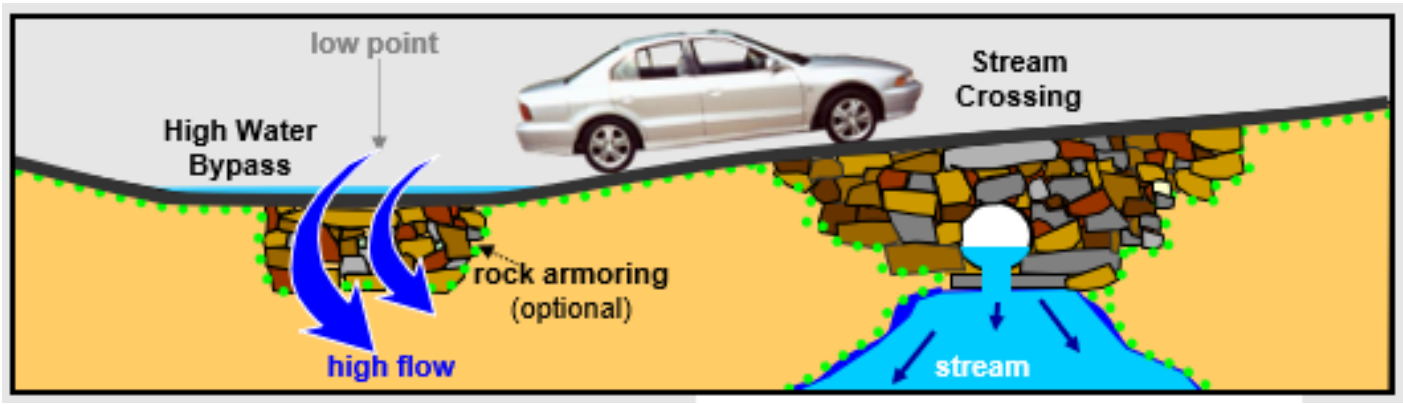
Technical Bulletin

High-Water Bypass

2/2019

Center for Dirt and Gravel Road Studies

High-Water Bypass- A flat, low-lying section of road that serves as an emergency spillway to allow water to flow over the road with minimal damage during extreme flow events.



Stream Crossing with a high-water bypass

PURPOSE

A high-water bypass is employed to protect a road from significant damage during wet weather events, where flowing water crosses the road surface. A high-water bypass is designed to reduce erosion and loss of road material caused by concentrated flood flows. A properly installed by-pass will often avert catastrophic loss at a stream crossing and allow for a passable road post-flood.

BENEFITS OF A HIGH-WATER BYPASS (HWBP)

- Reduces risk of failures and emergency maintenance needs at stream crossings
- Minimizes loss of costly road material and damage to drainage structures
- Allows for effective management of storm flows despite the capability of bridges and culverts
- Provides an alternative and measure of insurance when site conditions prohibit an adequate crossing
- Increases floodplain connectivity disrupted by the road

HOW THEY WORK

A high-water bypass disperses flowing water into a wide shallow sheet as it crosses the road, which greatly reduces its erosion potential. Sometimes referred to as an emergency spillway, these structures use the same wide and flat design found on most dam overflow systems.

WHERE TO USE

Generally a high-water bypass is employed on lower volume roads, where sheet flow water over the road is more acceptable. Consider a HWBP where topography or stream characteristics result in periodic overtopping, regardless of the opening size at the stream crossing, or where there are restrictions that prohibit the installation of an adequate stream structure. These conditions might exist in wide floodplains with braided overflow channels, or where a larger structure is not financially feasible. Often a HWBP can be sited where flow historically overtops the road.

CONSIDERATIONS

Make the bypass level and as long as is practical with the road alignment. This will spread the current into thin sheet flow and reduce the hydraulic energy. To reduce erosion, rock armoring is often required along the downstream side of a HWBP. Where space or topography dictates, a HWBP can be built directly over a stream crossing. A HWBP is general intended for more extreme events only.

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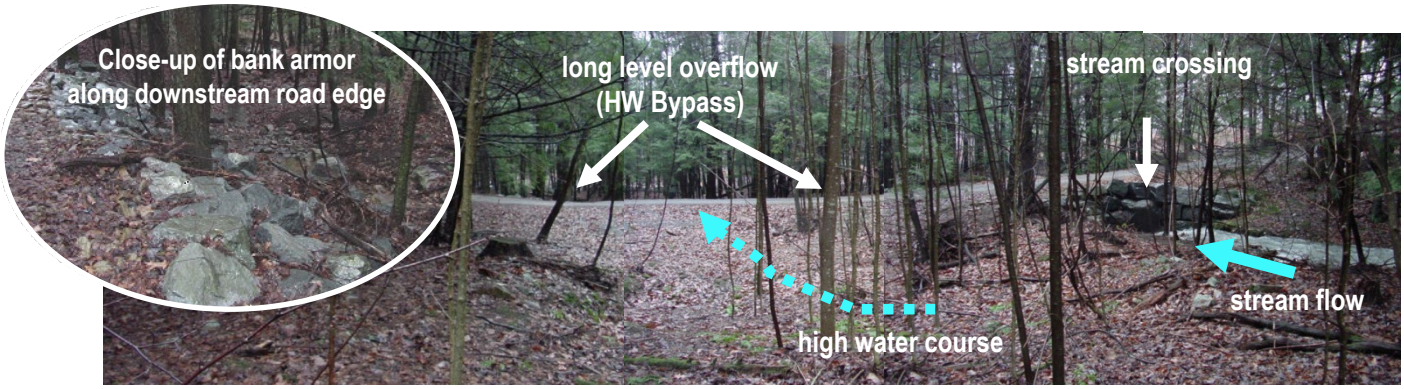

Geo-synthetic and rock reinforcement was used to stabilize this bypass. Heavy rock armoring was installed on the downstream road bank to guard against erosion and a potential head cut into the road. When stream flow spills into the floodplain, water will flow over the bypass.

Road Reinforcement: An important feature of a high-water bypass is the installation of a reinforced (hardened) road surface that will resist scour damage when overtopped by flood flows. The reinforced area must include the transitions at the ends of the bypass.

Bank Reinforcement: As additional insurance, reinforcement of the downstream road edge is important to prevent head cut erosion into the road. If a drop-off exists along the downslope side of the road, the bank should be armored to a point where erosion no longer threatens bank stability.

Excavation of bypass. Long and level end to end.

CONSTRUCTION SEQUENCE –

1. **Excavation:** Dig into the road to create room for surface reinforcement. Excavation depth will depend on the method of reinforcement and materials specified (i.e. - size of geogrid, size of stone, etc.) as well as the planned final road surface elevation. The excavated area should be level end to end to reflect the spillway in the finished road surface.
2. **Geotextiles:** It may be desirable to place separation fabric in the bottom of the excavated area, especially if the subsoil is considered unstable. Construction materials such as geogrid and rock can then be installed overtop of the fabric.
3. **Rock:** If geo-cell is installed, almost any aggregate or rock can be used to fill the cells. Often clean open-graded stone is used to improve sub-surface drainage and road base stability.
4. **Surface:** Generally, only a thin (“choke”) lift of surface aggregate is placed over the reinforcement rock, to make a smooth surface with minimal aggregate loss in flood events.

Geo-cell with stone fill. Upstream side keyed below ground.

CONSTRUCTION CONSIDERATIONS

- **Size:** Make the bypass as long as practical, considering anticipated overflow volumes and available space on site.
- **Elevation:** Use survey equipment to ensure the finished surface of the bypass is the lowest section of road in the floodplain.
- **Shape:** Use survey equipment to ensure that the reinforced area and the finished bypass surface are flat end to end.

Finished bypass with grade control and scour protection along downstream road edge.

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