MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 16-05-B-02
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To: Electronic Distribution Recipients

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Subject: Storm Drain Design Frequency and Catch Basin Spacing

Expiration
This Technical memorandum supersedes Technical Memorandum 11-14-B-05 and will expire on September 13, 2021 unless superseded or placed into the MnDOT Drainage Manual prior to that date.

Implementation
The provisions of this Technical Memorandum apply to Trunk Highway Storm Drain Systems. The design guidance in this Technical Memorandum is effective immediately for projects in the early stages of the preliminary design phase, and may be incorporated into projects in a more advanced design phase.

Introduction
Storm drain design frequency and catch basin spacing criteria are used in the design of storm drain systems. Questions regarding interpretation of the policy provided in the August 2000 edition of the MnDOT Drainage Manual are intended to be addressed by this Technical Memorandum. This Technical Memorandum also adapts the allowable spread criteria to accommodate the adoption of flexible design criteria for lane and shoulder width.

Purpose
This Technical memorandum is intended to update MnDOT spread criteria to accommodate flexible design, and to clarify policy relating to design frequency, allowable spread, and placement of catch basins and bridge deck drains contained in the August 2000 edition of the MnDOT Drainage Manual.

Guidelines
The minimum design frequency for storm drains and the allowable spread of water onto the roadway shall be in accordance with the criteria in the following table and subsequent guidance.

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TABLE 1: DESIGN FREQUENCY AND ALLOWABLE SPREAD FOR STORM DRAINS

ROADWAY TYPE	DESIGN FREQUENCY	DESIGN SPEED	SHOULDER WIDTH (FEET)	LANE WIDTH (FEET)	ALLOWABLE SPREAD (FEET)
Interstate	10 Year	ALL	ALL	ALL	S
	50 Year at Major Sag Point				S + 3
Trunk Highway ADT 5000 and Greater	10 Year	ALL	≥ 8	ALL	S
		>45 mph	4 – 8	≥ 12	8
			< 4	≥ 12	S + 4
			< 8	< 12	S + 3(1)
		≤ 45 mph	2 – 8	≥ 12	8
			< 2	≥ 12	S + 6
			< 8	< 12	S + 5(1)
	50 Year at Major Sag Point	ALL	ALL	≥ 12	S + 6
				< 12	S + 5
Trunk Highway ADT Less than 5000	5 Year	ALL	≥ 8	ALL	S
		>45 mph	4 – 8	≥ 12	8
			< 4	≥ 12	S + 4
			< 8	< 12	S + 3(1)
		≤ 45 mph	2 – 8	≥ 12	8
			< 2	≥ 12	S + 6
			< 8	< 12	S + 5(1)

(1) Allowable spread not to exceed 8 Feet

S: Shoulder width (feet) is the distance from the edge of the travel lane to the face of the curb and includes the gutter width.

D: Driving lane width (feet) of the driving lane adjacent to the shoulder

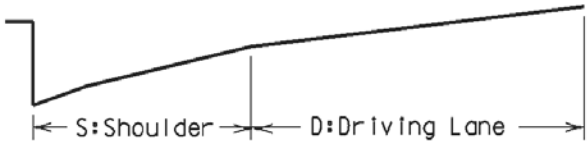

Figure 1: Shoulder and Driving Lane Description

Trunk Highway Turn Lanes
Design Frequency: Use Table 1 for the mainline.
Allowable Spread = (Turn lane width – 6 feet)

Trunk Highway and Interstate Ramps and Loops
Design Frequency: Use Table 1 for the mainline.
Allowable Spread: 1/2 roadway width for single lane ramps/loops. Use mainline spread criteria from Table 1 if there are multiple lanes.

Collector/Distributor and Auxiliary Lanes
Design Frequency: Use Table 1 for the mainline.
Allowable Spread: Use Table 1 Trunk Highway Criteria.

Frontage Roads and Local Streets
MnDOT Frontage Roads Design Frequency and Allowable Spread: Use Table 1 Trunk Highway Criteria.

Local Frontage Roads and Streets Design Frequency and Allowable Spread: Use criteria from the State Aid Manual Allowable Spread Table if the road is on the State Aid System; otherwise use criteria established by the local road authority.

Roundabouts
Design Frequency: Use Table 1 for connecting roadway with the larger design frequency.
Allowable Spread: Use Table 1 Trunk Highway Criteria.

Use additional inlets to limit runby across connecting roadways.

Managed Lanes
Design Frequency and Allowable Spread: Use Table 1 for the mainline.

Sag Points
A major sag point refers to a true sag where flooding of 1 foot or more can occur.

A flanking inlet is recommended on each side of the inlet for a major sag point. At least one flanking inlet is required where the water can pond 2 feet deep or more. The flanking inlet location should be based on Table 8.4 of the Drainage Manual.

For local roads, consider designing the storm drain system for sag points at critical locations for a 50 year design frequency in order to limit water ponding to a depth less than 1 foot on roads that are otherwise passable.

For all sag points, it is recommended that curb inlets or combination grate/curb openings be utilized. If a grate alone is used at sag point, assume a portion of the grate is clogged by debris. A reasonable assumption is that the grate is half clogged with debris.

For sag point inlets on bridges, assume all of the deck drains on the bridge upstream of the inlet(s) are half clogged with debris.

Storm drains should be designed to take into consideration potential damage to adjacent properties.

Additional Inlet Locations
There are a number of locations where inlets are necessary with little regard to computed spread or contributing drainage area. Examples of some, but not all, locations are as follows:

- Sag points in the gutter grade
- Upstream of median breaks, entrances/exit ramp gores, cross walks and stream intersections,
- Immediately upstream and downstream of bridges
- Immediately upstream of cross slope reversals
- On side streets at intersections
- At the end of channels in cut sections
- Behind curbs, shoulders or sidewalks to drain low areas
- Where necessary to collect snow melt.

Bridge Deck Drainage
Design frequency and Allowable Spread: Use Table 1.

The primary best practice for bridge deck design is to eliminate or minimize the use of an under deck drainage system or piping. Secondly, it is to minimize the amount of flow over the joints at the ends of the bridge. Best practices do not override design frequency and allowable spread criteria.

Specific design practices that can reduce the need for bridge storm drain systems and improve deck drainage performance include:

- Avoid zero gradients, sag vertical curves and superelevation transitions with flat pavement sections.
- Minimize or avoid the need for deck drains to the maximum extent possible with the bridge deck geometry design by modifying cross slope breaks, longitudinal slope/profile adjustments, or shoulder width.
- Minimize or avoid use of below deck piped drainage systems due to capital and maintenance costs, and expected low reliability due to lack of durability, clogging, segments becoming separated and/or unattached.
- Consider the following during deck drain positioning:
    - Position drains so they do not discharge directly into a waterway.
    - Position drains directly above an appropriate outlet point to eliminate piping and bends.
    - Position drains without piping systems so that water does not splash onto beams or piers.
    - Provide a riprap splash pad or erosion protection at the drainage outlet points.
- Collect highway drainage prior to it reaching the bridge.
- Include runoff management and erosion protection at bridge ends.

Questions
Any questions regarding the technical provisions of this Technical Memorandum can be addressed to following:

- **Andrea Hendrickson, State Hydraulics Engineer at (651) 366-4466**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at http://techmemos.dot.state.mn.us/techmemo.aspx.

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