



Design Scene Part 2 – Plan Conventions

Chapter 12 Drainage

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Chapter 12 Drainage

15" Safety Apron

The 15" CS Safety apron is not covered by Standard Plate 3128. Therefore, when using this size metal safety apron be sure to include a detail in the plan for it.

Casting Assembly Removal

When the removal of a structure is paid by EACH, it includes the removal of the casting. If the casting is to be salvaged, the pay item SALVAGE CASTING by EACH should be added.

When the removal of a structure is paid by the LIN FT, then follow the intent of spec 2506 and pay for the removal of the casting separately. The tabs would show remove structure and remove casting.

Chinook Winds and Winter Snows

A combination which frequently results in hazardous winter conditions on shaded portions of roadways under bridges. Icing conditions are a danger in themselves, and they present further hazards during corrective maintenance operations. Paradoxically, they melt away maintenance funds. Potentially hazardous conditions and rising maintenance costs often can be prevented by thoughtful design. Hydraulics Engineers, request that designers place catch basins in such a manner so that runoff in gutters can be intercepted before it can flow under bridges to freeze in those shaded areas. This is a relatively simple design concept which, if employed wherever feasible, will not only reduce recurring maintenance cost, but may also prevent bodily harm and property damage. All surface design features should be carefully evaluated to minimize or prevent, where possible, the flow of water across pavement surfaces. This is especially important in the case of water from winter thaws. For example, snow and ice accumulations on raised islands thawing, and then freezing on the road surface, might be prevented by use of a drained, depressed island.

Classes of Reinforced Concrete Arch Pipe

Class IIA, IIIA, and IVA are the classes available for pipe arches up to and including a nominal span of 51". Certain classes are not available for spans of 58" or greater. Refer to Standard Plate 3014 for information on which classes are available for each span; refer to Tech. Memo. 20-05-B-01 for information on selecting the desired pipe class dependent on minimum cover and maximum fill height.

Culvert Extension/Apron Replacement

The use of standard culvert bedding (Standard Plans 5-297.440 and 5-297.441) is recommended beneath culvert extensions or apron replacements, unless modified by District Materials/Soils. Site-specific conditions such as soil properties, location relative to driving lanes, or bedding used under existing culvert can justify bedding modifications for extensions, however, a minimum of 6" of bedding is recommended. It is recommended to include a pay item in the plan for culvert bedding and a detail should be included if the standard plans are not utilized.

Culvert Safety Aprons and Grates in the Clear Zone

Refer to Chapter 13 in the Facility Design Guide for guidance.

Culvert Work

When work is to be done on a portion of a culvert, such as a lining or a salvage/install aprons, every effort should be made to bring the aprons up to current standards. A safety apron and/or grate may be needed to accomplish this. However, the District does have the option of not bringing the aprons up to current standards. When determining the feasibility, the District should investigate the risk, run off the road data, grading, right of way, safety concerns, etc of adding safety features. If it is not feasible, the designer should place a full explanation as to why in the design file. There are a few locations, however, that require safety features to be added. One such location is a median culvert. If you have specific questions, please contact the Project Design Services office.

Dewatering

When DEWATERING is a pay item in the plan, the location(s) should be referenced either as a note in the SEQ or in a tabulation. Also provide information for a bidder and the MnDOT estimating unit to estimate the cost of dewatering. Suggested information to include in the plan or special provisions are observed water depth, 2 year event depth and flow, and details for dewatering.

Drainage Flow Arrows

Plans should contain drainage flow arrows on the plan sheets indicating the direction of flow for culverts, bridges, ditches, ditch breaks, etc.

Drainage Structures in Bus Pads in Alternate Bid Plans

If bus pads are required, they may be handled differently for concrete vs bituminous pavement.

Grates

The type of grate used with a catch basin affects the amount of runoff intercepted along a curb and gutter. The location of the catch basin, whether on a slope or at a low point, also should be considered when choosing the type of grate to be used. The advantages and disadvantages of some of MnDOT grates are as follows:

Standard Plate 4154 (vane type) (Grate Casting 816)

Advantages: Less susceptible to plugging with debris, intercepts large flow depths on steep slopes. Bicycle safe when placed in correct position.

Disadvantages: Has less capacity at low points than parallel grate Standard Plate 4153.

Standard Plate 4152 (vane type) (Grate Casting 814)

Advantages: Bicycle safe

Disadvantages: Tends to plug with debris, water tends to skip across grate with large flow depths on steep slopes.

Standard Plate 4155 (ADA Grate Inlet Casting) (Casting assembly ADA-1 Casting No, 817)

Advantages: ADA compliant

Disadvantages: Hydraulically less efficient so could result in more CB's to capture stormwater.

In some situations, these recommendations may not be the best choice, consult with the Hydraulic or Water Resource Engineer for site specific guidance.

Headwalls (Polyethylene Option)

Include the High-Density Polyethylene Headwall for Subsurface Drain Detail in the plan when the intent is to use Polyethylene (P.E.) as an option to the concrete headwall we currently use. Sub note CONCRETE HEADWALL pay item: THE CONTRACTOR HAS THE OPTION OF USING A POLYETHYLENE HEADWALL AS SHOWN ON SHEET ____.

The detail can be found: <https://standardplans.dot.state.mn.us/stdplan.aspx> under the Design Detail/Drainage and Erosion pulldown menu.

Inplace Drainage Structures

On projects where inplace manholes or catch basins will be adjusted or reconstructed, the following additional information is necessary for survey crews:

- Design or type of structure
- Cone Type A, B or C
- Height of adjusting rings – if no rings, indicate this
- Height of casting

This information is also necessary when the design requires connecting new drainage pipes to inplace structures. Please inform your District Surveys Engineer of these requirements.

Also, during review of supplemental agreements, we noticed several agreements had to be processed due to the incorrect size of existing storm sewer pipes in the plan. A more careful check, especially those pipes that require extensions, is in order.

Parallel Pipes and Aprons in the Median

Parallel pipes located in the median require 1:6 safety aprons and they must be grated. The apron design may be Safety Apron & Grate Design 3128 or Design 3148 with a 1:6 slope. The grading laterally adjacent to the apron is 1:6 to match the apron slope, and the grading above the apron must be 1:10 or flatter. See Facility Design Guide Section 10B.2.3 for additional information and Exhibit 10B-3 for an example.

Storm Sewer and Culvert Pipe Bedding

Standard Plans are available for:

- Standard Storm Sewer Bedding for Rigid and Flexible Pipe (5-297.442)
- Standard Culvert Bedding for Flexible Pipe (Without Treatments) (5-297.440)
- Standard Culvert Bedding for Rigid Pipe (Without Treatments) (5-297.441)

Design Details are available for:

- Culvert Bedding for Flexible Pipe with Treatments
- Culvert Bedding for Rigid Pipe with Treatments
- Culvert Bedding for Box Culverts

Plans with (2503) Storm Sewer Pipe:

- Fine aggregate bedding, including the cost of excavation, placement and compaction is included in the storm sewer pay item. No pay items or quantities for bedding in the plan.
- Excavation and backfill with select grading material are included in the cost of the storm sewer pay item.
- Include Standard Plan 5-297.442 Standard Storm Sewer Bedding for Rigid and Flexible Pipe.

Plans with (2501) Pipe Culverts without Treatments:

- Quantities for fine aggregate bedding should be computed, tabulated and a pay item included in the plan. The bedding pay item includes the cost of excavation, placement and compaction.
- Excavation and backfill with select grading material are included in the cost of the culvert pay item.
- Include Standard Plan 5-297.440 Standard Culvert Bedding for Flexible Pipe and/or 5-297.441 Standard Culvert Bedding for Rigid Pipe for pipe materials allowed in the Plan.

Plans with (2501) Pipe Culverts with Treatments:

- Quantities for fine aggregate bedding should be computed, tabulated and included in the plan. The bedding pay item includes the cost of excavation, placement and compaction.
- Excavation and backfill material must be computed, tabulated and included in the plan.
- Include Design Detail: Culvert Bedding for Flexible Pipe and/or Rigid Pipe with Treatments for pipe materials allowed in the Plan.
- Culvert tabulations should reference Treatment Types for each culvert.

Plans with (2501) Pipe Culverts that are field and driveway entrance culverts:

- Rigid and metal (flexible) entrance culverts do not require fine aggregate bedding unless specified in the plans.
- Plastic (flexible) culverts do require fine aggregate bedding, but the cost of excavation, placement and compaction is included in the culvert pay item. No pay items or quantities for bedding in the plan.
- No Standard Plans or Details are required for rigid and metal (flexible) entrance culverts. Include Standard Plan 5-297.440 Standard Culvert Bedding for Flexible Pipe if plastic pipe is allowed as an option for entrance culverts.

Plans with (2412) Box Culverts:

- Quantities for aggregate bedding should be computed, tabulated and included in the plan. The bedding pay item includes the cost of excavation, placement and compaction.
- Excavation and backfill material must be computed, tabulated and included in the plan.
- Include Design Detail: Box Culvert Bedding and Plastic Soils Cap