URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

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TECHNICAL MEMORANDUM

FROM: Ken MacKenzie and Dr. James C.Y. Guo, (University of Colorado)

SUBJECT: Hydraulic Efficiency of Street Inlets Common to UDFCD Region

DATE: March 21, 2011 (Revised, Original January 4, 2011)

When the *Urban Storm Drainage Criteria Manual* (USDCM) was updated in 2001, a series of Visual Basic© driven spreadsheet workbook design tools, including the workbook *UD-Inlet.xls* were created. During the process of creating this workbook, it became clear that the nationally accepted method of determining inlet capacity as described in the FHWA Hydraulic Engineering Circular No. 22 (HEC-22), was inadequate to describe the specific hydraulic characteristics of the most commonly used inlets in the UDFCD region. In 2006, UDFCD commissioned a study to investigate the hydraulic efficiencies of the CDOT Type 13 and Denver No. 16 grated inlets in valley and combination configuration, and the CDOT Type R curb opening inlets for street and roadway drainage (see Figure 1).

The study was completed at the Colorado State University (CSU) hydraulic laboratory, where a 1/3 scale model was constructed to study the hydraulics of these inlets. The project was financially supported by the Urban Drainage and Flood Control District, the Colorado Department of Transportation, Denver, Adams County, Arapahoe County, Arvada, Douglas County, Jefferson County, Boulder, Golden, Lafayette, Lakewood, Littleton, and Lone Tree.

(a) CDOT Type 13 grated inlet in combination configuration

(b) Denver No. 16 grated inlet in combination configuration

(c) CDOT Type R curb opening inlet

Figure 1. *Street inlets common to the UDFCD region.*

It was concluded that the USDCM design procedures and formulas provide a generally appropriate foundation to represent the hydraulic performance of these three inlets. The focus, therefore, was on adjusting the specific design parameters used in the empirical formulas to better agree with the laboratory data.

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Testing was performed from January 2007 through November 2008. A total of 318 tests were conducted in two basic street drainage conditions: a sump condition, in which all of the street flow was captured by the inlets, and an on-grade condition, in which only a portion of the total street flow was captured and the rest of the flow bypassed the inlets.

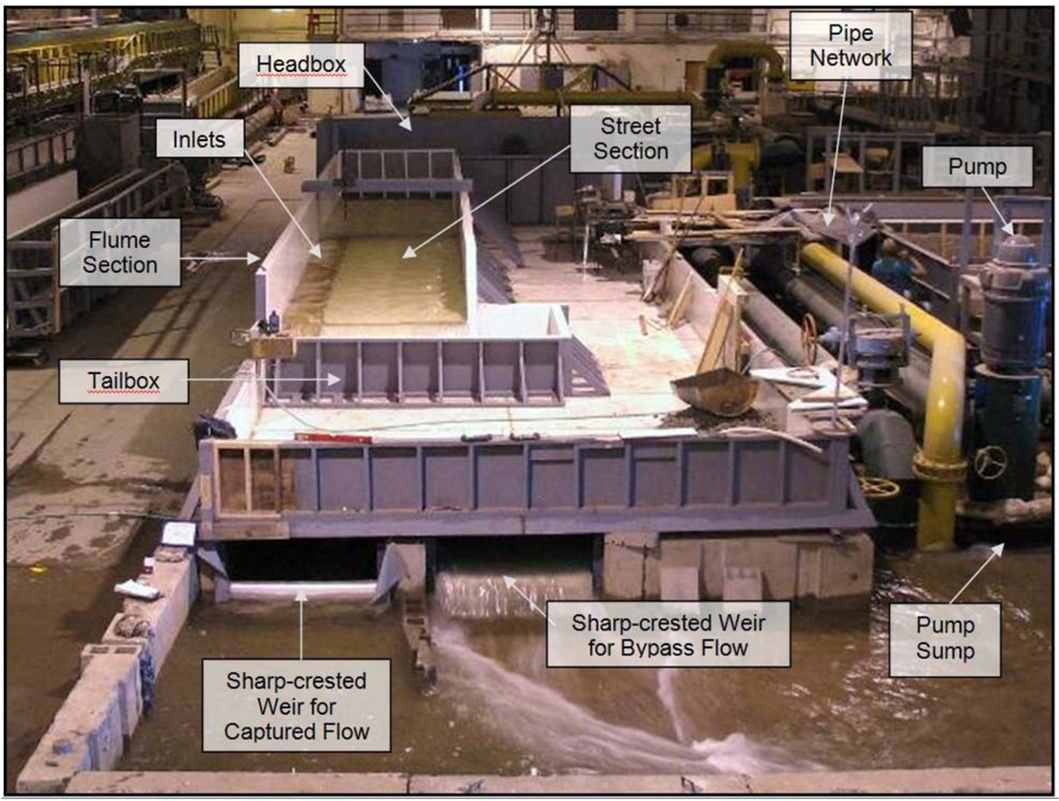

***Figure 2.** Laboratory layout of modeled street, sidewalk, curb, gutter, and inlets.*

INLETS ON GRADES

For a grated street inlet on a longitudinal grade, stormwater available for capture can be divided into frontal (or gutter) flow that is carried within the inlet width, and side flow that is outside the inlet width and spreads into the traffic lanes. Generally speaking, most of the frontal flow will be intercepted by the inlet and most of the side flow will not. The ratio of intercepted frontal flow to total frontal flow is approximated by the equation:

$$R_f = 1.0 - 0.09(V - V_o) \quad (1)$$

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Where R_f is the ratio of intercepted frontal flow to total frontal flow, V is the mean gutter flow velocity, and V_o is the splash-over velocity, i.e., the minimum velocity where some of the flow begins to jump or splash over the entire length of the inlet. V_o is a function of the grate length and the hydraulic characteristics of the openings, e.g., the Denver No. 16 grate has a higher splash-over velocity due to its directional cast vanes, than that of the CDOT Type 13. The splash-over velocity can be estimated as:

$$V_o = \alpha + \beta L_e - \gamma L^2{}_e + \eta L^3{}_e \qquad (2)$$

Where L_e = effective grate length in feet. New values for coefficients, α, β, γ, and η were developed by applying multiple regression analyses to the data collected during the on-grade grate tests. It was found that the HEC-22 method (in conjunction with previous assumptions regarding splash-over characteristics) tends to over-predict the efficiency of the Type 13 and No. 16 grates, sometimes by quite a bit.

Figures 3 and 4 demonstrate only limited agreement between the observed and predicted hydraulic efficiency using the above design procedure with the new coefficients. Further analysis is needed in the "splash-over velocity" methodology as this study was not able to verify the results of the 1977 FHWA study upon which HEC-22 is based, and may have exposed serious shortcomings with the "splash-over velocity" methodology. It appears that depth of flow is as important as velocity.

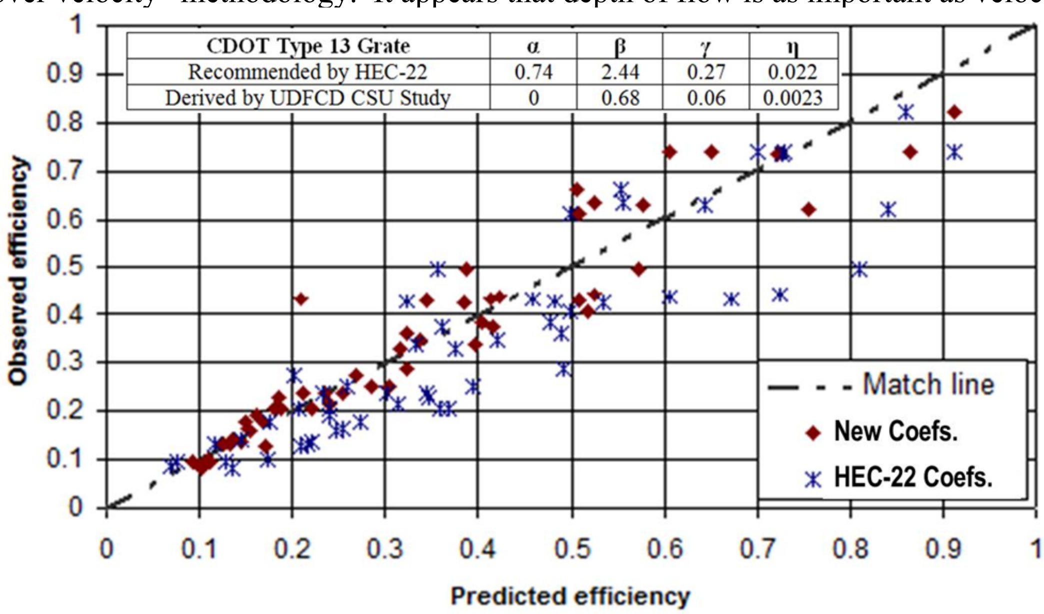

Figure 3. *Predicted vs. observed efficiency for Type 13 combination inlet.*

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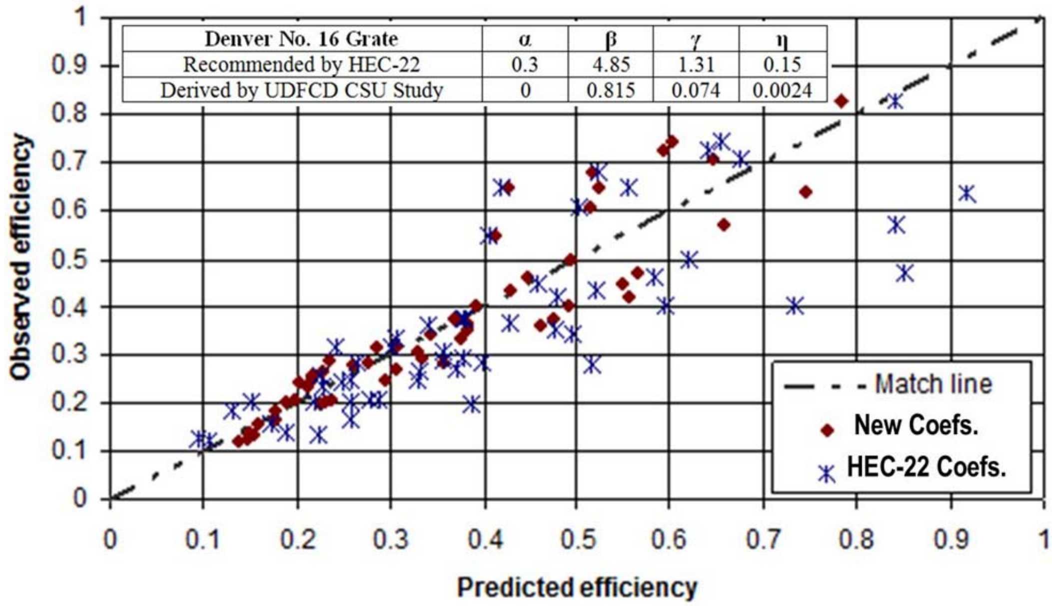

Figure 4. *Predicted vs. observed efficiency for Type 16 combination inlet*

For the CDOT Type R curb opening inlet on a continuous grade, the required opening length, L_T, for complete interception of the design storm runoff, Q_s, on the street is computed by:

$$L_T = NQ_S{}^a S_L^b \left(\frac{1}{nS_e} \right)^c \tag{3}$$

In which L_T is the required length for a 100% runoff interception, N is a reduction factor, S_L = street longitudinal slope, n = Manning's roughness, and S_e = equivalent transverse street slope. The analysis of the laboratory data collected in this study led to a new set of coefficients for Equation 3. For the Type R inlet, the HEC-22 method was modified with newly derived coefficients. The comparison between observed and predicted hydraulic efficiency is presented in Figure 5.

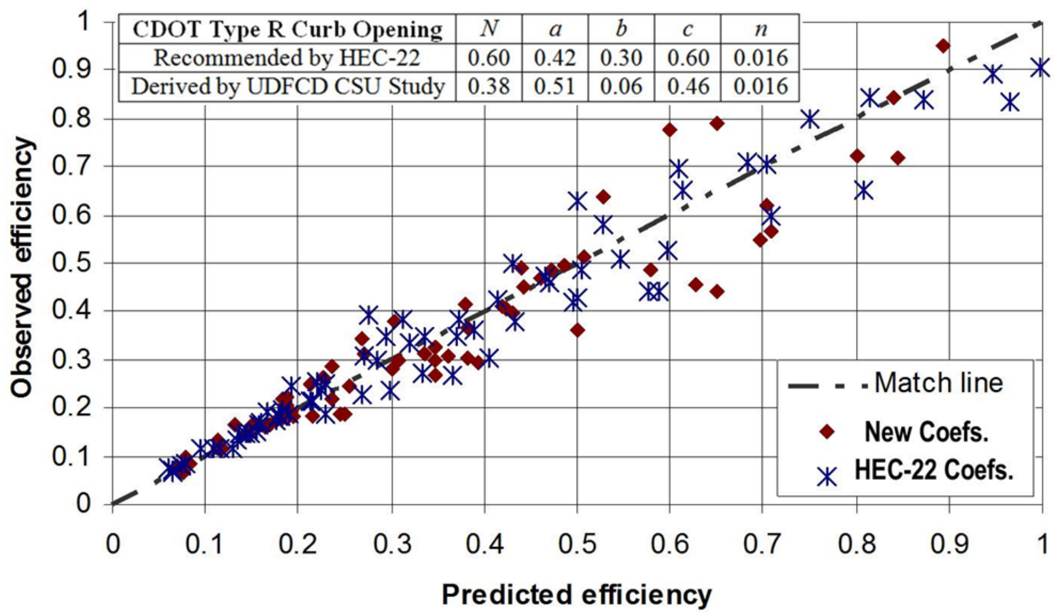

Figure 5. *Predicted vs. observed efficiency for Type R inlets*

GRATED INLETS IN SUMPS

The flow through a sump inlet varies with respect to depth and continuously changes from weir flow at shallow depths, mixed flow at intermediate depths, and orifice flow at greater depths. The classic formulas for weir and orifice flows were modified with weir length or area opening ratios as:

$$Q_w = N_w C_w (2W_g + L_e) D^{3/2} \tag{4}$$

$$Q_o = N_o C_o W_g L_e \sqrt{2gD} \tag{5}$$

Where Q_w = weir flow in cfs, Q_o = orifice flow in cfs, W_g = grate width in feet, L_e = effective grate length in feet, D = water depth in feet at gutter flow line outside of any local depression, N_w = weir length grate reduction factor, N_o = orifice area grate reduction factor, C_w = weir discharge coefficient, and C_o = orifice discharge coefficient. The transient process between weir and orifice flows is termed mixed flow that is modeled as:

$$Q_m = C_m \sqrt{Q_w Q_o} \tag{6}$$

Where Q_m = mixed flow in cfs and C_m = mixed flow coefficient. In practice, for the given water depth, it is suggested that the interception capacity for the in-sump grate be the smallest among the weir, orifice, and mixed flows as:

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$$Q_i = \min(Q_w, Q_m, Q_o) \tag{7}$$

The recommended coefficients, C_w, C_m, and C_o are listed in Table 1.

Inlet Type	N_w	C_w	N_o	C_o	C_m
CDOT Type 13 Grate	0.70	3.30	0.43	0.60	0.93
Denver No. 16 Grate	0.73	3.60	0.31	0.60	0.90
Type 13 / No. 16 Combination Curb Opening	1.0	3.70	1.0	0.66	0.86
CDOT Type R Curb Opening	1.0	3.60	1.0	0.67	0.93

Table 1: *Coefficients for various inlets in sumps.*

CURB OPENING INLETS IN SUMPS

Like a grated inlet, a curb opening inlet operates under weir, orifice, or mixed flow. The capacity of a CDOT Type R Inlet is estimated based on its curb opening geometry as:

$$Q_w = C_w N_w L_e D^{3/2} \tag{8}$$

$$Q_o = C_o N_o (L_e H_c)\sqrt{2g(D - 0.5 H_c SIN\theta)} \tag{9}$$

Where H_c = height of the curb opening throat. Equations 6 and 7 also apply to curb opening inlets. The HEC-22 procedure was found to overestimate the capacity of a curb opening inlet under shallow depth, and underestimates capacity when water depth exceeds 0.8 feet. The new equations and coefficients agree well with the observed data for depths greater than 0.8 feet, as shown in Figure 6.

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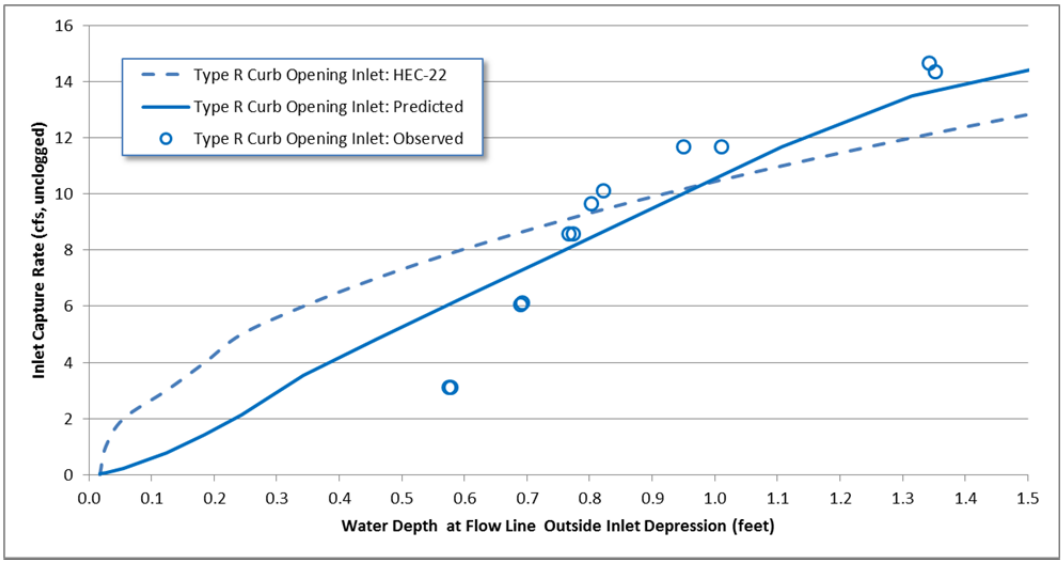

Figure 6. *Flow capacity vs. depth for type r inlets in sumps*

COMBINATION INLETS IN SUMPS

Because the vault for a Type 13 or No. 16 combination inlet lies under the grate, any water entering the curb opening is forced through a narrow horizontal opening that exists under the curb head and in the plane of the grate. Therefore the capacity of a 3-ft curb opening associated with a Type 13 or No. 16 combination inlet is estimated based on this horizontal throat opening geometry as:

$$Q_w = C_w N_w L_e D^{3/2} \quad (10)$$

$$Q_o = C_o N_o (0.44 L_e)\sqrt{2gD} \quad (11)$$

Where $0.44L_e$ represents the horizontal orifice area (in ft^2) for Type 13 and No. 16 inlets. Equations 6 and 7 apply to curb openings associated with combination inlets as well.

Until now, estimation of the hydraulics of combination inlets has been unclear, even though thousands of combination inlets have been installed in the UDFCD region over time. In this study, a new approach was formulated to model the interception capacity of a combination inlet. It is suggested that a reduction factor tied to the geometric mean of the grate and curb opening capacities be applied to the algebraic sum of the total interception as:

$$Q_t = Q_g + Q_c - K\sqrt{Q_g Q_c} \quad (12)$$

Where Q_t = interception capacity for combination inlet, Q_g = interception for grate, Q_c = interception for curb opening, and K = reduction factor. The least square method was set up to

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minimize the squared errors using the reduction factor, K. It was found that $K = 0.35$ for the CDOT Type 13 combination inlet, and $K = 0.20$ for the Denver No. 16 combination inlet. A higher reduction factor implies higher interference between the grate and the curb opening. The HEC-22 procedure assumes that the grate and curb opening function independently, resulting in a consistent overestimation of the capacity of a combination inlet. K is a lumped, average parameter representing the range of observed water depths in the laboratory. During the model tests, it was observed that when the grate surface area is subject to shallow water, the curb opening intercepted the flow only at its two corners, and did not behave as a side weir by collecting flow along its full length. Under deep water, vortex circulation dominates the flow pattern. As a result, the central portion of the curb opening more actively draws water into the inlet box. Equation 12 best represents the range of the observed data, as indicated in Figure 7.

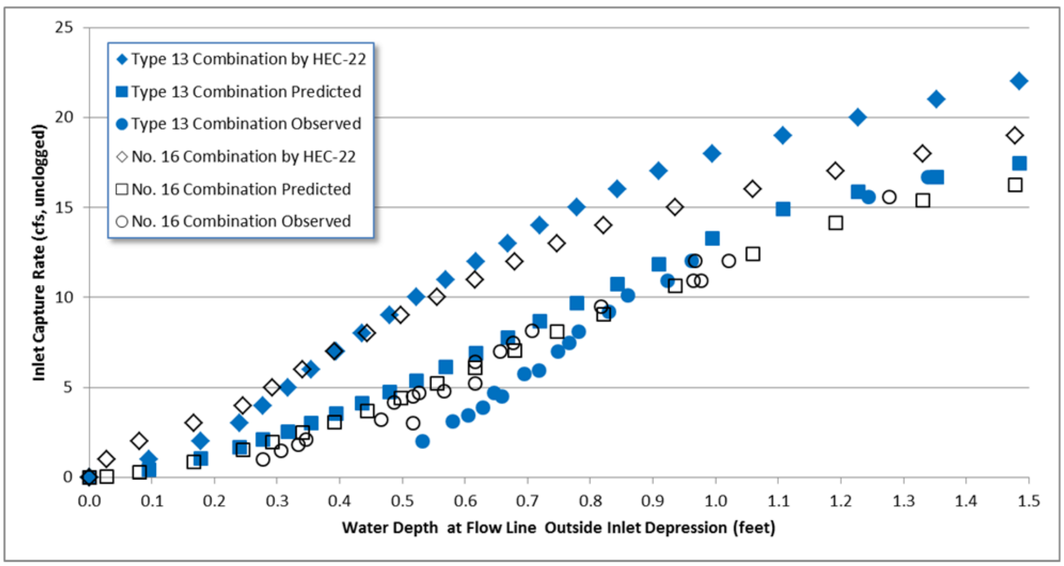

Figure 7. *Flow capacity vs. depth for combination inlets in sumps*

WEIR PERFORMANCE DECAY IN LONG SUMP INLETS

The CSU study demonstrated a phenomenon referred to as weir performance decay, which is a function of the length of the inlet. It was found that inlets become less effective in weir flow as they grow in length (as shown in Figure 8) if the intent is to limit ponding to less than or equal to the curb. This phenomenon can be expressed mathematically by a multiplier in the weir equation. For the Denver No. 16 and the CDOT Type 13 combination inlets, this Weir Performance Reduction Factor (WPRF) multiplier is found by:

$$WPRF_{13,16} = MIN\left[1, \frac{D_{FL}}{0.7 * MIN(9, L) + 4.3}\right] \quad (13)$$

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Where D_{FL} is the gutter flow line depth in inches and L is the total inlet length in feet. This equation applies to both the grate and the curb opening portions of the combination inlet. For the CDOT Type R and Denver No. 14 curb opening inlets, the Weir Performance Reduction Factor (WPRF) multiplier is found by:

$$WPRF_{14,R} = MIN\left[1, \frac{D_{FL}}{0.67D_{FL} + 0.24 * MIN(15, L)}\right] \tag{14}$$

Where D_{FL} is the gutter flow line depth in inches and L is the total inlet length in feet. This equation applies to both the grate and the curb opening portions of the combination inlet.

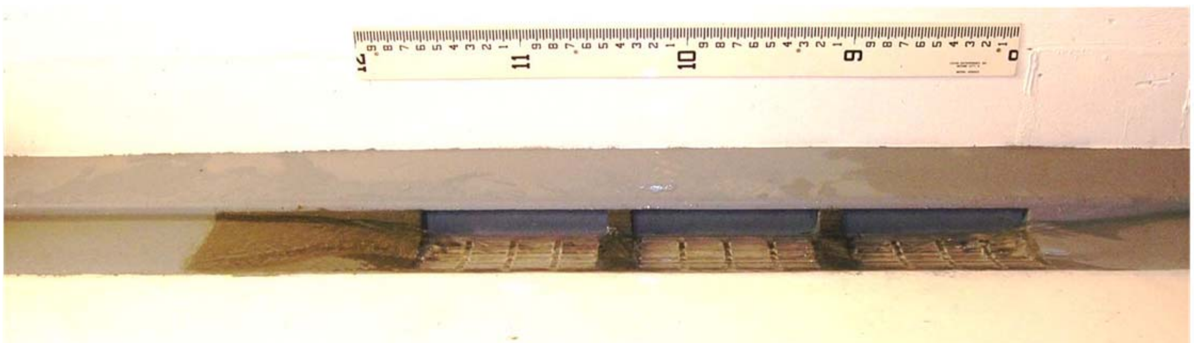

Figure 8. *Weir performance decay occurs when long inlets are used to limit ponding depths to small values (e.g., curb height) in sumps*

EMPIRICAL EQUATIONS FOR SELECTED SUMP INLETS

After calibrating the UD-Inlet workbook to match the laboratory results, empirical equations were developed for selected inlets common to the UDFCD region. For the CDOT Type R curb opening inlet and the Colorado Springs D-10-R curb opening inlet, the capacity for a given inlet length at a given ponding depth was found to be closely approximated by:

$$Q_{gpd} = \alpha L^{\beta} \tag{15}$$

Where Q_{gpd} is the inlet capacity for a given ponding depth outside the local depression, L is the given length of the inlet, and α and β are coefficients specific to that ponding depth. Similarly, the inlet length for a given required flow capacity at a given ponding depth was found to be closely approximated by:

$$L_{gpd} = \gamma Q^{\varphi} \tag{16}$$

Where L_{gpd} is the required inlet length for a given ponding depth outside the local depression, Q is the given (required) inlet capacity, and γ and φ are coefficients specific to that ponding depth. For the CDOT Type 13 combination inlet and the Denver No. 16 combination inlet, the capacity for a given number of inlets at a given ponding depth was found to be closely approximated by:

$$Q_{gpd} = \alpha x^{\beta} \tag{17}$$

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Where Q_{gpd} is the inlet capacity for a given ponding depth outside the local depression, x is the given number of inlet units, and α and β are coefficients specific to that ponding depth. Similarly, the number of inlet units necessary for a given required flow capacity at a given ponding depth was found to be closely approximated by:

$$y_{gpd} = \gamma Q^{\varphi} \tag{18}$$

Where y_{gpd} is the required number of inlet units for a specific ponding depth outside the local depression, Q is the given (required) inlet capacity, and γ and φ are coefficients specific to that ponding depth. Specific values for coefficients α, β, γ and φ are included in the appendix to this memorandum.

CONCLUSIONS AND RECOMMENDATIONS

As illustrated in the *USDCM* (2001), the current methods in determining the inlet efficiency for the CDOT Type 13, Denver No. 16, and CDOT Type R inlets had not previously been sufficiently verified. A physical model is sometimes the best way to duplicate complex physical conditions that are encountered in the field, and this is what we reproduced in the laboratory. The data collected and analyzed provided considerable insight to understand the performance of these commonly used inlets under varying hydraulic conditions.

In this study, it was found that HEC-22 agreement with observed test data was generally poor with a hydraulic efficiency over-predicted by an average of 20% for the Type 13 and 16 combination inlets and under-predicted by an average of 7% for the Type R inlet. Methods given in the *USDCM* (2001) will be improved as part of the 2012 update for the on-grade condition by implementing the new splash-over velocity coefficients for the Type 13 and No. 16 grates. Similarly, the existing HEC-22 formula for Type R inlet will be improved by the regression analysis using the observed data. The form of the original equation was preserved, and the overall fit to the observed efficiency data was improved considerably with efficiency errors averaging 3.8%.

All cases investigated in the laboratory were conducted under no clogging condition. As recommended, a decay-based clogging factor is applied to the grate area when the grate operates as an orifice or to the wetted perimeter when the grate operates as a weir (Guo 2000, 2006). The clogging decay coefficients are 0.5 for grated inlets and 0.25 for curb opening inlets.

Lastly, the relevance of uniform flow in the model was examined by repeating the analysis with the observed test data adjusted to conditions of uniform flow. An average difference in hydraulic efficiency is approximately 3%, for all inlets under uniform or non-uniform flow conditions in the model. As a result, it is concluded that the impact of the uniformity of the street flow immediately upstream of the inlet is negligible.

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APPENDIX:

RESULTS OF UDFCD STREET INLETS IN SUMP (SAG) LOCATIONS STUDY: ANALYSIS OF PHYSICAL MODEL AT CSU

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CDOT TYPE R CURB OPENING INLET IN SUMP

Weir Coefficient	C_W =	3.60	
Mixed Flow Coefficient	K =	0.93	
Orifice Coefficient	C_O =	0.67	
Curb Opening Length	L=	VARIES	ft
Throat height	h =	0.50	ft
Weir Length Reduction Factor	N_W =	1.00	
Orifice Area Reduction Factor	N_A =	1.00	
Throat Slope	Theta =	1.1065	rads, 63.4 degrees
Local Depression at Inlet	A_{LOCAL} =	3	inch
Gutter Width	w_G =	2	ft

All equations are based on the depth in the gutter flowline, $\mathbf{D_{FL}}$, away from the local depression

Curb opening weir depth D_W is measured at gutter-street interface, i.e., D_{FL} - W*S_W

Curb opening orifice depth D_O is measured as D_{FL} + A_{LOCAL}

Weir Performance Reduction Factor: =MIN(1,D_{FL}/(0.67*D_{FL}+0.24*L)) where D_{FL} is in inches and L is in feet

Weir Equation: $Q_W = C_W*N_W*MIN(1,DFL/(0.67*D_{FL}+0.24*L))*(L+1.8W_G)*D_W^{1.5}$ where W_G is the gutter width

Orifice Equation: $Q_O = C_O*N_A*L*h*(64.4*(D_O-h/2*SIN(Theta)))^{0.5}$

Mixed Flow Equation: $Q_M = K*(Q_W*Q_O)^{0.5}$

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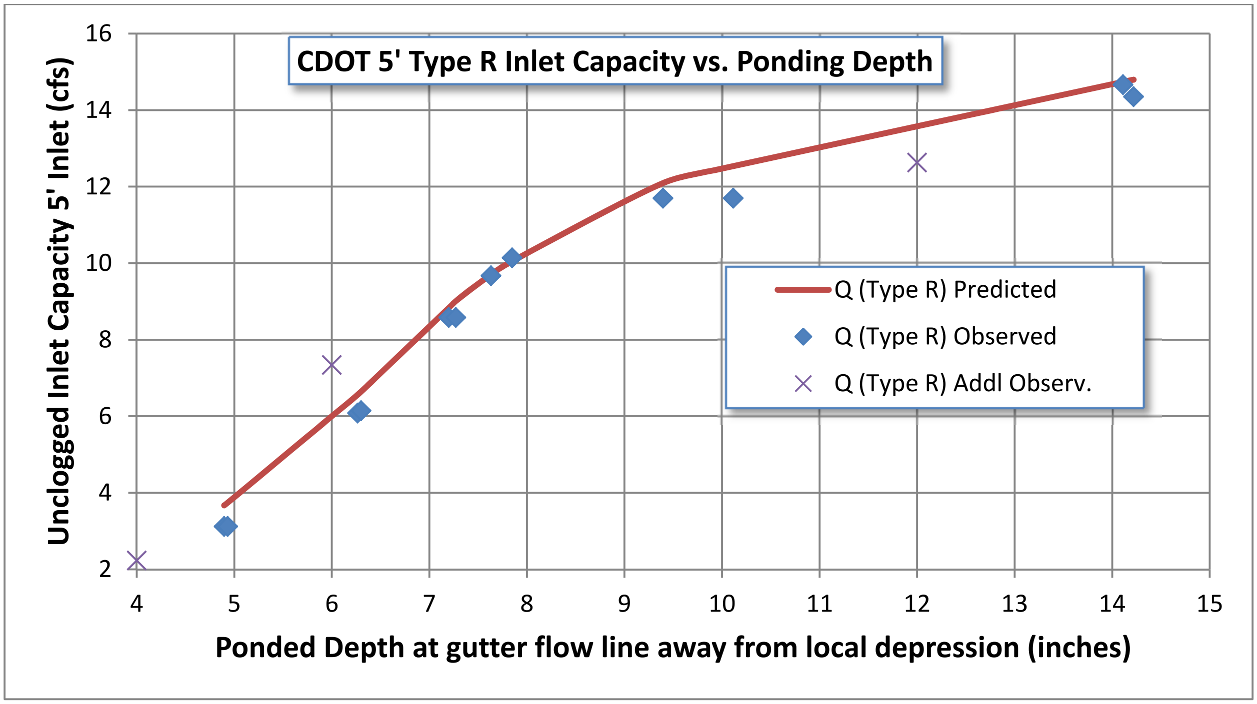

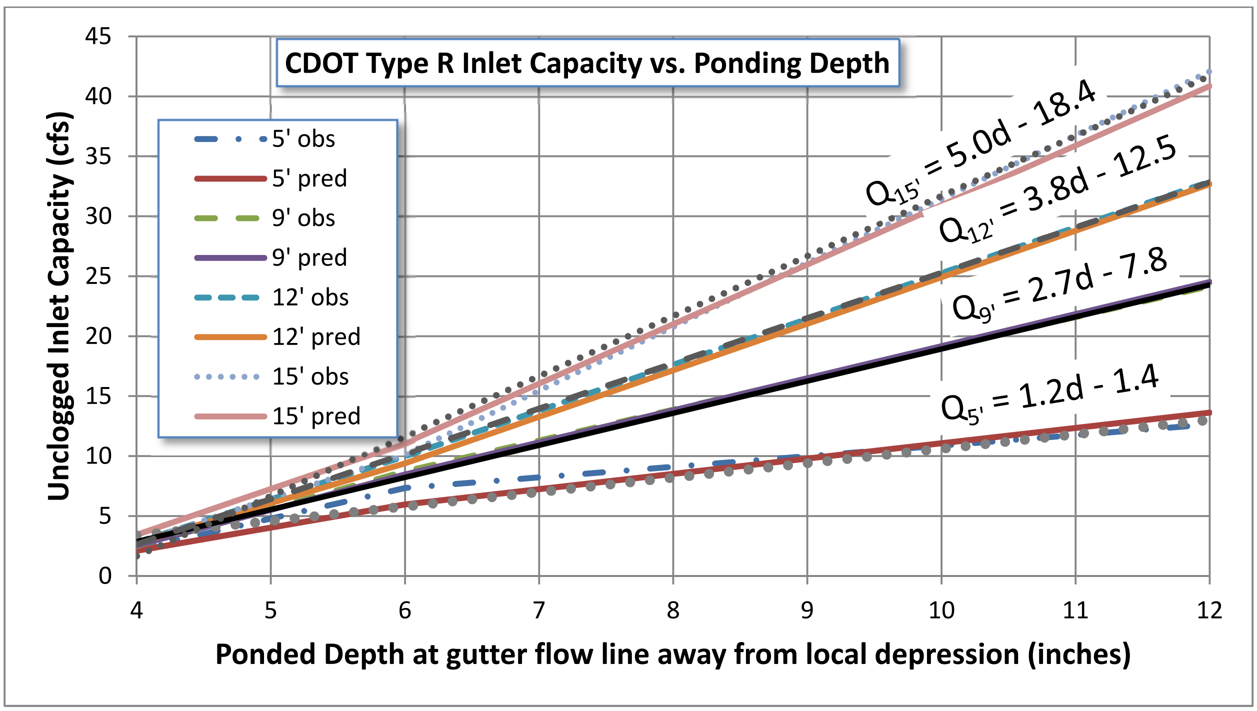

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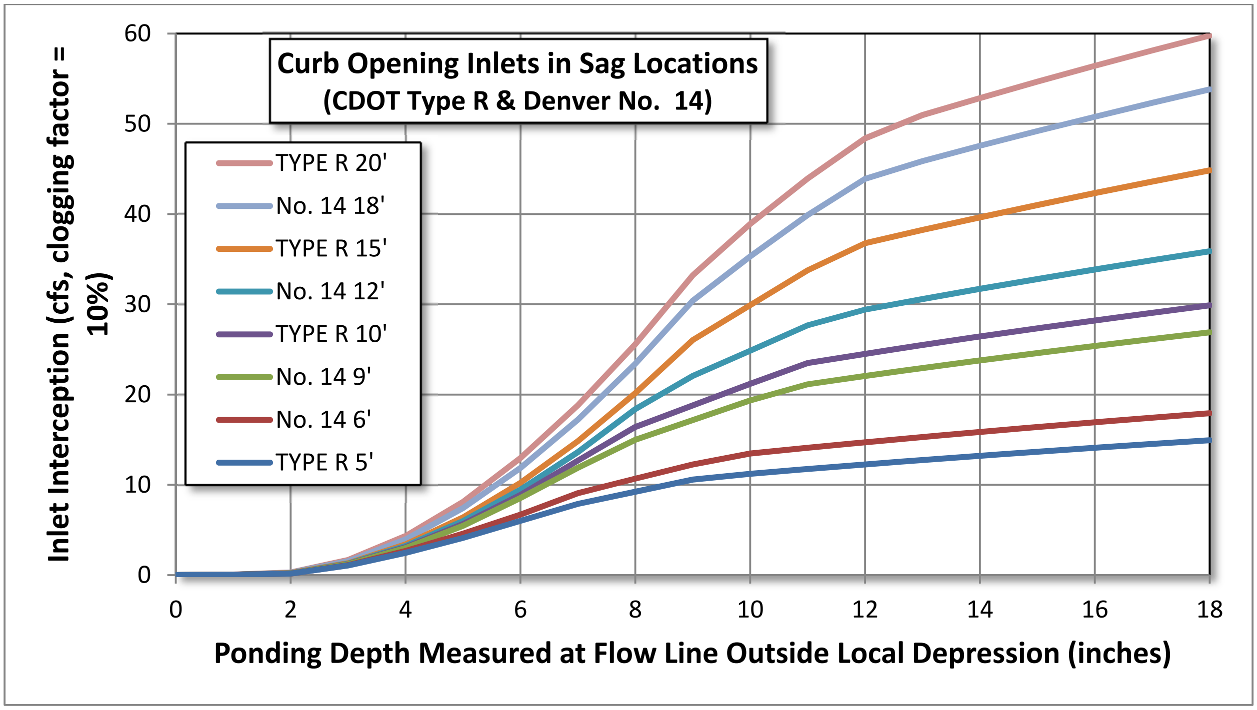

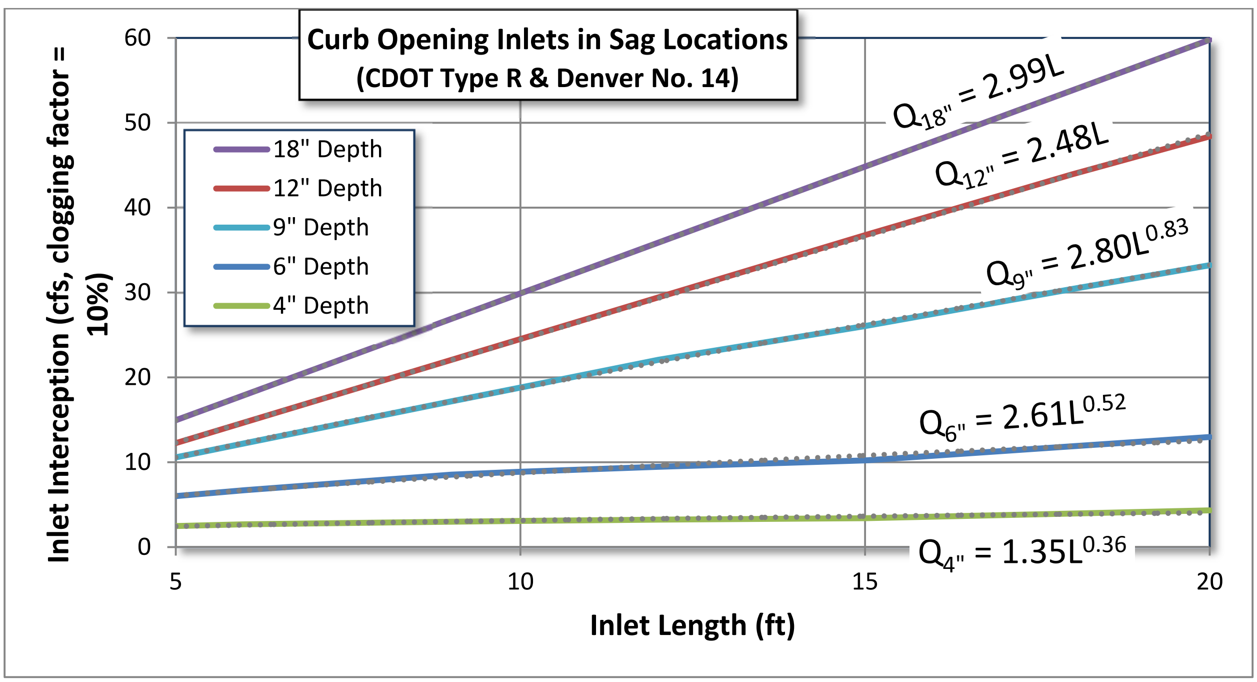

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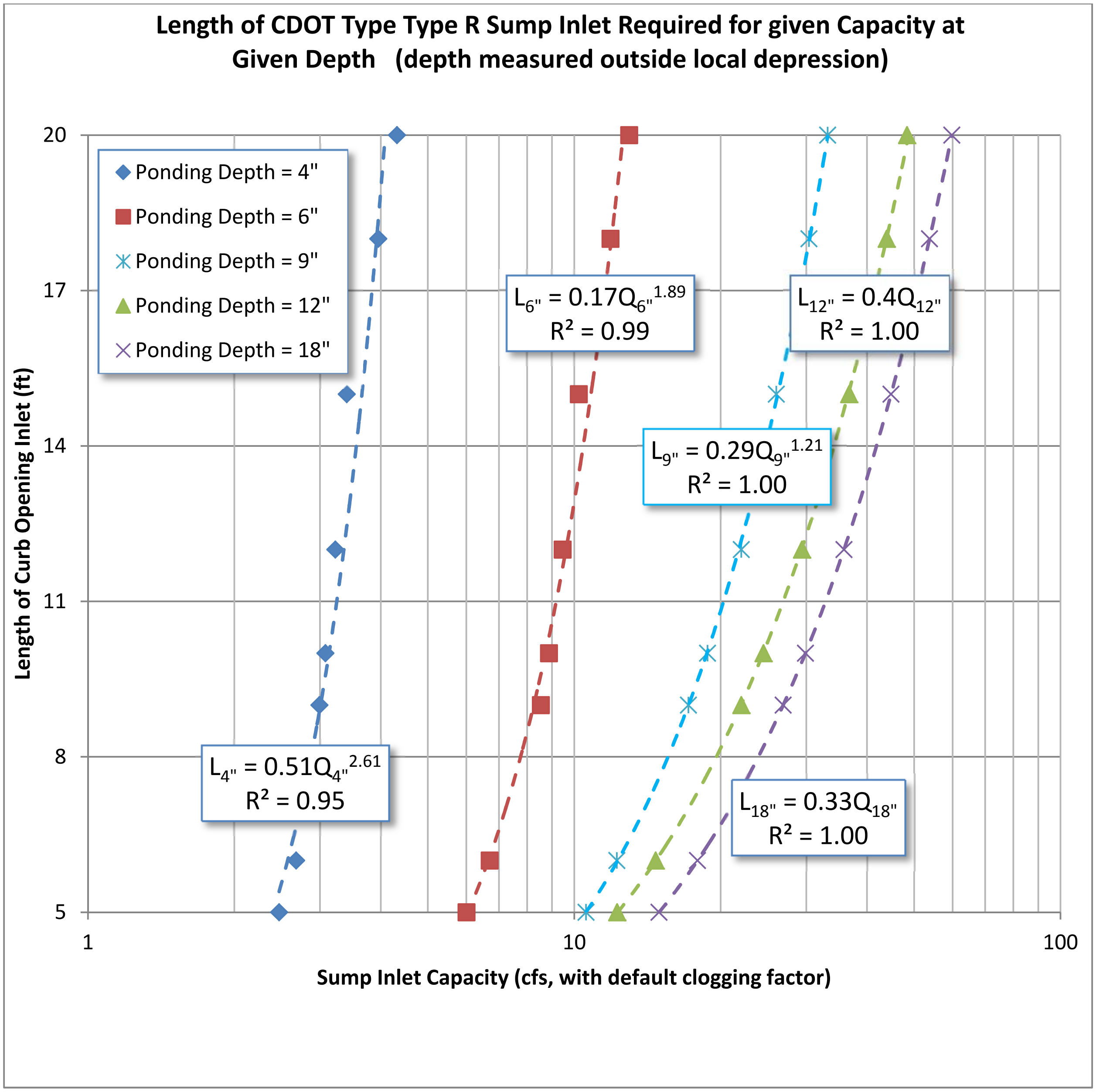

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CDOT 13 COMBINATION INLET IN SUMP

K_{16} = 0.35

	GRATE			CURB OPENING	
Weir Coefficient	C_W =	3.30		C_W =	3.70	
Mixed Flow Coefficient	K =	0.93		K =	0.86	
Orifice Coefficient	C_O =	0.60		C_O =	0.66	
Grate / Curb Opening Length	L=	VARIES	ft	L=	VARIES	ft
Grate Width / Throat height	W =	1.73	ft	h =	0.4375	ft
Weir Length Reduction Factor	N_W =	0.70		N_W =	1	
Orifice Area Reduction Factor	N_A =	0.43		N_A =	1	
Grate / Throat Slope	S_G =	0.1667	ft/ft	Theta =	0	rad, 0 deg
Local Depression at Inlet	A_{LOCAL} =	2	inch	A_{LOCAL} =	2	inch
Gutter Width	w_G =	2	ft	w_G =	2	ft

All equations are based on the depth in the gutter flowline, $\mathbf{D_{FL}}$, away from the local depression

Grate weir and orifice depth is measured at grate mid-width, i.e., $D_{FL} + A_{LOCAL} - S_G*W/2$

Curb opening weir depth D_W is measured at gutter-street interface, i.e., $D_{FL} - W*S_W$

Curb opening orifice depth D_O is measured as $D_{FL} + A_{LOCAL}$

Weir Performance Reduction Factor: =MIN(1,D_{FL}/(0.7*MIN(L,9)+4.3)) where D_{FL} is in inches and L is in feet

Grate Weir Equation: $Q_{W\text{-}GRATE} = C_W*N_W*MIN(1,D_W/(0.7*MIN(L,9)+4.3))*(L+2W)*D_W^{1.5}$

Grate Orifice Equation: $Q_{O\text{-}GRATE} = C_O*N_A*L*W*(64.4*(D_O)^{0.5}$

Grate Mixed Flow Equation: $Q_{M\text{-}GRATE} = K_{GRATE}*(Q_{W\text{-}GRATE}*Q_{O\text{-}GRATE})^{0.5}$

Grate Capacity Equation: $Q_{GRATE} = MIN(Q_{W\text{-}GRATE},Q_{O\text{-}GRATE},Q_{M\text{-}GRATE})$

Curb Weir Equation: $Q_{W\text{-}CURB} = C_W*N_W*MIN(1,D_W/(0.7*MIN(L,9)+4.3))*L*D_W^{1.5}$

Curb Orifice Equation: $Q_{O\text{-}CURB} = C_O*N_A*L*h*(64.4*(D_O\text{-}h/2*SIN(Theta)))^{0.5}$

Curb Mixed Flow Equation: $Q_{M\text{-}CURB} = K_{CURB}*(Q_{W\text{-}CURB}*Q_{O\text{-}CURB})^{0.5}$

Curb Capacity Equation: $Q_{CURB} = MIN(Q_{W\text{-}CURB},Q_{O\text{-}CURB},Q_{M\text{-}CURB})$

CDOT Type 13 Combination Inlet Capacity Equation: $Q_{13\text{-}COMB} = Q_{GRATE} + Q_{CURB} - K_{13}*(Q_{GRATE} * Q_{CURB})^{0.5}$

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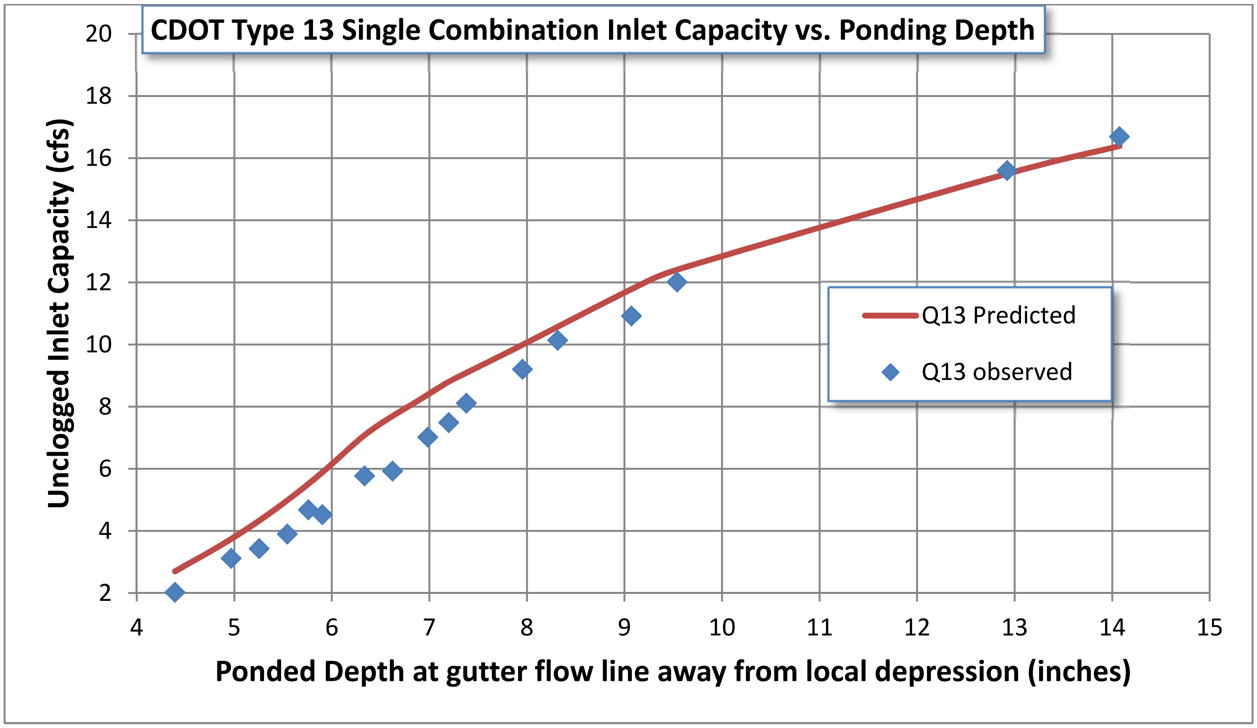

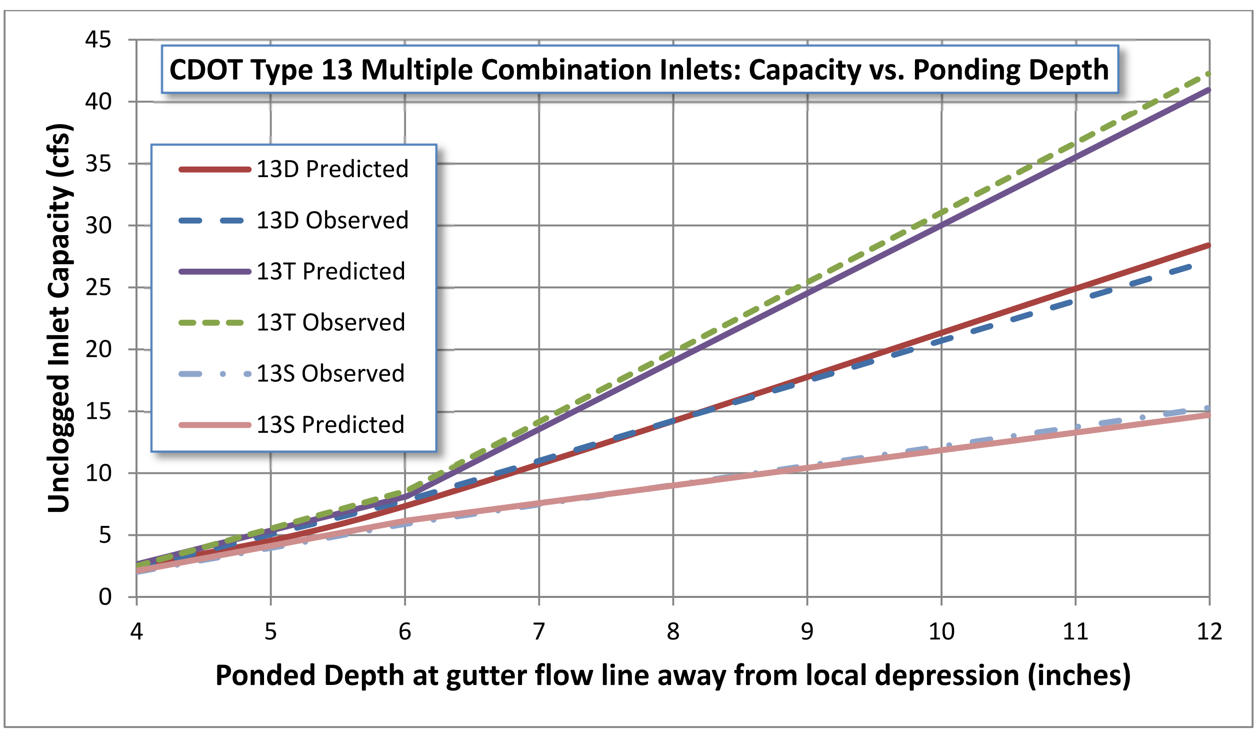

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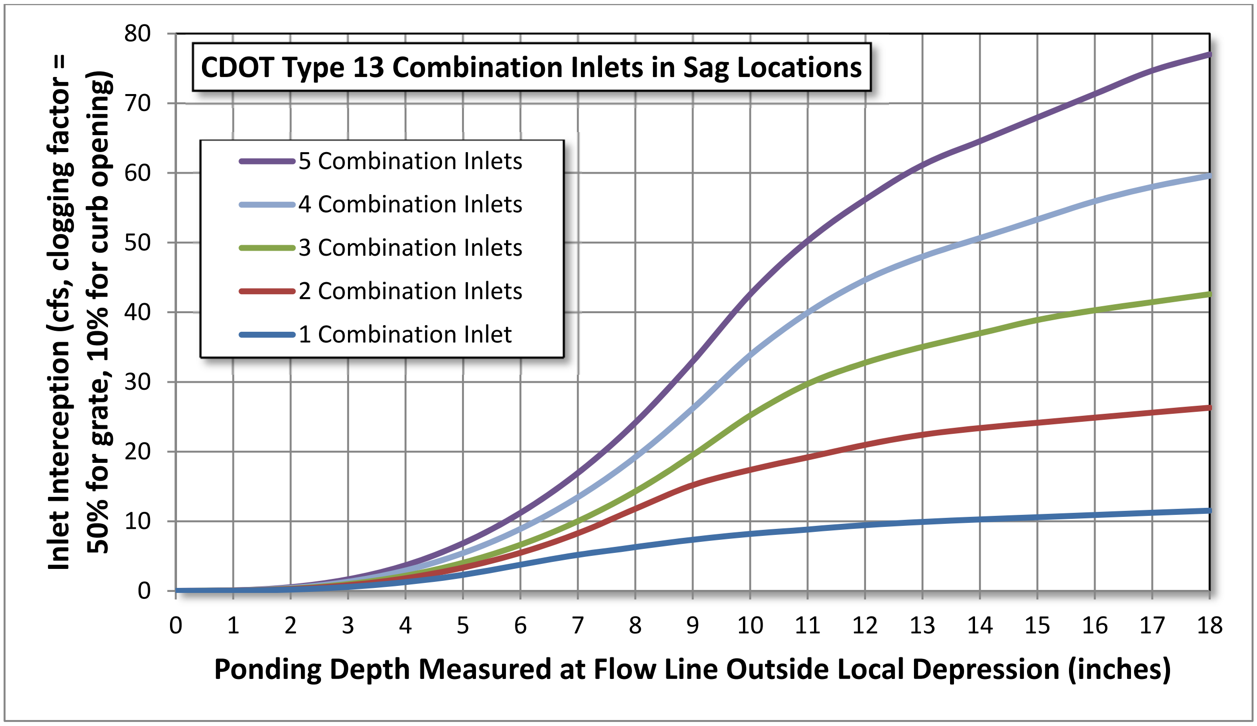

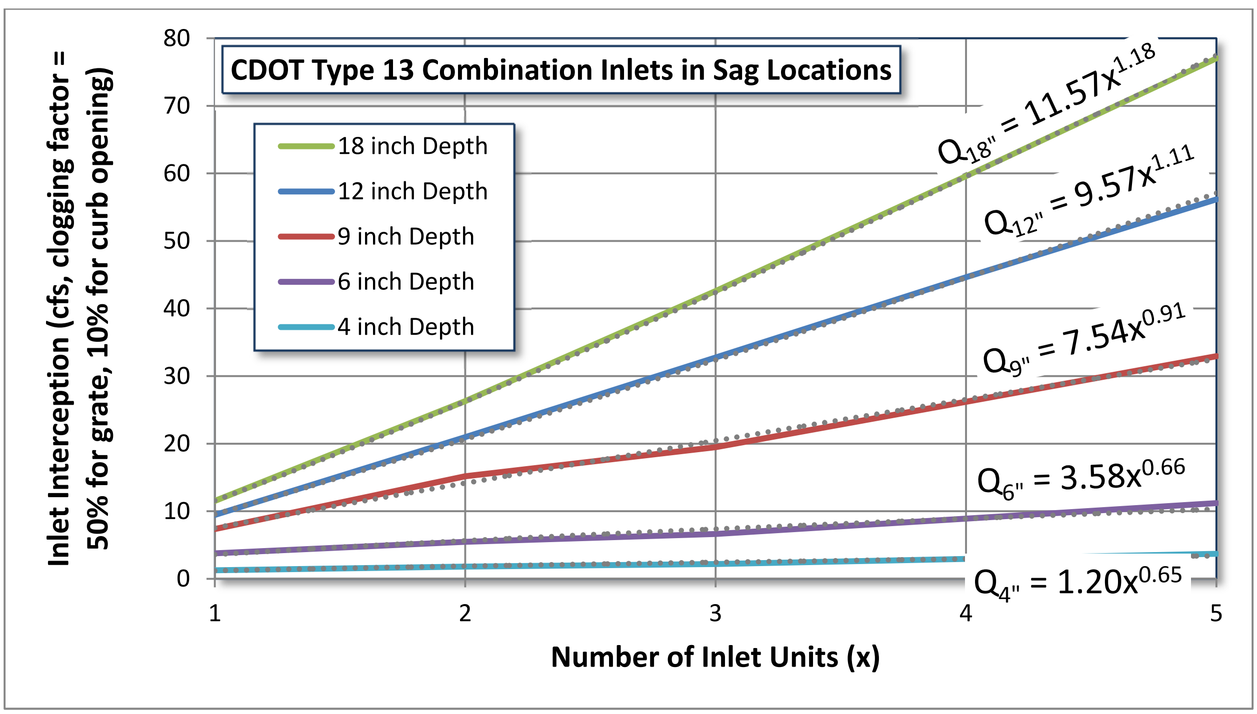

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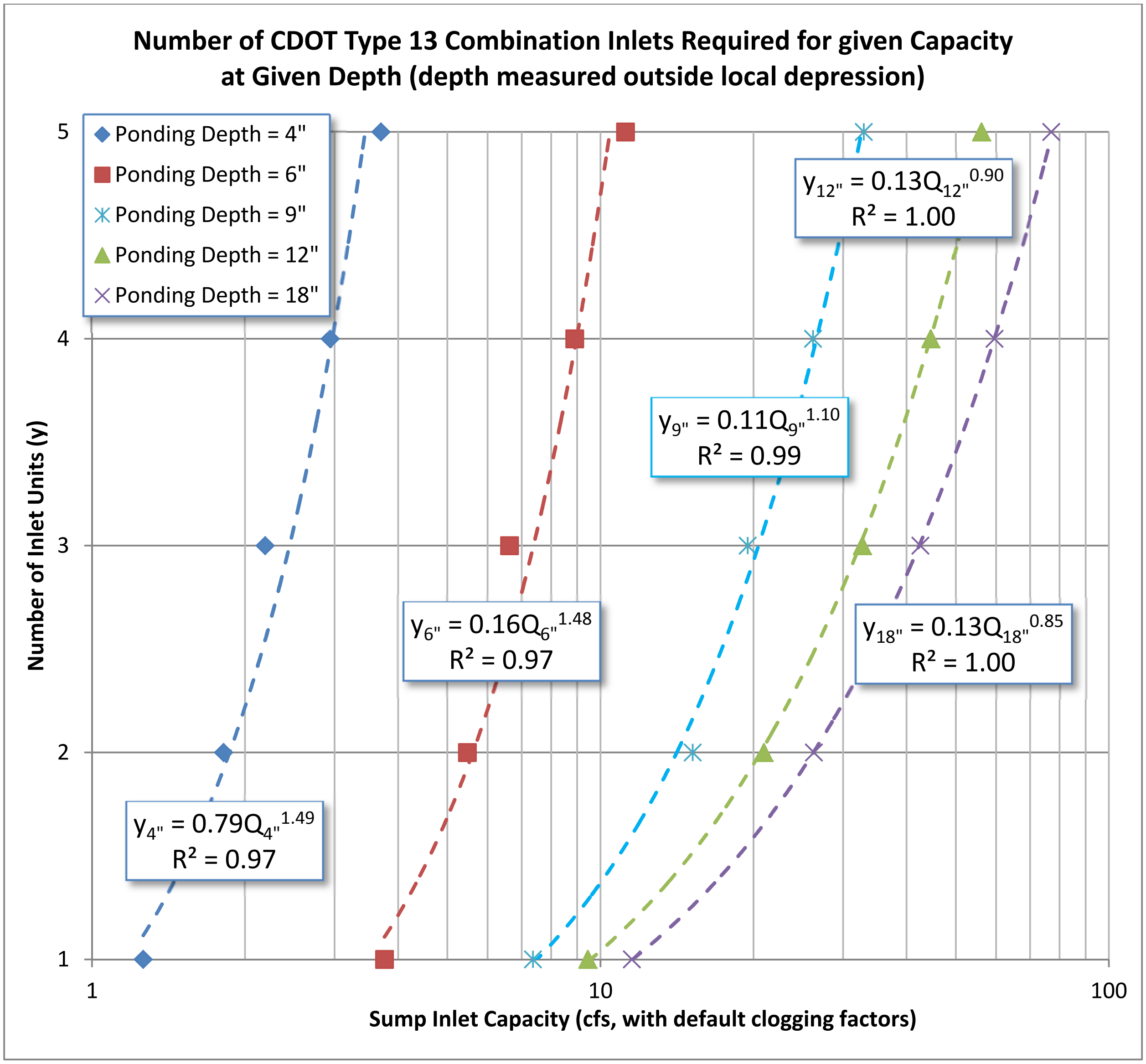

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DENVER 16 COMBINATION INLET IN SUMP

K_{16} = 0.20

	GRATE			CURB OPENING		
Weir Coefficient	C_W =	3.60		C_W =	3.70	
Mixed Flow Coefficient	K =	0.90		K =	0.86	
Orifice Coefficient	C_O =	0.60		C_O =	0.66	
Grate / Curb Opening Length	L=	VARIES	ft	L=	VARIES	ft
Grate Width / Throat height	W =	1.73	ft	h =	0.4375	ft
Weir Length Reduction Factor	N_W =	0.73		N_W =	1	
Orifice Area Reduction Factor	N_A =	0.31		N_A =	1	
Grate / Throat Slope	S_G =	0.1667	ft/ft	Theta =	0	rad, 0 deg
Local Depression at Inlet	A_{LOCAL} =	2	inch	A_{LOCAL} =	2	inch
Gutter Width	w_G =	2	ft	w_G =	2	ft

All equations are based on the depth in the gutter flowline, $\mathbf{D_{FL}}$, away from the local depression

Grate weir and orifice depth is measured at grate mid-width, i.e., $D_{FL} + A_{LOCAL} - S_G*W/2$

Curb opening weir depth D_W is measured at gutter-street interface, i.e., $D_{FL} - W*S_W$

Curb opening orifice depth D_O is measured as $D_{FL} + A_{LOCAL}$

Weir Performance Reduction Factor: =MIN(1,D_{FL}/(0.7*MIN(L,9)+4.3)) where D_{FL} is in inches and L is in feet

Grate Weir Equation: $Q_{W\text{-}GRATE} = C_W*N_W*MIN(1,D_W/(0.7*MIN(L,9)+4.3))*(L+2W)*D_W^{1.5}$

Grate Orifice Equation: $Q_{O\text{-}GRATE} = C_O*N_A*L*W*(64.4*(D_O)^{0.5}$

Grate Mixed Flow Equation: $Q_{M\text{-}GRATE} = K_{GRATE}*(Q_{W\text{-}GRATE}*Q_{O\text{-}GRATE})^{0.5}$

Grate Capacity Equation: $Q_{GRATE} = MIN(Q_{W\text{-}GRATE},Q_{O\text{-}GRATE},Q_{M\text{-}GRATE})$

Curb Weir Equation: $Q_{W\text{-}CURB} = C_W*N_W*MIN(1,D_W/(0.7*MIN(L,9)+4.3))*L*D_W^{1.5}$

Curb Orifice Equation: $Q_{O\text{-}CURB} = C_O*N_A*L*h*(64.4*(D_O-h/2*SIN(Theta)))^{0.5}$

Curb Mixed Flow Equation: $Q_{M\text{-}CURB} = K_{CURB}*(Q_{W\text{-}CURB}*Q_{O\text{-}CURB})^{0.5}$

Curb Capacity Equation: $Q_{CURB} = MIN(Q_{W\text{-}CURB},Q_{O\text{-}CURB},Q_{M\text{-}CURB})$

Denver No. 16 Combination Inlet Capacity Equation: $Q_{16\text{-}COMB} = Q_{GRATE} + Q_{CURB} - K_{16}*(Q_{GRATE} * Q_{CURB})^{0.5}$

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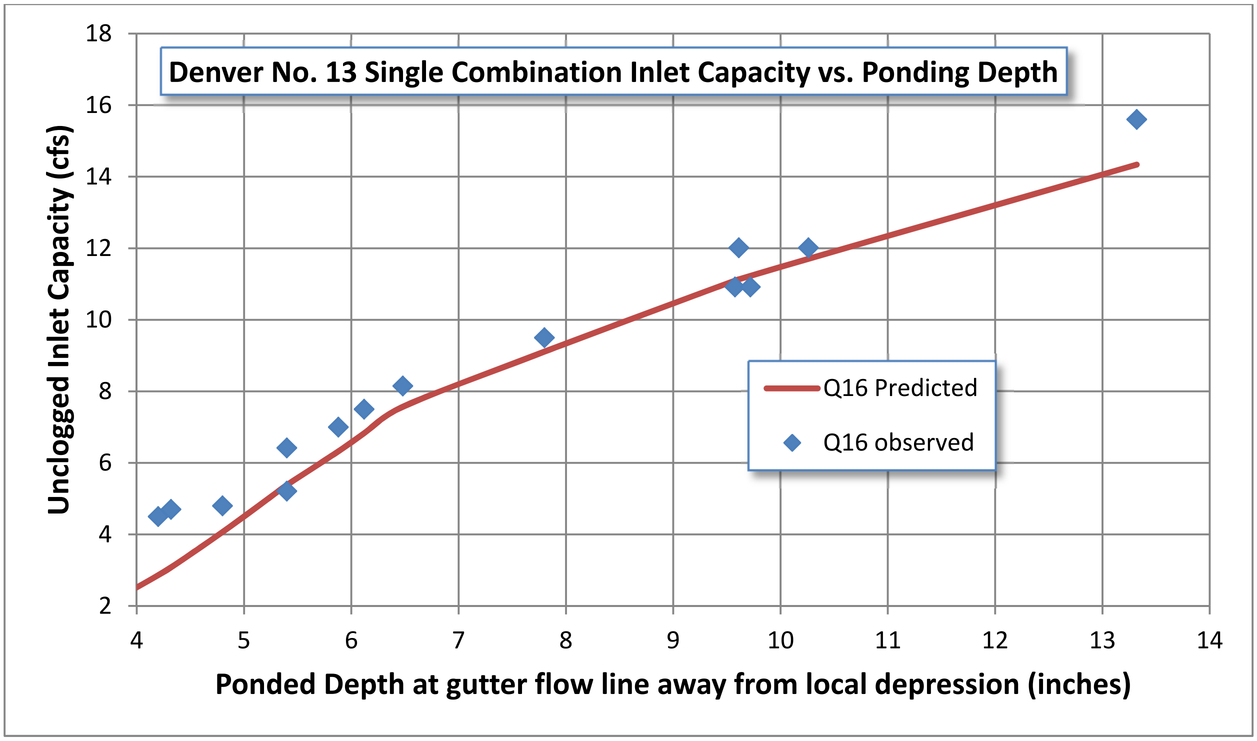

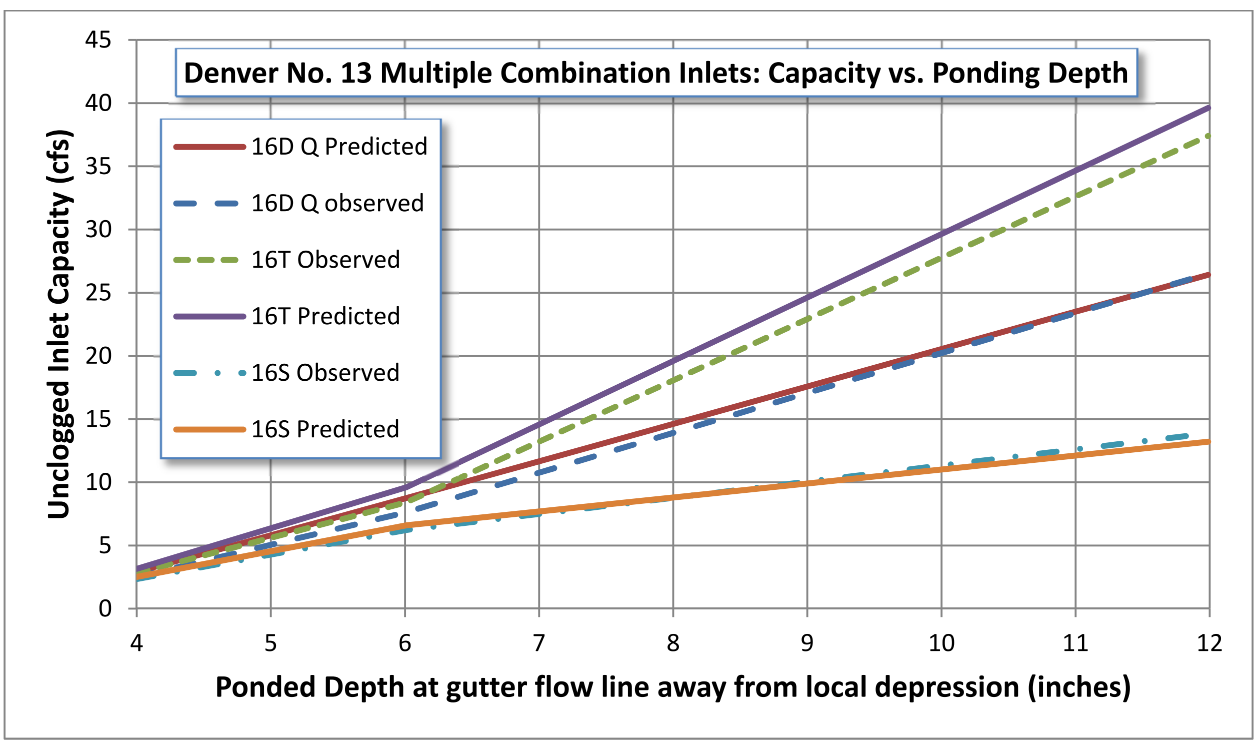

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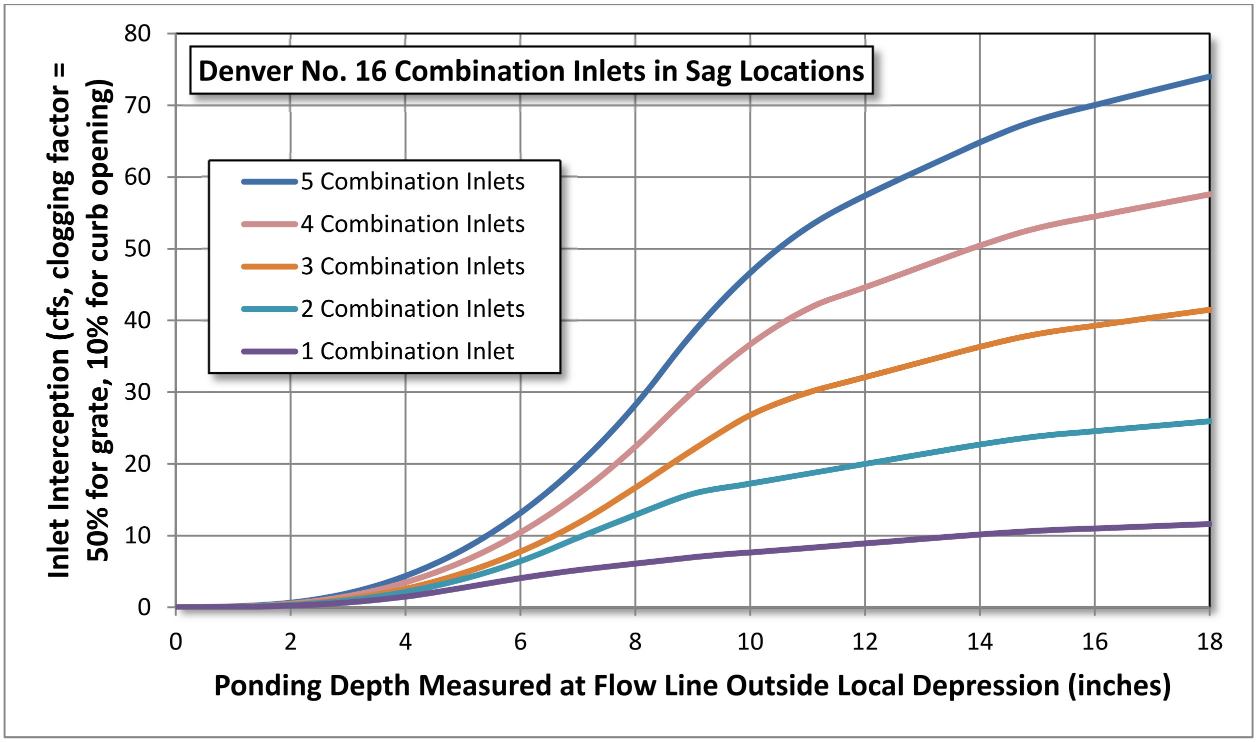

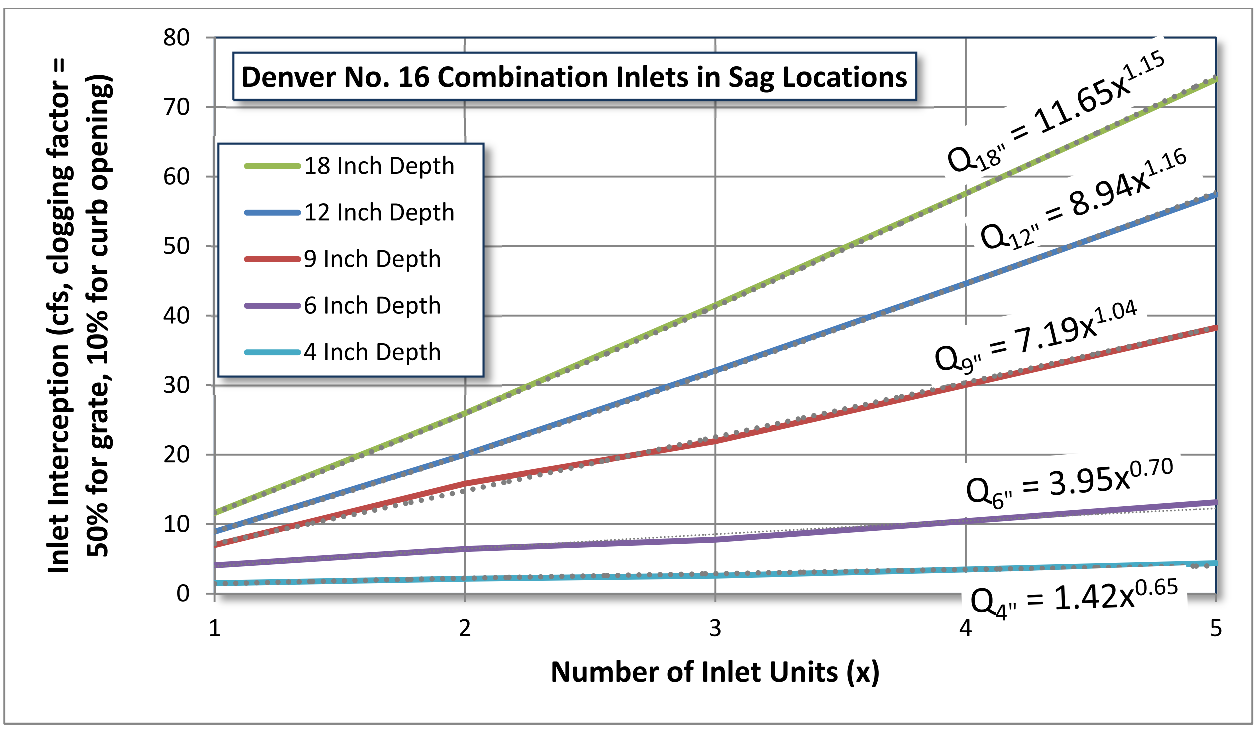

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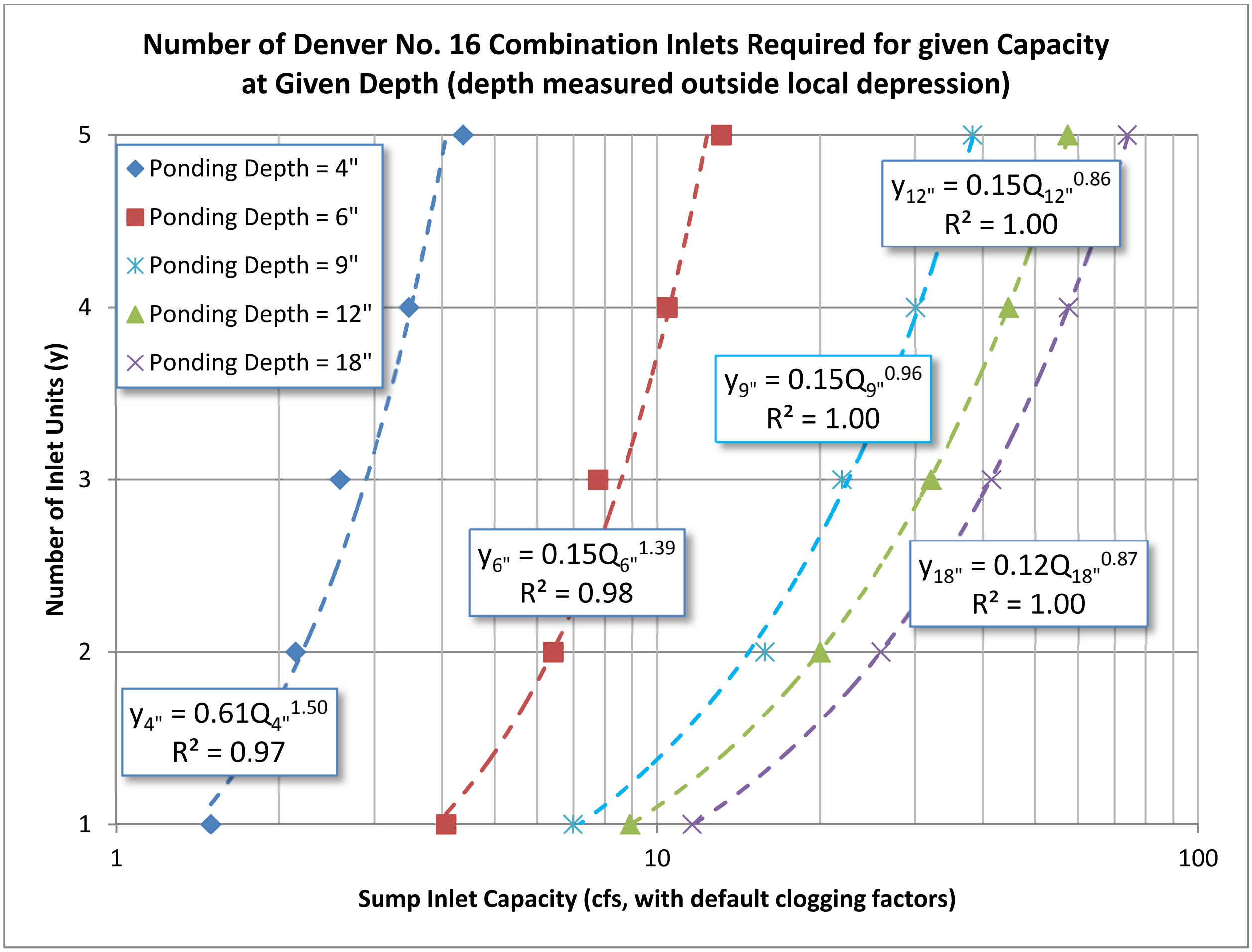

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COLORADO SPRINGS D-10-R CURB OPENING INLET IN SUMP*

Weir Coefficient	C_W =	3.60	
Mixed Flow Coefficient	K =	0.93	
Orifice Coefficient	C_O =	0.67	
Curb Opening Length	L=	VARIES	ft
Throat height	h =	0.667	ft
Weir Length Reduction Factor	N_W =	1.00	
Orifice Area Reduction Factor	N_A =	1.00	
Throat Slope	Theta =	1.4137	rads, 81 degrees
Local Depression at Inlet	A_{LOCAL} =	4	inch
Gutter Width	w_G =	2	ft

All equations are based on the depth in the gutter flowline, $\mathbf{D_{FL}}$, away from the local depression

Curb opening weir depth D_W is measured at gutter-street interface, i.e., D_{FL} - $W*S_W$

Curb opening orifice depth D_O is measured as $D_{FL} + A_{LOCAL}$

Weir Performance Reduction Factor: =MIN(1,D_{FL}/(0.67*D_{FL}+0.24*L)) where D_{FL} is in inches and L is i

Weir Equation: Q_W = C_W*N_W*MIN(1,DFL/(0.67*D_{FL}+0.24*L))*(L+1.8W_G)*$D_W^{1.5}$ where W_G is the gutter

Orifice Equation: $Q_O = C_O*N_A*L*h*(64.4*(D_O-h/2*SIN(Theta)))^{0.5}$

Mixed Flow Equation: $Q_M = K*(Q_W*Q_O)^{0.5}$

*** This inlet was not modeled at CSU, however the weir, orifice, and k coefficients are assumed to be similar to that of the CDOT Type R inlet.**

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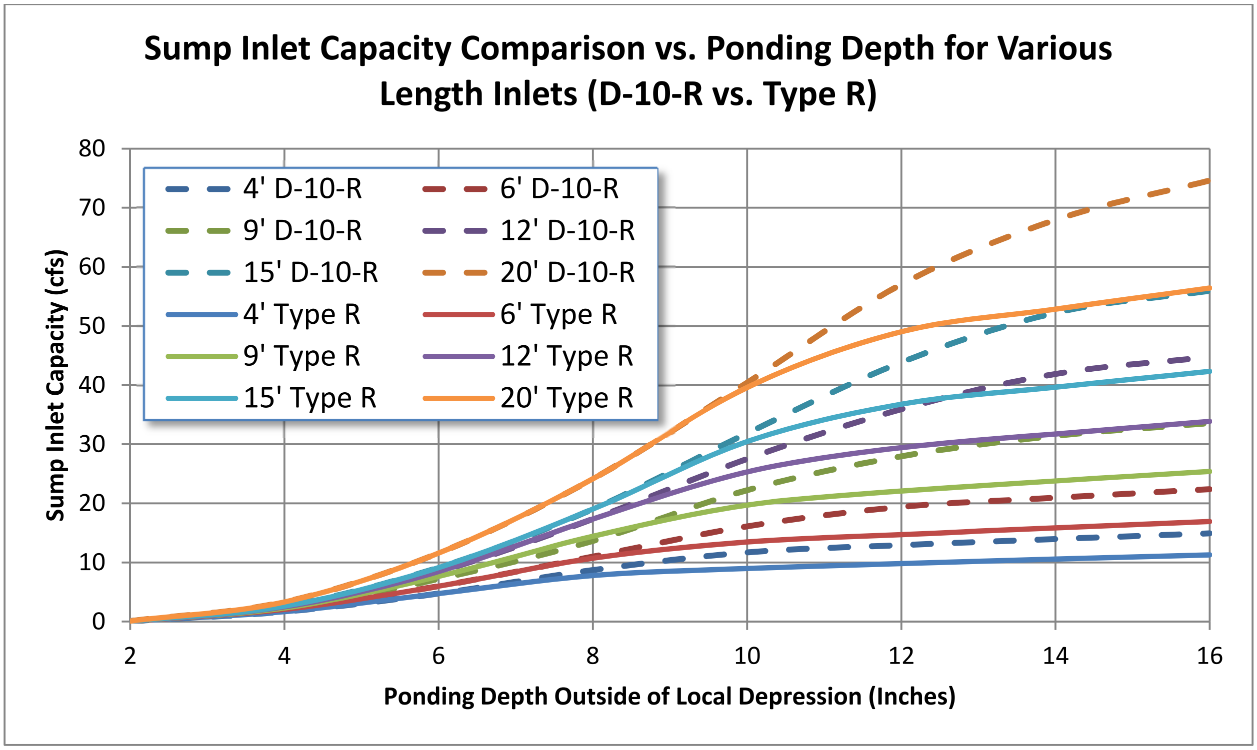

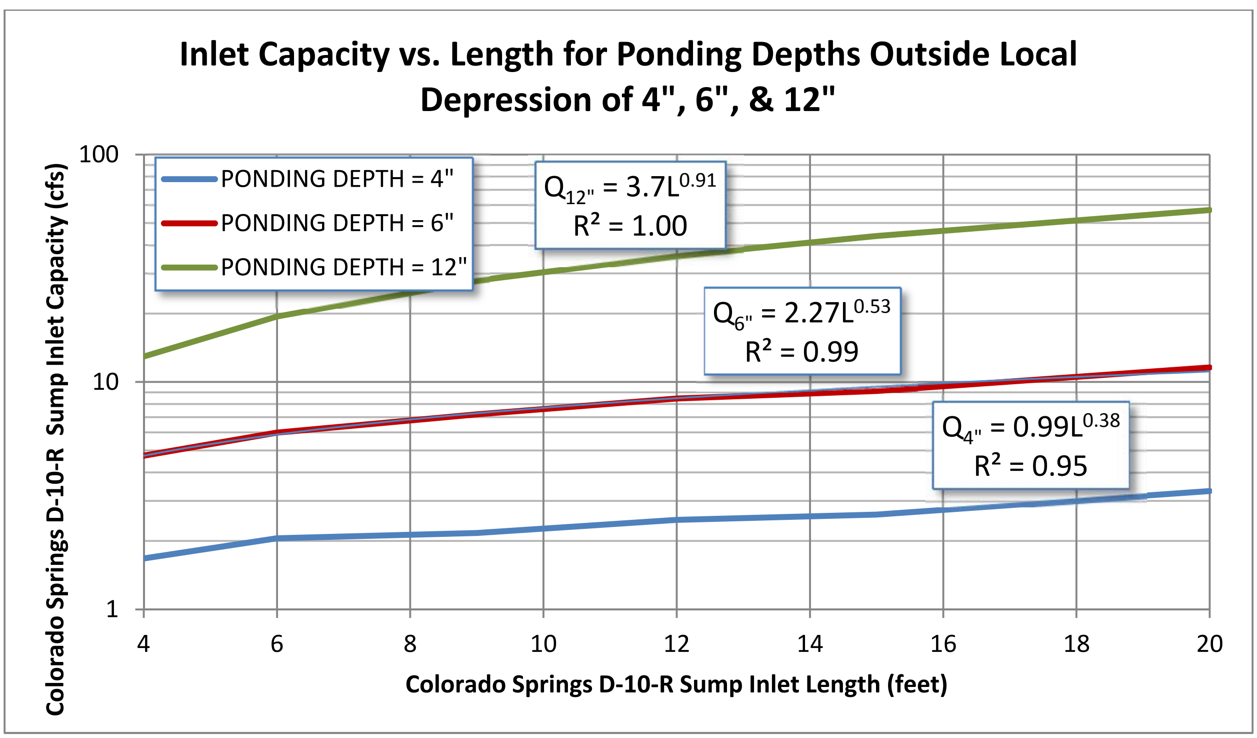

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