18-1 BRIDGE DECK DRAINAGE

Basic Concepts

Bridge drainage covers the collection and removal of waters from a bridge deck. To accomplish this function, drains are placed adjacent to curbs for collection of water which is then either dumped directly on the ground or is conveyed to a suitable disposal point.

Bridge Deck Drainage is Divided into Two Classes

- *Class I*. All locations, usually urban, where drainage must be carried via piping to some suitable disposal point. Short vertical or near vertical down spouts to clear girder flanges are not considered in this category.
- *Class II.* All locations, usually rural, where drainage may be disposed of by free fall directly under the drain.

Four Standard Types of Structure Drains

- *Type A*. To be used for Class II drainage at locations adjacent to median curbs where a grate is desirable.
- *Type B*. To be used for Class II drainage at locations adjacent to barrier rail curbs.
- *Type C.* To be used for both Class I and Class II drainage. Intended primarily for use on steel or precast girder construction in deck areas where there is no main reinforcing running longitudinally in the deck to conflict with a drain of this size. This drain will intercept more deck runoff than other types.
- *Type D*. To be used for Class I Drainage and is the type most commonly used for this class.

  D-1 has a deep basin and is preferred when drains need to be located in interior bays of box girder bridges.

  D-2 has a shallow basin and is intended for use in deck overhangs. Make sure a D-3 cannot be used before calling out this drain.

  D-3 is an improvement over the D-2 drain and is the preferred drain for deck overhangs.

Structure Drains for Special Applications

- *Double Wide Type D Drain.* When hydraulic demand exceeds the capacity of a single Type D drain inlet, consider using a double wide Type D drain.
- *Slotted Drains.* Slotted drains in bridge decks should be used only to intercept sheet-flow. Drains should be located in the shoulder either normal to traffic or parallel to traffic, 12" from edge of outside traffic lane. For wide bridges with flat cross slopes, additional drains may be located 12" from traffic lane lines.
- *Drop-Thru Drains and Scuppers.* A good, economical choice for Class II drainage. Locate these drains so water and roadway debris will not fall on pedestrians, motorists, and railroad right-of-ways. Inform the District when considering this type of drain as there may be additional restrictions that would prohibit scuppers and drop-thru drains.

Drain Inlet Location

It is the policy of Structure Design to provide drains at the following locations:

a. At low points where there is a sag vertical curve.

b. Where ponding may occur due to a combination of "near-flat" profile grades and initial residual camber.

c. Adjacent to any area where water will cross the deck due to reversal of superelevation.

d. The termination of a curb nosing which separates two roadways.

e. Immediately preceding and upstream of expansion joint seal assemblies in bridge decks. Complete interception of all flow prior to the joint is not required.

Drainage Disposal

Drainage disposal, required for Class I drainage only, is accomplished in one of two ways via concealed piping by either:

a. Discharging at ground level adjacent to a gutter or other disposal area; or

b. Discharging underground into a catch basin or connecting to a storm drain.

Coordinate with the District to determine the method of discharge.

Criteria for Piping

a. Exposed piping detracts from the appearance of the structure and should be avoided.

b. Piping should be 6" minimum diameter welded steel pipe with 1/8" minimum wall thickness. For multiple inlets, near-horizontal slopes, or runs of 50' or more, 8" piping is preferred. Runs should be on as steep a grade as conditions will allow with a maximum of 4 inlets per run. Inlets should be located upgrade from the bent or abutment outlets whenever possible. All bends should be smooth and on an 18" minimum radius for 6" diameter pipe and a 24" minimum radius for 8" diameter pipe. Mitered bends shall not be used. The length of near horizontal (2 percent minimum) runs should be kept to a minimum.

c. Expansion couplings must be shown on the plans where drain pipes cross expansion joints at hinges and abutments.

d. The use of clean out openings must be given careful consideration by the designer. When the piping system consists of a single run from inlet to outlet, cleaning is usually done from the outlet end with a power driven plumber's auger. For this situation, a cleanout opening should not be used, because it may provide a "blind alley" for the auger and make cleaning from the outlet impossible. For a more complex piping system, properly placed cleanout openings can facilitate cleaning by providing additional access points in the line.

Design Procedures and Details

Refer to *Bridge Design Aids*, Section 17.

(original signed by Kevin J. Thompson)

Kevin Thompson
State Bridge Engineer
Deputy Chief, Division of Engineering Services
Structure Design