

Description Any of several measures can be used to control erosion and sedimentation originating with haul roads, detours, access roads, and other unpaved or temporary roadbeds associated with a construction project. Possible measures include:

Road Placement: Place temporary roads as far as possible away from streams, surface waters or wetlands.

Open-Top Box Culvert: A wooden culvert installed across the road grade to convey surface runoff and roadside ditch flows to the downslope side. Open-top box culverts are useful for collecting surface runoff and ditch flows and channeling this water across the road without eroding the drainage system or road surface.

Waterbar (or Cross Ditch): A cut and berm built at a downward angle across the roadway, extending from the cutbank to the opposite fill shoulder. Waterbars reduce erosion by diverting stormwater runoff from the road surface and directing it to a safe discharge area.

Road Sloping: Constructing the road with an outward slope of 1 to 2% from the cut slope to the fill slope. Sloped roads are designed to divert surface water off the entire road surface so that water does not concentrate in any specific location.

Rolling Dip: Constructing the road with shallow, outward-sloping dips or undulations to collect surface runoff and con

roads where erosion of the roadbed and fill slope is unlikely due to low runoff volume or intensity.

Rolling Dip: Used as a runoff diversion measure to prevent erosion of the road surface. Rolling dips are effective on long inclines to keep stormwater from flowing directly down the road, where it may cause gullying and other damage to the road surface and grade.

Level Spreader: Useful where concentrated runoff from bare ground or other unstabilized areas can be diverted onto stabilized areas under sheet flow conditions. Level spreaders are often placed at the outlets of diversion dikes or runoff interception trenches to control runoff, dissipate water velocity, and disperse the water over a broad surface area. Level spreaders are relatively inexpensive to install. They may be used on slopes of 3:1 or flatter.

Limitations

Drainage area - unlimited	Maximum slope – 15%
Minimum bedrock depth – 3 ft	Minimum water table - N/A
NRCS soil type - ABCD	Freeze/thaw – good
Drainage/flood control – no	

Open-Top Box Culvert: Generally, box culverts are not required on grades of 6% or less and are ineffective under continuous or recurrent use where cleaning is sporadic.

Waterbar: Suitable only for light-use, low-maintenance, unpaved roads.

Road Sloping: Suitable only for low-traffic haul roads where runoff volume and intensity are low.

Rolling Dip: Not suitable on road grades steeper than 5% .

Level Spreader: Level spreaders are not recommended for use in most situations. They are not suitable on slopes steeper than 3:1 or where the soils are easily erodible. They should be constructed only on natural soils, not on fill material. Level spreaders cannot handle large quantities of sediment-laden stormwater. If altered by erosion or other disturbance, they may "short circuit" and actually concentrate flows into small streams instead of spreading the flows into sheet flow.

Targeted Pollutants

Sediment
Phosphorus
Trace Metal
Hydrocarbons

Design Parameters

Open-Top Box Culvert: Box culverts can be built from logs lumber discarded guardrail or corrugated steel. They are installed at a skewed angle downgrade across the roadway, with the discharge end extending 6 to 12 in beyond the surface of the roadbed.

~~Spacing between culverts should be in accordance with recommended cross~~

drainage spacing in Table 6-1. Where recommended spacing is less than 33 ft, the road should be paved with gravel or crushed rock.

Waterbar: Waterbars are generally constructed using a blade-equipped tractor or by hand. The size of the waterbar depends on the amount of precipitation in the area, the soil erodibility, and anticipated traffic.

- The waterbar should extend from the cutbank side of the road completely across to the fillslope side.
- Cut dimensions: Up to 16 in deep across road, 8 to 16 in deep at outlet, 3 to 4 ft wide.
- Berm dimensions and orientation: 1 to 2 ft high 5 in minimum height, skewed at angle of 30° to 40° across road.
- Spacing between bars: Use Table 6-1 for recommended cross drain spacing on low to moderately steep topography.
- Discharge: Runoff should not be directed onto fill material without proper energy dissipation and drainage away from the fill.

Geotextile (filter fabric): Most installations will include geotextile (filter fabric) with the properties listed in Table 6-2, placed over the entire area to be covered with aggregate. Work on single residential lots will generally not need geotextile unless there is potential for excessive erosion, a high water table or other risk factor. The geotextile should be a woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The geotextile should be rot resistant and inert to commonly encountered chemicals, hydrocarbons, mildew.

Road Sloping: The slope should be approximately 1 to 2% from the cut slope outward to the fill slope. Berms on the outside of the road should be limited or removed to allow water to flow off the road surface. Provide sediment collection or erosion-control measures at the toe of the fill slope to prevent excessive erosion and sediment transport.

Rolling Dip: (applies to roads greater than 150 ft long only) The dip should be approximately 1 ft below the surface plane of the road. The upgrade approach to the bottom of the dip should be approximately 66 ft long. The downgrade approach to the bottom of the dip should be approximately 23 ft long. Align the dip across the road at nearly a 90° angle, and slope it outward approximately 5% .

Construction Guidelines

Open-Top Box Culvert: Construct a box-like frame (three-sided, open-topped) of logs, lumber, discarded guardrail, or corrugated steel. Install it flush with the road surface, skewed at an angle downgrade across the roadway. Set the inflow end at the same grade as the side ditches on the road and extend it into the cut bank. The discharge end should extend 6 to 12 in. beyond the surface of the roadbed and should be directed onto vegetated ground or riprap or into another erosion-control structure such as a sediment trap or catch basin.

Waterbar: Cut each waterbar into solid soil to a minimum depth of 6 in. next to the cutbank and 8 in. at the road shoulder, with an adverse

grade on the downroad or downgrade side of the waterbar. Build a continuous, firm berm of soil, at least 6 in. above normal grade, parallel to the waterbar cut on its downhill side. Include a bank tie-in point, cut 6 to 12 in. into the roadbed. For added stability, the bar may be compacted with a nonerosive fill material. The completed waterbar should extend across the full roadway width, aligned at an angle of 30° to 40° relative to the roadway. A dissipation or filter device (such as riprap or silt fence) may be needed below the waterbar to control erosion and trap sediment.

Road Sloping: Road sloping is built into the road during construction. Install erosion- and sediment-control measures downslope before completing the finish grade of the sloped road. Then construct the outward slope of 1 to 2% , as specified in the contract plans.

Rolling Dip: Rolling dips are built into the road, during construction, following the natural contours of the land. Install erosion and sediment measures at the low point of the dip (drainage outfall to fill slope) before final grading to direct stormwater discharge from the dip. Construct the dip according to the specifications shown in the contract plans. If not specified, make the dip 1 ft deep, with a 23 ft-long approach on the downgrade side and a 66 ft-long approach on the upgrade side.

Maintenance

Inspect all devices regularly according to provisions of the contract or project site plan. Make repairs promptly to avoid progressive damage. Remove accumulated sediments as necessary to ensure proper functioning.

Open-Top Box Culvert: Clean and repair the culverts on a regular basis. Remove sediments and other debris that may block drainage flow or decrease structural efficiency.

Waterbar: Properly constructed bars should require little or no maintenance. However, all waterbars need to be open at the lower end so water can easily flow away from the roadway. Hand shovel work may be necessary following high runoff periods or severe storms to ensure unrestricted flow.

Road Sloping: Minor regrading may be required to maintain slope angle.

Rolling Dip: Outflows should be kept free of debris to prevent ponding.

Table 6-1. Recommended Cross Drain Spacing (Source: ITD, 1994)

Road Grade (percent)	Spacing Between Open-Top Culverts, feet (meters)
2 to 5	300 to 500 (90 to 150)
6 to 10	200 to 300 (60 to 90)
11 to 15	100 to 200 (30 to 60)
16 to 20	<100 (<30)

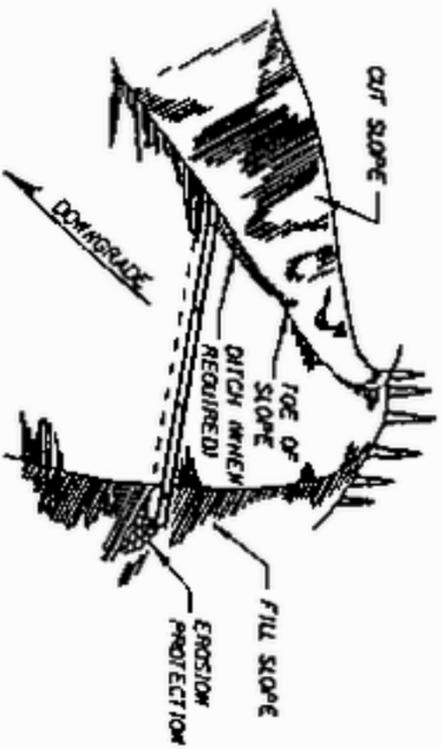
Table 6-2. Geotextile Properties by Road Type

Geotextile Properties	Light Duty ¹ Roads Grade Subgrade	Heavy Duty ² Haul Roads Rough Graded	Test Method
Grab Tensile Strength (lbs)	200	220	ASTM D1682
Elongation at Failure (%)	50	60	ASTM D1682
Mullen Brust Strength (lbs)	190	430	ASTM D3786
Puncture Strength (lbs)	40	125	ASTM D751 modified
Equivalent Opening Size	40-80	40-80	US Std Sieve CW-02215
Aggregate Depth (in.)	6	10	--

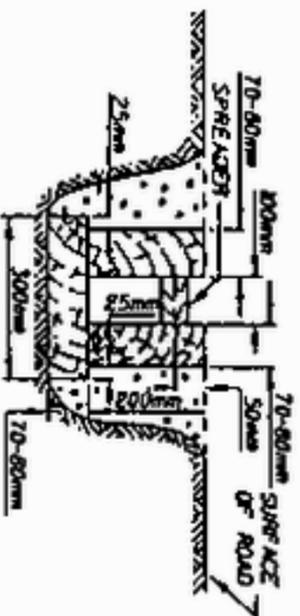
¹Light Duty Road: Are sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

²Heavy Duty Road: Are sites with only rough grading, and where most travel would be multi-axle vehicles. Trevira Spunbond 1135, Mirafi 600X, or equivalent.

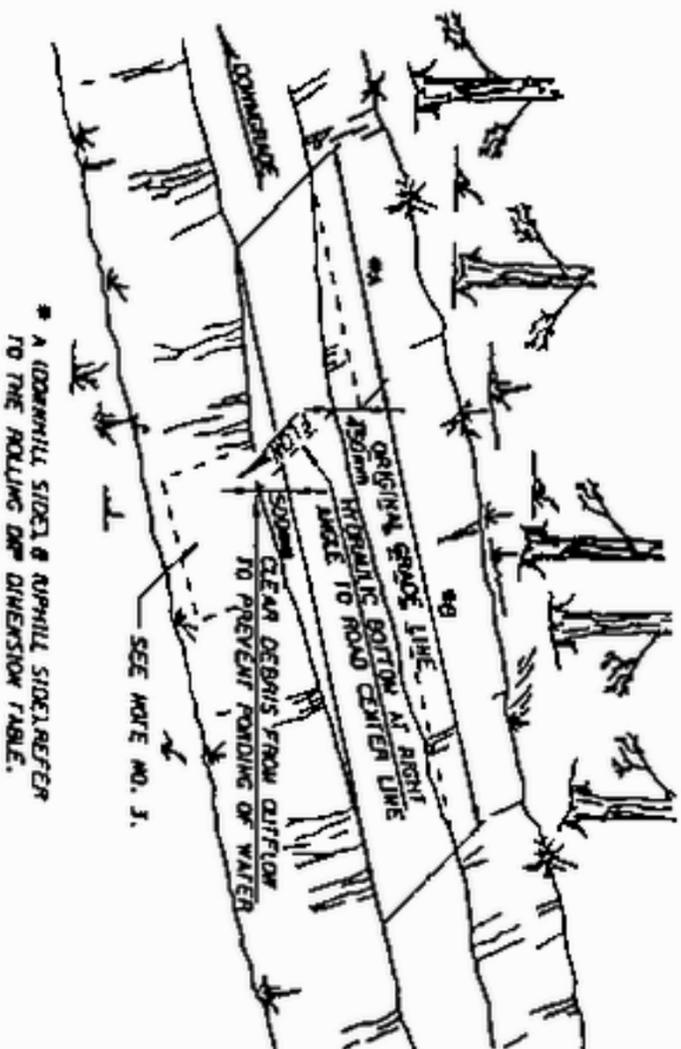
³Geotextiles not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.



PERSPECTIVE VIEW

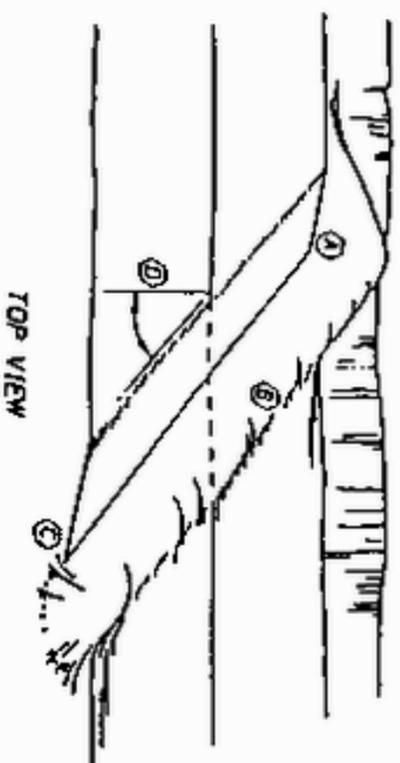


END VIEW
OPEN-TOP BOX CULVERT

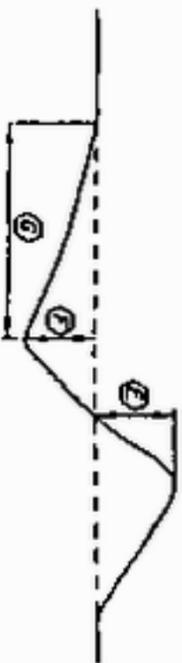


* A DOWNHILL SIDE & UPHILL SIDE REFER TO THE ROLLING DIP DIMENSION TABLE.

ROLLING DIP DETAIL



TOP VIEW



- A. BANK 1/2-IN POINT CUT 50 TO 300 mm INTO ROADBED.
- B. CROSS DRAIN BERM HEIGHT ABOUT 0.5 m ABOVE ROAD BED.
- C. DRAIN OUTLET CUT 200 TO 400 mm INTO ROAD.
- D. ANGLE DRAIN UP TO 45° DOWNGRADE WITH ROAD CENTERLINE.
- E. HEIGHT UP TO 0.5 m.
- F. DEPTH TO 0.5 m.
- G. 1.0 TO 1.2 m.

CROSS SECTION AT CENTER LINE
WATERBAR (OR CROSS-DITCH)
[SEE NOTE NO. 2]



- 1. OVERT RIMOFF ACROSS ROAD SURFACE FROM TOE OF CUT SLOPE TO FILL SLOPE.
- 2. ROAD SURFACE MUST BE RELATIVELY EVEN TO PREVENT PUDDING & EROSION.

ROAD SLOPING

ROLLING DIP DIMENSION TABLE			
DOWNGRADE	A (DOWNHILL)	B (UPHILL)	
0% TO 4%	10.5	20	
4% TO 6%	7.5	25	
6% TO 8%	4.5	26	

NOTES

1. ALL OF THE INSTALLATIONS SHOWN ON THIS DRAWING SHALL BE USED IN CONJUNCTION WITH ITD CATALOG OF STORM WATER BEST MANAGEMENT PRACTICES (BMP) FOR HIGHWAY CONSTRUCTION AND MAINTENANCE.
2. CONSTRUCT WATERBARS OR CROSS DITCHES ONLY ON UNPAVED HAUL ROADS WITH LIMITED OR NO TRAFFIC. THE DEVICE CONFIGURATION SHOULD BE ADJUSTED TO FIELD CONDITIONS.
3. A SEDIMENT FILTERING DEVICE SHALL BE PLACED AT OUTFLOW OF A ROLLING DIP.
4. ALL DIMENSIONS AND DISTANCES ARE IN METERS UNLESS OTHERWISE NOTED AND ALL THE DETAILS SHOWN ARE NOT DRAWN TO ANY SCALE.