

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

October 10, 2014

DESIGN BULLETIN No. 14-12

SUBJECT: DESIGN GUIDE FOR THE U.S. ARMY CORPS OF ENGINEERS REQUIREMENT - PROPOSED EMBEDDED CULVERTS

Tollway Drainage Design Manual, Section 8.5, shall be revised as follows:

8.5 Special Installations of Culverts

Special studies shall be performed where fill heights exceed 20 feet and where soil conditions or other factors may indicate abnormal installation procedures. The designer's recommendation for such special treatments shall be included in the preliminary drainage design.

For channel crossings located within Waters of the U.S. (and under the jurisdiction of the U.S. Army Corps of Engineers) it is recommended that the proposed culvert be embedded by approximately 1 foot for water quality purposes. This embedded portion will be in addition to the required culvert size to meet hydraulic requirements. For instance if a 6' W x 3' H box culvert is required for hydraulic purposes, then a 6' W x 4' H culvert will be placed within the channel with 1 foot being buried. For larger bridge openings with a defined channel, a 3-sided culvert can be proposed instead.

Embedded culverts should be designed with a natural soil "n" value (~ 0.03) instead of a typical "n" value (0.012) used for concrete. In hydraulically sensitive outfall locations, where providing additional hydraulic conveyance would result in downstream flooding, riprap may be provided at the upstream and downstream end treatments, to meet the hydraulic requirements. If utilized, the riprap shall not be placed throughout the entire length of the culvert but instead placed in a manner in which could be removed and replaced by Tollway Maintenance staff. The embedded culverts shall be designed so as not to impede low water flows or the safe passage of fish and aquatic organisms and allow for the natural substrate to colonize the structure's bottom, encourage fish movement and maintain the existing channel slope.

The Illinois Tollway has developed two methods for placing riprap at embedded culverts. In Figure 8.5.1 (Method 1), the riprap material shall protrude approximately 5 feet into the culvert at both the upstream and downstream ends and then taper off at a 1:10 (V:H) slope (which is intended to allow fish passage during flood events). In Figure 8.5.2 (Method 2), would install a concrete curb with low flow weir, at each end. This method may be desired in streams with higher flows, poor access for maintenance, or an unreliable/changing watershed upstream. Both methods utilize riprap to dissipate large inflow and outflow velocities and allow for soils to naturally fill up the embedded depth throughout the rest of the culvert bottom. These approaches adhere to the U.S. Army Corps of Engineers requirement of allowing *the natural substrate to colonize the structure's bottom, encourage fish movement and maintain the existing channel slope.*

Figure 8.5.1: Riprap Design Method 1

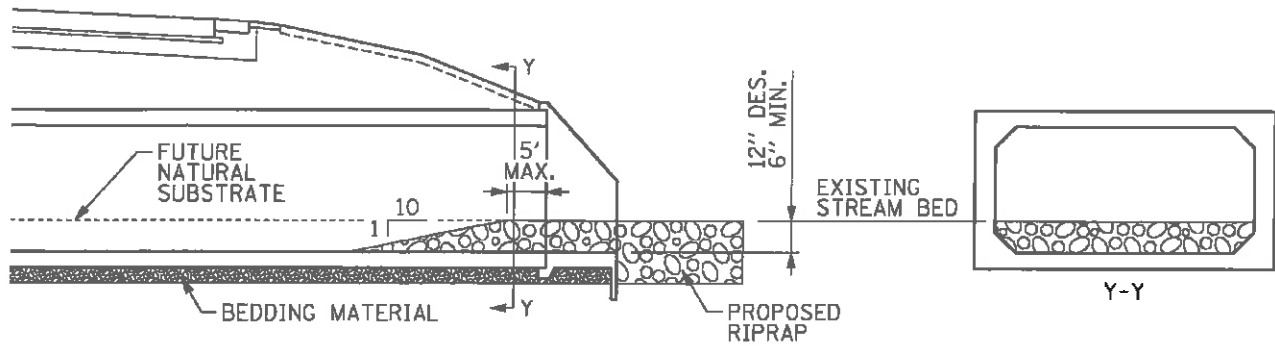
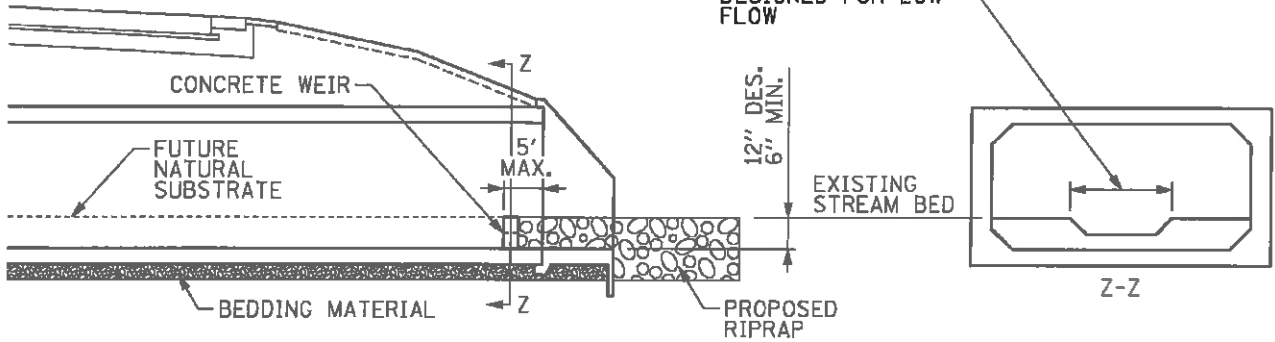



Figure 8.5.2: Riprap Design Method 2



Design Section Engineers (DSE) are hereby directed to immediately utilize this design criteria for all contracts scheduled for 2015 construction. This revision will be included in the next release of Tollway Manuals.


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10/15/14
 Date