

PC-4 CHANNEL PROTECTION—RIGID CHANNEL LINER

Refer to: ITD Standard Specifications, Sections 209 and 623.

ITD Standard Drawing P-2-D.

For assistance, contact the Hydraulics Engineer at the ITD Headquarters Roadway Design Section.

**BMP Objectives**

- Perimeter Control
- Slope Protection
- Borrow and Stockpiles
- Drainage Areas
- Sediment Trapping
- Stream Protection
- Temporary Stabilizing
- Permanent Stabilizing

Definition and Purpose

Rigid channel liners are non-erosive structures or surfaces placed in a channel or ditch that may be used to prevent erosion resulting from high velocities of water. Typical measures include the following:

- Portland Cement Concrete: Rigid concrete liners that cover channel or ditch banks and create a non-erosive surface.
- Grid pavers: Pre-cast or cast-in-place concrete units that are placed along the channel or ditch banks to stabilize the bank and leave open spaces where vegetation can be established.
- Asphalt: Asphalt concrete (plant mix) that is placed along the channel or ditch bank to create a non-erosive surface.

Appropriate Applications

- Rigid channel protection is used where vegetative stabilization practices are not practical and where the channel or ditch banks are subject to heavy erosion from high flows. Rigid liners are preferable to mat-type linings or unlined channels where high-flow velocities are anticipated.
- When deciding which method to use, consider cost and availability of materials, aesthetic concerns, the need to protect vegetation or wildlife habitat, velocity and turbulence of the flow, and the disturbance involved in installing the control measure. For instance, many channel protection structures can be designed to allow revegetation to establish along the bank; however, a rigid liner will most likely preclude most vegetation.

Limitations

- Rigid liners may preclude their use in some situations. Consider the following disadvantages or limitations of rigid liners before selecting a channel protection technique. Rigid liners may:
 - Not provide the water quality or aesthetic benefits that vegetative practices provide.
 - Require design by qualified professional engineers.
 - Be more expensive than other erosion control methods.
 - Require additional permits for installation.
 - Alter stream dynamics, causing changes in the channel downstream.
 - Cause negative impacts to wildlife habitats.
- The use of rigid channel liners below the high water mark of a stream or other water body (waters of the U.S.) should be carefully evaluated due to Section 404 permit requirements. A Section 404 permit (401 Certification) and an Idaho Department of Water Resources Stream Alteration Permit may be required.

Design Parameters

- Applicable federal, state, and local requirements should be followed in designing the rigid liner. Permanent rigid channel liners must be designed to handle expected flood conditions.
- The following table offers suggested guidance in selection of rigid channel protection liners. Values for unlined and vegetation lined channels are included for reference.

<i>Channel Liner Type</i>	<i>Velocity (meter/second)</i>	
	<i>Low</i>	<i>Maximum</i>
<i>Unlined earthen ditch</i>	<i>0.3</i>	<i>0.6</i>
<i>Asphalt or concrete lined</i>	<i>0.6</i>	<i>4.5</i>
<i>Vegetation</i>	<i>0.6</i>	<i>1.2</i>
<i>Grid pavers lining</i>	<i>1.0</i>	<i>3.5</i>

- If allowed by permit, grade control measures may be required to reduce the gradient of open channels. Check dams, drop structures, or other structures may be located in a reasonably straight channel section. They must be constructed of durable materials (such as cast-in-place concrete, rock, or gabions) that are adapted for use in hydraulic structures. The banks should be stabilized upstream and downstream at sufficient distances with riprap or other lining to prevent scour and bank erosion.

- Reinforced concrete structures may require drainage behind the bulkhead or retaining wall to mitigate freeze/thaw effects and erosion around the structure. Grid pavers should be designed and installed according to manufacturers' recommendations.
- Concrete and asphalt-concrete permit maximum flow capacity due to their low roughness coefficients. Bank liners require a firm, compacted, stable foundation and must be carried below channel bed (to prevent undercutting) and at least 6 inches above the design waterline. Side slopes should be 1H:1V or flatter.

Construction Guidelines

- Place materials for rigid linings to provide:
 - Asphalt plant mix: 2.5 inches minimum thickness.
 - Concrete liner: 4 inches minimum thickness.
- Install channel liners or other protection structures immediately after channel construction. Construct as directed or as specified in the contract.
- Provide compacted, firm, stable foundations as required for Portland Cement Concrete and asphalt plant mix liners.

Maintenance and Inspection

- Conduct inspections as required by the NPDES permit or contract specifications during construction.
- Periodic inspection and maintenance will be required based on post-construction site conditions.
- Make any repairs necessary to ensure the measure is operating properly.
- Maintain the rigid liners and structures as installed.
- Repair liner damage as soon as possible to prevent further damage or erosion to the channel bank or bed.
- Clean and remove debris as necessary.