APPENDIX C
INLETS

1.0 Introduction

The application and types of storm drainage inlets are presented in detail in this Appendix.

2.0 Inlet Locations

Inlets are required at locations needed to collect runoff within the design controls specified in the design frequency and spread section in Appendix D. In addition, there are a number of locations where inlets may be necessary with little regard to contributing drainage area. These locations should be marked on the plans prior to any computations regarding discharge, water spread, inlet capacity, or bypass. Examples of such locations are as follows:

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

Inlets should not be located in the path where pedestrians are likely to walk.

3.0 Types

Storm drain inlets are used to collect surface runoff and discharge it to an underground storm drainage system. Inlets are typically located in gutter sections, paved medians, roadside ditches and median channels. Inlets used for the drainage of highway surfaces can be divided into five classes and are discussed in the following sections.

3.1 Grate Inlets

These inlets consist of an opening in the gutter covered by one or more grates. They are best suited for use on continuous grades. Since they are susceptible to clogging with debris, the use of standard grate inlets at sag points should be limited to minor sag point locations without debris potential. Special design (oversize) grate inlets can be utilized at major sag points if sufficient capacity is provided for clogging. In this case, flanking inlets are definitely recommended. Grates should be bicycle safe when bike traffic is possible and structurally designed to handle the appropriate loads when subject to traffic.

3.2 Curb-Opening Inlets

These inlets are vertical openings in the curb covered by a top slab. They are best suited for use at sag points since they can convey large quantities of water and debris. They are a viable alternative to grates in many locations where grates would be hazardous for pedestrians or bicyclists. They are generally not recommended for use on steep continuous grades.

3.3 Slotted Drain Inlets

These inlets consist of a slotted opening with bars perpendicular to the opening. Slotted inlets function as weirs with flow entering from the side. They can be used to intercept sheet flow, collect gutter flow with or without curbs, modify existing systems to accommodate roadway widening or increased runoff, and reduce ponding depth and spread at grate inlets. The two types of slotted inlets in general use are the vertical riser type and the vane type.

Note: Standard drawing RD328 is an example of a vertical riser slotted inlet. Reference manufacturer literature for information on vane type slotted inlets.

Slotted drains have been used with varying degrees of success. In fact, the situations which warrant the use of slotted drain inlets can actually hinder their performance. Slotted drain inlets are usually placed in areas of minimal horizontal slope and superelevation. Since the invert of the drain is parallel to the pavement, siltation can occur due to flow velocities. Slotted drain inlets are most efficient when constructed on pavement slopes that are sufficient to produce velocities for clean-out or are provided with a tapered slot that allows an adequate slope on the pipe.

3.4 Combination Inlets

Various types of combination inlets are in use. Curb opening and grate combinations are common, some with the curb opening upstream of the grate, and some with the curb opening adjacent to the grate. Slotted inlets are also used in combination with grates, located either longitudinally upstream of the grate, or transversely adjacent to the grate. Engineering judgment is necessary to determine if the total capacity of the inlet is the sum of the individual components

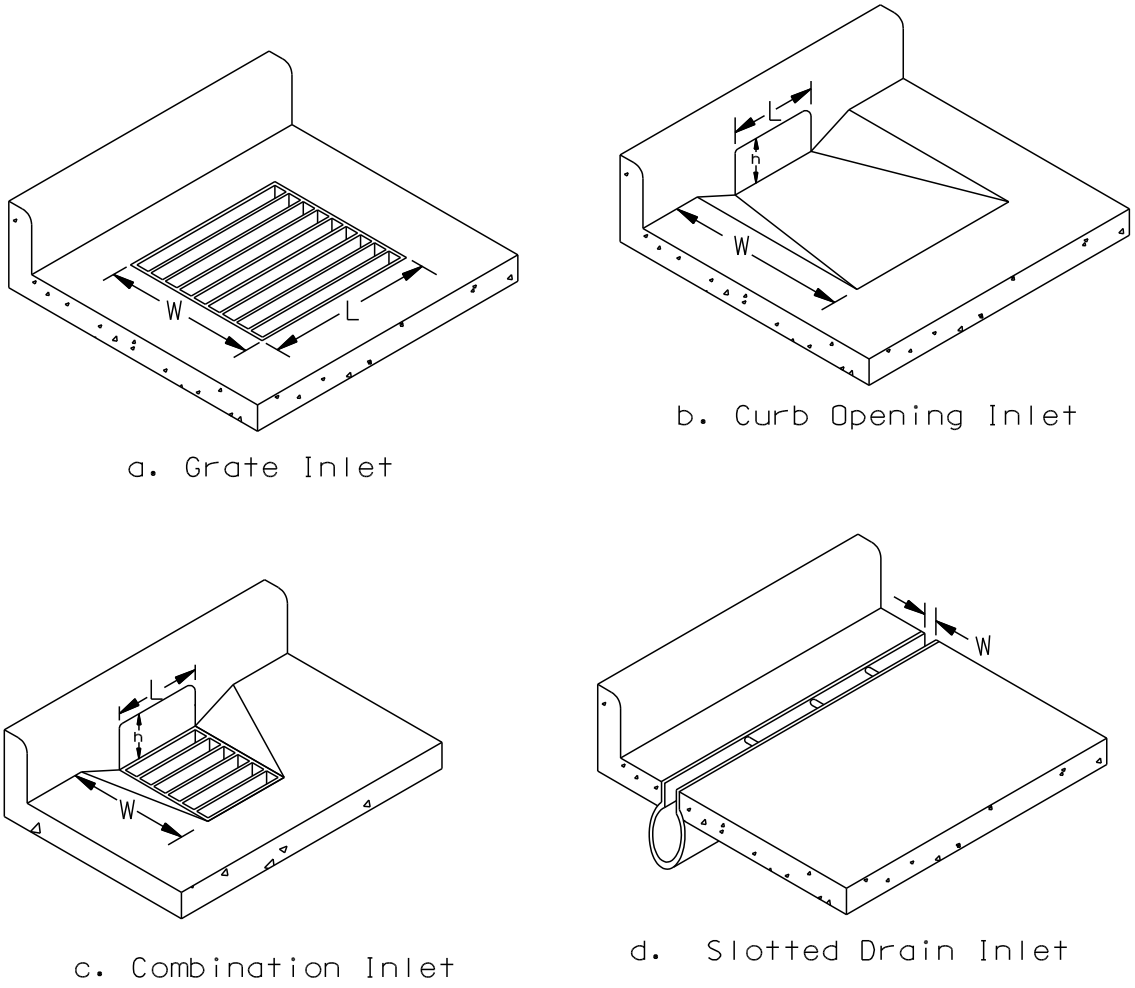

Figure 1 - Typical Storm Drain Inlets

or a portion of each. The gutter grade, cross slope and proximity of the inlets to each other will be deciding factors. Combination inlets may be desirable in sags because they can provide additional capacity in the event of plugging.

3.5 Trench Drain Systems

Trench Drain systems are a modular slotted drain system with a sloping invert and removable grates. The interior of the system has a radius smooth finish to improve flow and minimize siltation. These systems with their continuous grates are best suited for intercepting flow on very flat surfaces with little or no longitudinal grade. A limiting factor of trench drains is they are incapable of handling flow over 0.5 cubic feet per second over a 300 foot length because drain depths graduate from about 5-inches to 12-inches. The majority of other considerations such as constructability and maintenance are similar between the trench drain system and the traditional catch basin system. Where trench drains may be a little more expensive than concrete pipe, large equipment is not needed to install them so the costs balance out.

3.6 ODOT Inlets

Several Standard inlets are used in ODOT drainage systems and are listed in Table A.

The hydraulic capacity of a storm drain inlet depends upon its geometry as well as the characteristics of the gutter flow. To maximize hydraulic capacity, it is recommended to use the following ODOT inlets with the optimal gutter grade ranges listed in the table below.

Gutter Grade	Inlet Recommendations
less than 8 percent	CG-2, G-2 are both acceptable
less than 1 percent	CG-3 more efficient than CG-1 and G-1
greater than 1 percent	CG-3 not recommended

4.0 Maximum/Minimum Depth

Minimum inlet depth is controlled by the minimum cover requirements for the type of pipe used. Refer to **Chapter 5** and Standard Drawings RD380, 382, 384, 386 for guidance.

Maximum inlet depth shall be 6 feet. Deeper depths are permissible if maintenance practices will allow. The designer should check with the appropriate District Maintenance Supervisor before specifying inlets deeper than 6 feet.

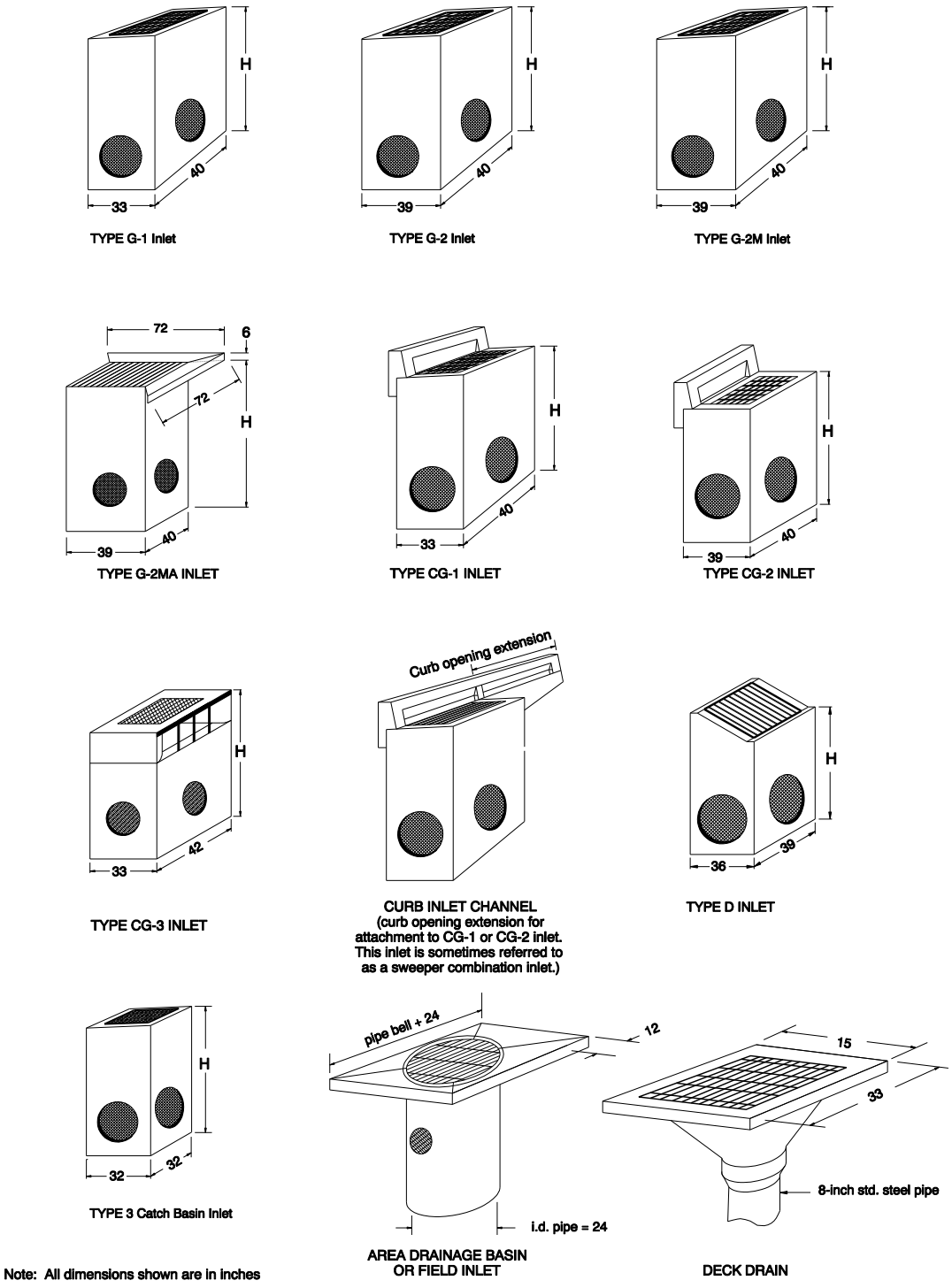

Figure 2 - ODOT Inlets

Table A
ODOT Inlets

I.D.	Configuration	Where Used	Standard Drawing No.
G-1	Single Grate*	Small areas with no debris; recommended for two-lane highways.	RD364
G-2	Double Grate*	Where considerable water or debris is anticipated; recommended for multiple-lane highways	RD364
G-2M	Single Grate	Areas without traffic, bicycles or pedestrians such as medians and ditches.	RD364
G-2MA	Single Grate with concrete apron	Areas without traffic, bicycles or pedestrians such as medians and ditches having variable 1V: 10H-1V: 20H side slope.	RD364
CG-1	Single Grate* plus curb opening	Where debris or trash is anticipated and in sags; recommended for two-lane highways.	RD366
CG-2	Double Grate* plus curb opening	Where considerable water or debris is anticipated and in sags; recommended for multiple-lane highways	RD366
CG-3	Curb Opening only	Where longitudinal grade is relatively flat and bicycle traffic is anticipated; good debris passage capabilities.	RD372
Curb Inlet Channel	Curb Opening Extension for attachment to CG-1 or CG-2 inlets.	Where longitudinal grade is relatively flat and bicycle traffic is anticipated; good debris passage capabilities.	RD366
D	Single Grate on inclined slope	Side drainages and at end of ditches where debris is anticipated; functions as a trash rack.	RD370
Type 3 C.B.	Single Grate*	Where minimal debris or trash is anticipated and where pedestrians may be present.	RD378
Area Drainage Basin or Field Inlet	Single Round Grate* with concrete apron .	Where No Traffic is anticipated. Medians, ditches, flat vegetated areas.	RD374
Slotted Drain	C.M.P. Slotted Drain	Areas with minimal debris ; not recommended for sags.	RD328
Deck Drain Type A	Single Grate* deck drain.	Bridge deck drain	BR120

* Bicycle safe grate(s)

Table B
ODOT Inlet Standard Design Parameters

I.D.	Grate, curb opening, or slot Width (feet)	Grate, curb opening or slot Length (feet)	Grate Perimeter (feet)	Depression (inches)	Clear Opening Area (square feet)	Clear Opening Ratio (percent)	Equiv. Grate Type
G-1	1.75	2.67	6.16	0	3.48	75	P-1-7/8-4
G-2	2.25	2.67	7.17	0	4.29	72	P-1-7/8-4
G-2M	2.25	2.67	9.83	0	4.79	80	P-1-7/8
G-2MA	2.25	2.67	9.83	1.5	4.79	80	P-1-7/8
CG-1	1.75	2.67	6.16	1.5	3.48	75	P-1-7/8-4
CG-2	2.25	2.67	7.17	1.5	4.29	72	P-1-7/8-4
CG-3	h = 0.36	2.5	N/A	2	0.90	N/A	N/A
Curb Inlet Channel	h = 0.33	6	N/A	1.5	2	N/A	N/A
D	2.25	h = 1.38	N/A	0	4.79	80	P-1-7/8
Type 3 Catch Basin	2.29	2.29	9.16	1.5	2.04	40	
					On-Grade		Reticuline
					Sump		30° Tiltbar
Area Drainage Basin or Field Inlet	2 Round	2 Round	6.28	0.24	2.08	68	P-1-7/8-4
Slotted Drain	0.15	specified on plans	N/A	0	N/A	N/A	N/A
Deck Drain Type A	1.12	2.67	4.91	0	1.66	56	P-1-1/8

5.0 Maximum Diameter Pipe Connections

Figure 3 illustrates the maximum diameter that may be connected to standard inlet types. The designer should check skewed connections to ensure they will fit into the inlet box.

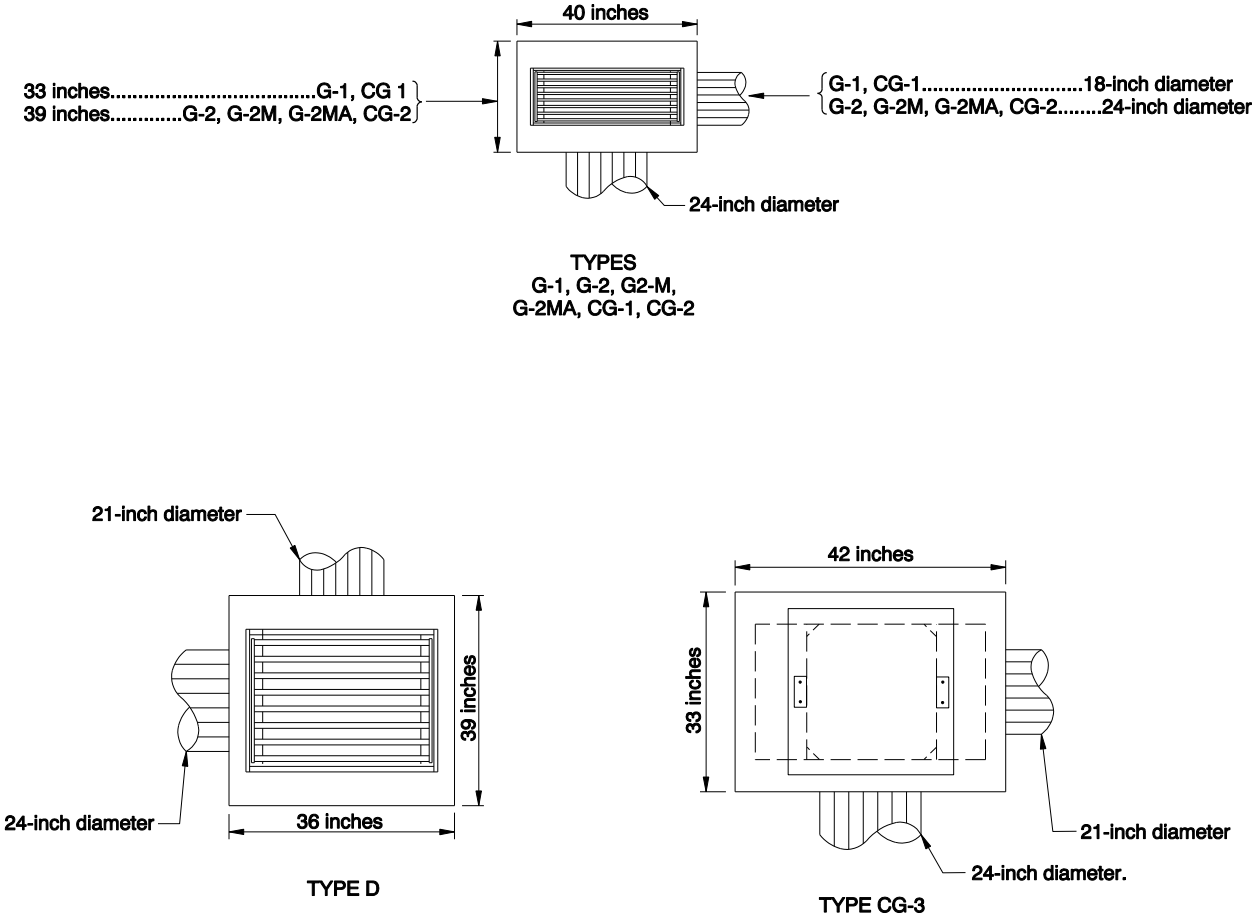

Figure 3 - Maximum Diameter pipe connections to inlets