Example Problem 1C-1_2: Interstate Overlay Project

An Interstate project has been initiated to repair the pavement on a section of roadway. A pavement analysis determines a 6″ overlay is required.

Step 1 – Identify the design criteria that may be affected.

In this case, adding 6″ of elevation to the roadway and tying into the existing ground will impact one or more of the following:

- Lane width.
- Roadway cross-slope.
- Shoulder cross-slope.
- Shoulder width.
- Foreslopes.
- Clear zone (because it is directly related to the foreslopes).
- Ditch width.

Step 2 – Identify the current values and acceptable ranges from the Initial Design Criteria Tables

For this example, assume the DDHV truck volume is less than 250. The initial design criteria values from the tables are:

Design Element		Preferred Values		Acceptable – Requires Approval per Section 1C-8		Existing Condition
clear zone (ft) – Refer to Section 8A-2		34		30		Generally 37′ to hazards, 2 large culverts at 31′ in the median
Pavement cross-slope (%)		2%		1.5% min, 3% max		2%
		outside lane	inside lane	outside lane	inside lane	
Design lane width (ft)		12	12	12	12	12
shoulder width (ft) (may include a portion of lane pavement width)		10	6	10	4	10 outside / 6 inside
shoulder cross-slope (%)		4%		6% maximum-but not less than the adjacent lane		4%
foreslope (see Roadway Typical Cross Sections)	adjacent to shoulder	10:1 for 4′ then 6:1		4:1		6:1
	beyond standard ditch depth and design clear zone	3.5:1		3:1		
	curbed roadways	curbed roadways are not preferred		not steeper than 3:1		
normal outside ditch (depth × width) (ft)		5 × 10		--		5 x 10

Step 3 – Identify all reasonable options and determine how they would affect the design criteria

Shoulder cross slope, inside shoulder width, and foreslopes are greater than the acceptable value thresholds, so these areas should be analyzed to meet the project requirements.

Outside shoulders

- By steepening the shoulders to 6%, 2.4″ of the 6″ is gained (per Table 1), leaving 3.6″ yet to be accounted for.

- By constructing a 4:1 foreslope adjacent to the shoulder, the width of construction required to meet the existing foreslope to compensate for the 3.6″ of depth that is still unaccounted is about 3.6′ (per Table 2). A granular fillet at a 4:1 slope will meet the acceptable criteria. A 4:1 slope is considered recoverable, so this will not affect the clear zone. Existing guardrail should be analyzed to ensure it will function properly if slopes are steepened.

Inside shoulders

- By steepening the inside shoulders to 6%, only 1.44″ of height would be gained (per Table1), leaving 4.56″ yet to be accounted.
- In addition to the first option, by constructing a 4:1 foreslope, the width of construction to meet the existing foreslope at a 4.56″ of depth is 4.56′ (per Table 2). This exceeds the desirable width for granular fillets. Additionally, bringing in this amount of earth fill would be relatively expensive because of the erosion control features required for such a small quantity.
- Another option in addition to the first option is to construct a 3:1 foreslope. The width of construction to meet the existing foreslope would be about 2.5′ (per Table 2). This is a reasonable width for a rock fillet. However, if this option is selected, consider that the 3:1 slope is not recoverable and will impact the width of clear zone provided. The 2.5′ of 3:1 slope is deducted from the provided clear zone, leaving two median pipes within a 29′ clear zone. Because this is an Interstate project (FHWA is generally reluctant to approve 3:1 slopes on Interstate projects), this option would require significant justification.
- Another option is to reduce the inside shoulder width to 4′ and adjust the cross-slope to 6%, which creates nearly an inch of fall (per Table 1). Then, the remaining 2′ of the existing shoulder can be sloped at 4:1. This will absorb about 5″ of the added height (remember the 4% slope would have provided nearly 1″ of fall in the outer 2′). By combining the shoulder cross-slope steepening and the shoulder width narrowing, the full 6″ overlay can be accommodated.
- The previous options could be partially combined for other solutions.

Step 4 – Select the best option

For this example, we've selected a combination of reducing the shoulder width, steepening the cross-slope of the shoulder, and adding a 4:1 rock fillet. This option is shown below in the Project Design Criteria Worksheet.

Design Element		Preferred Values		Acceptable – Requires Approval per Section 1C-8		Existing Condition	Proposed
clear zone (ft) – Refer to Section 8A-2		34		30		Generally 37′ to hazards, 2 large culverts at 31′ in the median	Generally 37′ to hazards, 2 large culverts at 31′ in the median
mainline cross-slope (%)		2%		1.5% min, 3% max		2%	2%
		outside lane	inside lane(s)	outside lane	inside lane(s)		
Design lane width (ft)		12	12	12	12	12	12
shoulder width (ft) (may include a portion of lane pavement width)		10	6	10	4	10 outside / 6 inside	10 outside / 4 inside
shoulder cross-slope (%)		4%		6% but not less than the adjacent lane		4%	6%
foreslope (see Roadway Typical Cross Sections)	adjacent to shoulder	10:1 for 4′ then 6:1		4:1		6:1	Outside-4:1 rock fillet to existing Inside- round 2′ of shoulder at approx 5:1 with 4:1 rock fillet
	beyond standard ditch depth and design clear zone	3.5:1		3:1			
	curbed roadways	curbed roadways are not preferred		not steeper than 3:1			
normal outside ditch (depth × width) (ft)		5 × 10		--		5 x 10	5 x 10

Step 5 – Submit the design for approval and document the process (Section 1C-8)