DIKES

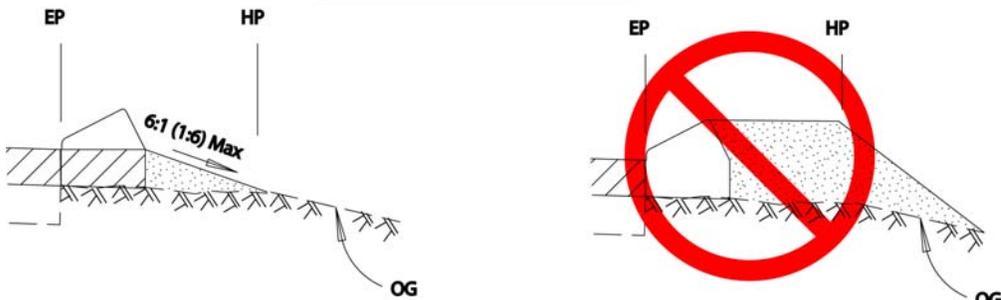


Figure 4

### LEGEND

 Overlay (thickness varies)

 Shoulder Backing

 Embankment

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### LONGITUDINAL DRAINAGE (ROADSIDE DITCHES/GUTTERS)

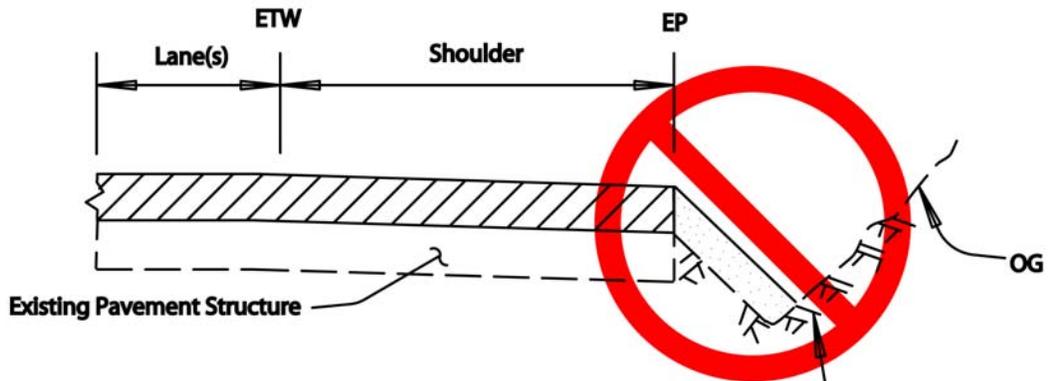
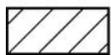


Figure 5

Consult with area maintenance personnel and materials engineer regarding erodability of ditch, alt materials to shld backing, slope sloughing and rock fall catchment in ditch. Consult with District Hydraulics regarding acceptable change in ditch capacity. Consult District Storm Water Coordinator regarding water quality issues.

### LEGEND



Overlay (thickness varies)



Shoulder Backing