PAVED FLUME

(Permanent Practice)

Definition

A small concrete-lined channel to convey water on a relatively steep slope to a non-erosive release in a stream or waterway.

Purpose

To conduct concentrated runoff safely down the face of a cut or fill slope without causing erosion.

Conditions Where Practice Applies

Where concentrated storm runoff must be conveyed from the top to the bottom of a cut or fill slope as part of a permanent erosion control system. Paved flumes serve as stable outlets for diversions, drainage channels, or natural drainageways that are located above relatively steep slopes. Restrict paved flumes to slopes of 2:1 or flatter.

Planning Considerations

Conveying storm runoff safely down steep slopes is an important consideration when planning permanent erosion control measures for a site. Paved flumes are often selected for this purpose, but other measures such as grassed waterways, riprap channels, and closed storm drains should also be considered. Evaluate the flow volume, velocity and duration of flow, degree of slope, soil and site conditions, visual impacts, construction costs, and maintenance requirements to decide which measures to use.

When planning paved flumes, give special attention to flow entrance conditions, soil stability, outlet energy dissipation, downstream stability, and freeboard or bypass capacity. Setting the flume well into the ground is especially important, particularly on fill slopes.

Paved chutes often have the upper portion of their side slopes grassed. This saves on materials and improves appearance. The paved portion carries the design flow, and the grassed area provides freeboard.

Design Criteria

1. Capacity. Consider peak runoff from the 10-yr storm as a minimum. Some building sites may need a 25-yr or 50-yr protection. Provide sufficient freeboard or bypass capacity to safeguard the installation from any peak flow expected during the life of the structure.

2. Slope. Ensure that the slope of a chute does not exceed 2:1 (50%).

3. Cutoff walls (Curtain walls). Provide cutoff walls at the beginning and end of paved flumes. Make the cutoff wall as wide as the flume, extend it at least 18 inches into the soil below the channel, and keep in a minimum thickness of 6 inches. Reinforce cutoff walls with 3/8-inch reinforcing steel bars placed on 6-inch centers.

4. Anchor lugs. Space anchor lugs a maximum of 10 ft on the center for e length of the flume. Make anchor lugs as wide as the bottom of the flume, extend them at least 1 ft into the soil below, and keep them a minimum thickness of 6 inches. Reinforce anchor lugs with 3/8-inch steel reinforcing bars placed on 6-inch centers.

5. Concrete. Keep concrete in the flume channel at least 5 inches thick and reinforce it with 3/8-inch steel bars. Ensure that the concrete used for flumes is a dense, durable product and sufficiently plastic for thorough consolidation but stiff enough to stay in place on steep slopes. As a minimum, use a mix certified as 3,000 lb/inch2.

6. Cross section. Ensure that flumes have a minimum depth of 1 ft with 2:1 side slopes. Base bottom widths on maximum flow capacity.

7. Alignment. Keep chute channels straight because they often carry supercritical flow velocities.

8. Drainage filters. Use a drainage filter to prevent piping and reduce uplift pressure wherever seepage or high water table may occur.

9. Inlet section. Ensure that the nearly level inlet to the chute has the following minimum dimensions: side walls 2 ft. high, width equal to the flume channel bottom, and side slope same as flume channel side slopes. Inlet length shall be long enough to train water flow into flume cross section.

10. Outlet section. Protect outlets for paved flumes from erosion. Use an energy dissipator to reduce high chute velocities to non-erosive rates. In addition, place riprap at the end of the dissipator to spread the flow evenly over the receiving area. Other measures, such as an impact basin, plunge pool, or rock riprap outlet structure, may also be needed.

Maintenance

Inspect flumes after each rainfall until all areas adjoining the flume are permanently stabilized and vegetated. Repair all damage noted in inspections immediately. After the slopes are stabilized, flumes need only periodic inspection and inspection after major storm events.

Plans and Specifications

Plans for installing paved flumes shall be in keeping with this practice standard and shall describe the requirements for achieving the intended purpose.

Specifications for construction and installation of a paved flume shall use or be in conformance with the following requirements. Any variation from these specifications shall be approved by an engineer.

1. Site Preparation. Construct the subgrade to the elevations shown on the plans. Remove all unsuitable material and replace them with stable materials. Compact the subgrade thoroughly and shape it to a smooth, uniform surface. Keep the subgrade moist at the time concrete is poured. On fill slopes, ensure that the soil adjacent to the chute for at least 3 feet is well-compacted.

2. Concrete. Place concrete for the flume to the thickness shown on the plans and finish it in a workman-like manner. Form, reinforce, and pour together cutoff walls, anchor lugs, and channel linings. Take adequate precautions to protect freshly poured concrete from extreme temperatures to ensure proper curing.

3. Expansion Joints. In very long flumes, install expansion joints at intervals not to exceed 50 ft. Provide transverse joints to control cracking at approximately 20-ft intervals. Transverse joints may be formed by using a 1/8-inch thick removable template or by sawing to a depth of at least 1 inch.

4. Filters. Place filters and foundation drains, when required, in the manner specified and protect them from contamination when pouring the concrete flume.

5. Properly stabilize and vegetate all disturbed areas immediately afte r construction.

Paved Flume Design Form

Project Location: City _____, County _____,

Section _____, Range _____, Township _____

Planned Construction Date: _____ Ending Date _____

Structural Data: Drainage Area _____ Acres

24-Hour Design Storm Frequency (to Emergency Spillway Crest): _____ Years

Overfall/Grade Controlled: _____ Feet

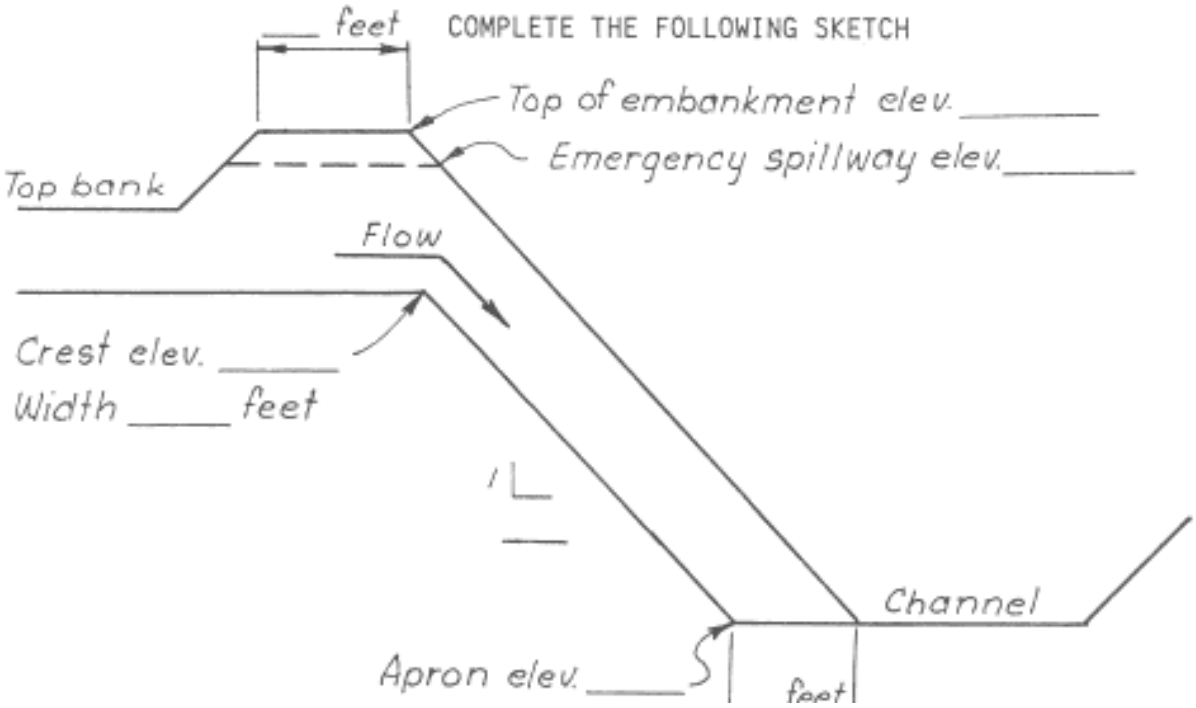
Embankment: Length _____ Feet, Height _____ Feet

Earth Spillway Width _____ Feet, Embankment Volume _____ Cu Yd

Maximum Discharge: Structure _____ CFS, Earth Spillway _____ CFS

Project/Developer Representative: _____ _____

Name Date



Note: Alter diagram as required to show additions or omissions.