CITY UTILITIES
DESIGN STANDARDS MANUAL

Book 2
Stormwater (SW)
SW10 Crossings

June 2015

SW10.01 Purpose

The primary function of a roadway is for safe movement of traffic. When a drainage structure crosses a roadway or railroad (railroads are treated as roadways in this section), design of the crossing shall comply with the standards and specifications of the agency having jurisdiction over the roadway. Design should consider the structural integrity of the roadway and safe movement of traffic in addition to hydraulic capacity of the structure.

SW10.02 General Design Considerations

1. Jurisdictional Agencies

   Design of drainage structures which cross a roadway shall comply with the standards and specifications of the agency having jurisdiction over the roadway.

2. Hydraulic Capacity

   Drainage structures crossing roadways shall be designed with sufficient hydraulic capacity to prevent runoff water from a 100-year event from over topping the roadway.

3. Minimum Pipe Diameter

   The minimum diameter of a storm sewer crossing a public roadway shall be 12 inches.

   The minimum diameter of a culvert crossing a public roadway shall be 15 inches.

4. Structural Design

   Drainage structures crossing a public roadway shall be designed to carry an AASHTO HS-20-44 design load. Structures crossing a railroad shall be designed to carry an E80 design load.

   Drainage structure installation depths shall comply with the minimum and maximum cover height for the type of structure installed. Structures shall have a minimum depth of cover of 3 feet.

5. Skew Angle

   The drainage structure crossing angle or skew shall not exceed 45 degrees measured from a line perpendicular to the roadway.

6. Culvert Length

   The length of a culvert with end treatment for a roadway crossing shall fit the existing or design roadway front slopes. End treatment shall, as much as practical, be flush with the slope and not cause the roadway front slope to vary from the typical section.

SW10.03 Roadway Crossing Design

1. Hydraulic Design

   Refer to Chapter SW5 - Hydrology and Chapter SW9 - Culverts for hydraulic design of roadway crossing culverts.

SW10.04 Length Design

1. General

   Culvert length shall be designed to fit existing or design roadway front slopes. Roadway safety shall be considered for culvert replacement projects where roadway shoulders are narrow and front slopes are steep. Consideration should be given to widening shoulders and flattening slopes where right of way width permits.

2. Regulated Drain Crossings

   A culvert in a regulated drain crossing a roadway may extend beyond road right of way into the drainage easement. The additional culvert length provides an opportunity for roadway safety improvements at an open channel crossing. Additional right of way may be acquired if the culvert is in a non-regulated drain which is not in a drainage easement.

3. Length Calculations for Perpendicular Crossing of Roadways or Railroads

   $L_P = S_d$ (left) + W + S_d (right)

   L_P = Total crossing length
   S_d = Slope distance between shoulder break and end of culvert or end treatment.
   $S_d = H \times S$
   H = Height from shoulder break elevation to culvert or end treatment invert elevation.
   $S = {}^{Rise}/_{Run}$ (eg. 3:1 slope = ${}^{3}/_{1} = 3$)

   Note:
   1. When end treatment is not used, S_d is determined at the point of intersection between the front slope and culvert invert.
   2. When end treatment is used, S_d is determined at the point of intersection between the front slope and end treatment invert.
   3. When end treatment is used, end treatment length must be subtracted from Total Crossing Length to determine Culvert Length.

   W = Distance between left and right shoulder breaks.

4. Length Calculations for Skewed Crossing of Roadways or Railroads

   $L_S = L_P / \cos(a)$
   a = angle of skew measured left or right from a line perpendicular to the road centerline.

SW10.05 Roadway Safety

1. Clear Zone

   The designer shall comply with clear zone requirements of the agency having jurisdiction over the roadway.

2. Guardrail and Handrail

   A guardrail or handrail may be required if a drainage structure, which crosses a roadway, creates a situation hazardous to traffic. The guardrail or handrail shall comply with the standards and specifications of the public agency having jurisdiction over the roadway or trail.

SW10.06 Construction

1. Traffic Control

   Drainage structure crossing installation may require traffic control measures.

   Permitting for construction signage or a road closure and establishment of a detour route must be obtained from the public agency having jurisdiction over the roadway.

2. Open Trench Installation / Jacking and Boring

   Permitting, traffic control, pavement removal, excavation, culvert material, bedding, backfill, pavement patching and restoration and seeding shall comply with the standards and specifications of the public agency having jurisdiction over the roadway. City Utilities' standards and specifications for structure material, bedding and backfill are required if more restrictive than the roadway agency standards and specifications.

SW10.07 Permitting

Roadway crossing construction may require approval and/or permitting from the agency having jurisdiction over the roadway. Each public agency may have design criteria which must be complied with for permitting.

1. Private Agencies

   Private agencies include railroad companies.

2. Public Agencies
   - City of Fort Wayne Street Engineering Department for work within City street or road right of way.
   - Indiana Department of Transportation, Fort Wayne District for work within State, Federal, or Interstate Highway rights of way.
   - Allen County Highway Department for work within County road right of way.
   - Fort Wayne Parks and Recreation Department for work affecting the River Greenway or trail and bicycle system.

- Allen County Surveyor's Office for work affecting Allen County regulated drains or mutual drains.
- Indiana Department of Natural resources (IDNR) for:
  - Early coordination for projects affecting stream channels or wetlands.
  - Stream crossings.
  - Work within a floodway or flood plain.
  - All culverts and bridges, public or private, with a drainage area equal to or greater than 1 square mile.
- Indiana Department of Environmental Management (IDEM) for Early Coordination for projects affecting stream channels, including regulated drains.
- United States Army Corps of Engineers (USACE) for Early Coordination for projects affecting wetlands or stream channels including regulated drains.

After Early Coordination is submitted to IDNR, IDEM and USACE (It is advisable to copy affected local public agencies) a field check is scheduled. The field check will determine which agency/agencies have jurisdiction and what permitting will be required.