Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Engineering
Department of Civil and Environmental Engineering

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Hydraulic Properties of Improved Culvert Inlets

Master's thesis in Hydropower Development
Supervisor: Elena Pummer
Co-supervisor: Joakim Sellevold
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Abstract

Culverts are valuable hydraulic structures necessary to safely route runoff through roadways or natural barriers. They must be correctly designed to avoid upstream flooding, sediment and debris accumulation or structural failure. Early works from John L. French, I.E. Idelchik and the Federel Highway Administration provide a deep insight on culver hydraulics, and their works confirm the complexities of culvert hydraulics on culvert design and optimization. These complexities are due to multiple flow conditions present. Moreover, in this study, a physical culver model was utilized to investigate the hydraulic efficiencies of conventional tapered linear inlets and optimized nonlinear inlets with elliptical arc edges. The experimental efforts included tests under outlet and inlet-controlled conditions, as well as scenarios using blockage elements with 35.7% and 75% blockage ratios. The overall results showed that the optimized inlets performed very well under inlet control conditions, however, further testing is necessary to corroborate the behavior of the optimized inlets under outlet control conditions.

Preface

This thesis is submitted for partial fulfilment of the two-year Master of Science program, Hydropower Development at the Norwegian University of Science and Technology. The author conducted laboratory work between March 2023 and August 2023 in the hydraulic laboratory at the Department of Civil and Environmental Engineering, Trondheim under the guidance of the main supervisor Associate Professor Elena Pummer, and co-supervisor Joakim Sellevold. The project has been funded by the Norwegian Public Roads Administration (Statens Vegvesen).

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Abbreviations

Δl	Edge Length
Δr	Edge Width
A	Culvert Barrel Cross Sectional Area
	Cross Sectional Area of Culvert Barrel Excluding
Ab	Blockage Area.
Aη	Cross Sectional Area of Control Surface
c	Coefficient Constant for Submerged Flow
CD	Inlet Discharge Coefficient
Cη	Control Surface Discharge Coefficient
D	Barrel Diameter
Dη	Control Section Rise/Diameter
EFm	Elastic Force in Model
EFp	Elastic Force in Prototype
Eu	Euler Number
Fr	Froude Number
g	Gravitational Acceleration
GFm	Gravitational Force in Model
GFp	Gravitational Force in Prototype
*H**	Dimensiones Headwater Elevation
He	Head Entrance Loss
Hf	Head Friction Loss
Ho	Head Exit Loss
Hw	Headwater Elevation
H'w	Effective Total Head
IFm	Inertial Force in Model
IFp	Inertial Force in Prototype
K	Coefficient for Unsubmerged Flow
KD	Inlet Pressure Term
Ke	Entrance Loss Coefficient
Keb	Entrance Loss Coefficient under Blockage Effects
Keu	Uncertainty Interval for Head Entrance Loss Coefficient
Kp	Dimensionless Pressure Term
Ks	Dimensionless Roughness
Ku	Unit Conversion Factor (1.811)
L	Length of the Culvert Barrel

Lm	Model Length
Lp	Prototype Length
M	Coefficient Constant for Unsubmerged Flow
M	Mach Number
n	Manning Roughness Coefficient
PFm	Pressure Force in Model
PFp	Pressure Force in Prototype
*Q**	Dimensionles Discharge
Qb	Discharge for Inlets with Blockage Elements
R	Hydraulic Radius
Re	Reynolds Number
S	Slope
STFm	Surface Tension Force in Model
STFp	Surface Tension Force in Prototype
u	Uncertainty Interval for a Parameter
V	Flow Velocity
Vd	Channel Velocity Downstream of the Culvert
VFm	Viscous Force in Model
VFp	Viscous Force in Prototype
Vo	Flow Velocity of Downstream Culvert Flowing Full
W	Weber Number
y	Hydraulic Depth
Y	Coefficient Constant for Submerged Flow
α	Circle Segment Central Angle
λ	Scale Factor
μ	Dynamic Viscosity
v	Kinematic Viscosity
ρ	Water Density
PS	Pressure Sensor

Acknowledgements

I would like to thank my main supervisor, Associate Professor Elena for her advice and diligence to check on my work progress. I also want to thank my co-supervisor Joakim Sellevold for entrusting me to work on his project. Not only was he extremely passionate about the research but always took the time to share his knowledge, check on my progression and make sure I understood the theoretical and practical complexities of my research topic. I am grateful for his mentorship and support.

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Furthermore, I also want to thank my classmates for the friendships, good times and memories made during the last two years. I want to thank my friend Nisal Senarathna, Lizi Kvirikashvili and Carolina Gomez for their assistance and cheerleading throughout the construction and testing phase of this research. Thanks to Sharon Lorio and Alejandra Martinez for the late-night talks that gave me energy to push through the long hours during experiments. Moreover, this study will also not be possible without the technical support from lab personal such as Mr. Eirik Nygård, who was always very kind and willing to help me complete the construction phase of the project, Mr. Geir Tesaker and Mr. Thai Mai.

Finally, I dedicate this master thesis to my late grandpa and grandma Francisco Arriola and Esperanza Guerrero, cousin Katherine Guevara, and Aunt Mayra Guerrero, they always believed in me and are deeply missed.

1 Introduction

Culverts are important hydraulic structures that safely route the excess runoff out of small catchments and convey it through natural barriers, road and roadway embankments (Schall et al., 2012). In Norway, there are 569,705 culverts where 15,578 culverts are owned by Bane NOR and 554,127 belong to the Norwegian Public Roads Administration (Statens Vegvesen) (Gianni et al., n.d.). Given their active and crucial presence in runoff routing in Norway, culverts must be designed to function efficiently to avoid failures such as upstream flooding, sediment built-up, erosion and unsafe passage of aquatic species (Schall et al., 2012).

The efficiency of a culvert is essential, and it's based on its ability to convey runoff at higher heads, thereby reducing local flooding or stream diversion during intense storm events. Figure 1-1 and Figure 1-2, show the most common culvert barrels used as well as their inlet types.

To investigate the possibility of optimizing culvert inlets and increase their hydraulic efficiencies, it's a valuable step towards road flood safety and other applications that can benefit from hydraulically efficient inlets.

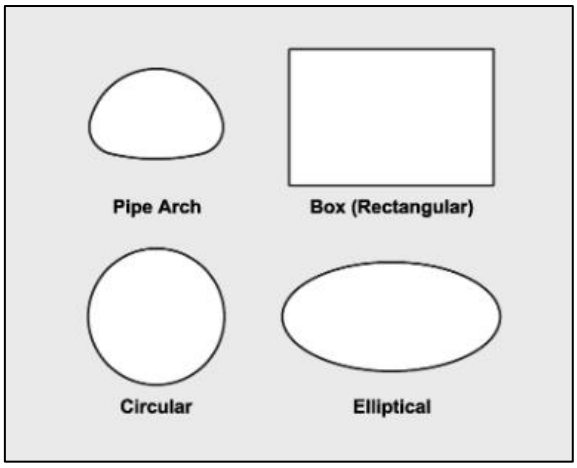

Figure 1-1: Most Common Culvert Barrel Shapes (Schall et al., 2012).

Figure 1-2: Standard Inlet Types (Schall et al., 2012).

In a culvert structure, different flow conditions, flow regimes and flow control types can occur. Normally, when water flows across the entire inner crossection area of a culvert barrel, full flow or pressure flow takes place. However, if there is free surface flow through the culvert barrel length, partial full flow is present (Schall et al., 2012).

The flow regimes are defined as subcritical, critical, and supercritical flow. The Froude number *(Fr)* (*Equation 1*). The Froude number is a dimensionless number, that can be utilized to determine the prevalent flow regime. Subcritical flow is characterized by having deep water column, slow velocity flow and a *(Fr)* value less than one. Critical flow is a point of transition between supercritical and subcritical flow, and it has a *(Fr)* value equal to one (Schall et al., 2012). Supercritical flow happens when there is a shallow water column, fast velocity flow, and its Fr value is bigger than one. Consequently, due to the presence of these flow regimes and outside factors, the inlet and outlet components of a culvert can suddenly become submerged or unsubmerged (Schall et al., 2012).

$$Fr = \frac{V}{\sqrt{gy}}$$

Equation 1: Froude Number Equation

The variable occurrence of these flow types and regimes can generate different flow control classifications, called inlet and outlet control. When the flow upstream of the culvert inlet is subcritical and transitions to supercritical flow, the system is under inlet control. However, when most of the culvert barrel length has full or partially full flow and a subcritical regime, the system is under outlet control. Due to these multiple flow conditions, the hydraulic design procedure for culvert is very complex.

The former Bureau of Public Roads now identified as the Federal Highway Administration, in the United States, has made several research efforts, since the 1950s, to generate culvert design methodologies able to secure a conservative minimum hydraulic performance and ensure adequate runoff conveyance (Schall et al., 2012). In addition, the Norwegian Public Roads Administration has also implemented efforts to improve its infrastructure through research. A PhD project currently being led by (Sellevold, Bruland, et al., 2023) and founded by the Norwegian Public Roads Administration, generated optimized nonlinear tapered inlets with elliptical arc edges to achieve higher hydraulic efficiencies under outlet and inlet control conditions.

Therefore, for this master thesis, a physical model and experiments were planned to take place at the hydraulic laboratory at NTNU. Conventional tapered linear inlets from (French, 1961) and optimized tapered nonlinear inlets from (Sellevold, Bruland, et al., 2023) shall be tested. The experiments will aim to determine the inlets hydraulic efficiencies and hydraulic behavior under blockage effects.

1.1 Objectives

The objective of this master thesis encompasses three steps. Perform a literature review to identify the methods to develop culvert structures and understand the factors affecting culverts efficiency and hydraulic performance from the earlier works of John L. in (French, 1961), FHWA in (Schall et al., 2012), (Tullis et al., 2008), (Idelchik et al., 2007), among other relevant sources on culvert hydraulics. Secondly, carry out physical experiments on conventional linear and optimized non-linear culverts with 10^{o}, 20^{o}, and 33.7^{o} taper angles. Finally, generate a comprehensive analysis of the data collected from outlet and inlet control experiments including blockage effects.

1.2 Summary of Thesis Outline.

This section provides a brief description of the thesis report structure. Chapter two consists of an overview of culvert hydraulics and the methodology used for evaluating the hydraulic performance of culverts, scale effects, blockage effects and uncertainty analysis. Chapter 3 presents the dimensions and geometry of the inlets to be experimentally tested.

Chapter 4 will describe the process employed to assemble and calibrate the model setup, as well as the process to carry out testing and data collection. Chapter 5 ad 6 shall present and discuss the results obtained from all the experiments performed, and finally Chapter 7 will provide key conclusions and recommendations derived from this study. Additional information regarding sources cited and extended calculations shall be included in Chapter 8: References, and Appendices sections.

2 Culvert Hydraulics Theory

In culvert hydraulics, there are several culvert design methodologies that have been developed in different parts of world. Some of these methodologies developed by Bodhaine (1968), Shall et all (2012) and Chin (2013) overlap to a large degree and differ based on their territory conditions and needs. As a result, this study will focus on two main methodologies, the FHWA Culvert Design Methodology (Schall et al., 2012) and the John L. French Culvert Design Methodology (French, 1961).

A schematic of a typical culvert design and its general components are shown in Figure 2-1.

2.1 Culvert Elements

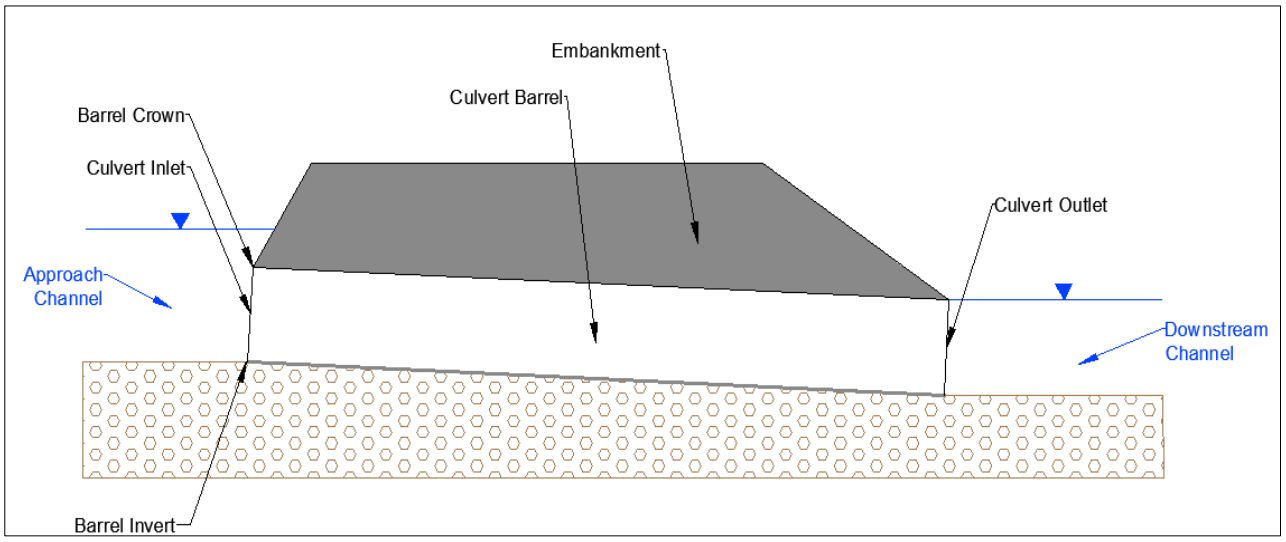

Figure 2-1: Typical Culvert Crossection

1. Culvert Inlet: Component responsible for the intake of flow from the approach channel.

2. Culvert Barrel: Component responsible for conveying water under a road or embankment. This study will focus on circular shaped culvert barrels.
3. Barrel Crown: Component representing the top or roof of the barrel.
4. Barrel Invert: Component representing the bottom of the barrel.
5. Embankment: Volume of earthen material placed and compacted for the purpose of raising the grade of a roadway (FHWA-RD-97-148, 2008).
6. Culvert Outlet: Component responsible for discharging water out of the culvert barrel.
7. Approach Channel: Artificial or natural incoming water channel upstream of the culvert inlet.

2.2 Culvert Design Methodology by FHWA

The FHWA design framework for hydraulic culvert design was first published in the 1960s and has been revised multiple times since. The present framework is given in Hydraulic Design of Highway Culverts (Schall et al. 2012)

The FHWA culvert design methodology uses a minimum performance approach where the usage of performance curves and nomographs are essential. However, culvert design software based on FHWA framework, HY-8, is also used, more effective and a modern alternative (Schall et al., 2012). Additionally, this methodology can be applied for a variety of culvert sizes, materials, and it can be utilized to achieve a culvert design adapted to unforeseen terrain conditions and specific project goals. Furthermore, the methodology also provides guidelines on providing safe passage for aquatic organisms, erosion and sedimentation prevention, and structural integrity of the hydraulic structure (Schall et al., 2012), however these guidelines shall not be considered in this research.

The FHWA methodology specifies the flow control types and submergence states that can occur in a culvert based on the culvert design and design discharge. At times, the prevailing flow can occur due to changes in the inlet geometry, control section, barrel slope, invert roughness or even potential blockages in the downstream channel (Schall et al., 2012).

2.2.1 Inlet Control

Under inlet control, the control section lies at the inlet or close to it. Low velocity and subcritical flow are present at the approach channel followed by a flow transition, where flow contraction occurs, at the control section. Downstream of the control section, the flow velocity increases and transitions to supercritical flow. If the inlet is not fully submerged, the culvert inlet behaves as a weir. However, if the inlet is fully submerged, it will act as an orifice (Schall et al., 2012). Figure 2-2 shows the different flow types based on the USGS classification, under inlet control. There are five different flow type configurations, where flow type 1 and 5 were represented during experiments (Schall et al., 2012).

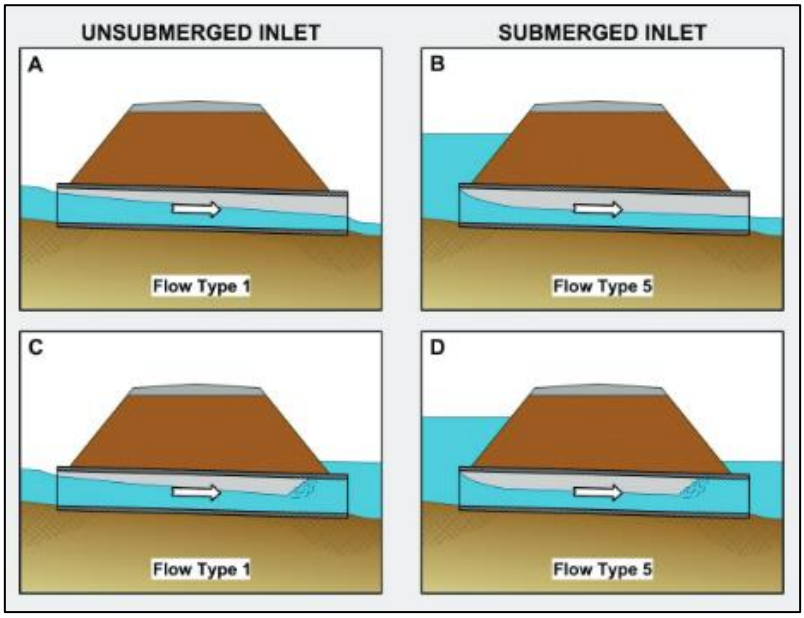

Figure 2-2: Flow types under inlet control (Schall et al., 2012).

Hydraulic design of culverts under inlet control is typically done using a dimensionless performance curve, it is a tool generated from test results, where the relationships between dimensionless discharge *(Q*)* and dimensionless headwater elevation *(H*)* are graphed. These curves help assess the culvert performance which can be affected by these components:

1. Headwater
2. Inlet area and shape
3. Inlet configuration
4. Barrel slope

The performance curves can be approximated using the following semi-dimensionless equations (*Equation 2*) and (*Equation 3*), for unsubmerged and submerged flow conditions, where K, M, c and Y are regression constants (Tullis et al., 2008).

(H)* and *(Q*)* are used to represent, in performance curves, the capacity of a culvert based on culvert geometry and flow conditions (Schall et al., 2012). This The H*-Q* relationship can be furthered determined using 5th degree polynomials (*Equation 4*) for both submerged and unsubmerged flow conditions (Schall et al., 2012). As a result, a high hydraulic efficiency under inlet control is defined by a low ratio of *(H*)* to dimensionless *(Q*)*.

$$\frac{H_w}{D} = K * \left[\frac{K_u Q}{AD^{0.5}}\right]^M$$

Equation 2: Unsubmerged Inlet Control

$$\frac{H_w}{D} = c\left[\frac{K_u Q}{AD^{0.5}}\right]^2 + Y + K_s S$$

Equation 3: Submerged Inlet Control

$$\frac{H_w^{'}}{D} = C_0 + C_1\left[\frac{K_u Q}{AD^{0,5}}\right] + C_2\left[\frac{K_u Q}{AD^{0,5}}\right]^2 + C_3\left[\frac{K_u Q}{AD^{0,5}}\right]^3 + C_4\left[\frac{K_u Q}{AD^{0,5}}\right]^4 + C_5\left[\frac{K_u Q}{AD^{0,5}}\right]^5$$

Equation 4: 5th Degree Polynomial Equation for Unsubmerged and Submerged Flow.

2.2.2 Outlet Control

Under outlet control, the control section lies at or downstream of the barrel outlet. Low velocity and subcritical flow are present through most of the barrel length. The flow right before the control section in the barrel depends on the submergence of the outlet. Different flow types under outlet control can occur based on the inlet geometry, barrel features and tailwater elevation.

Different combinations of headwater and tailwater elevation can generate submerged and unsubmerged conditions at the culvert inlet and outlet. Figure 2-3 shows the different flow types, specified by USGS, under outlet control (Schall et al., 2012). Flow types 4, 6 and 7 were represented in the experimental portion of this research.

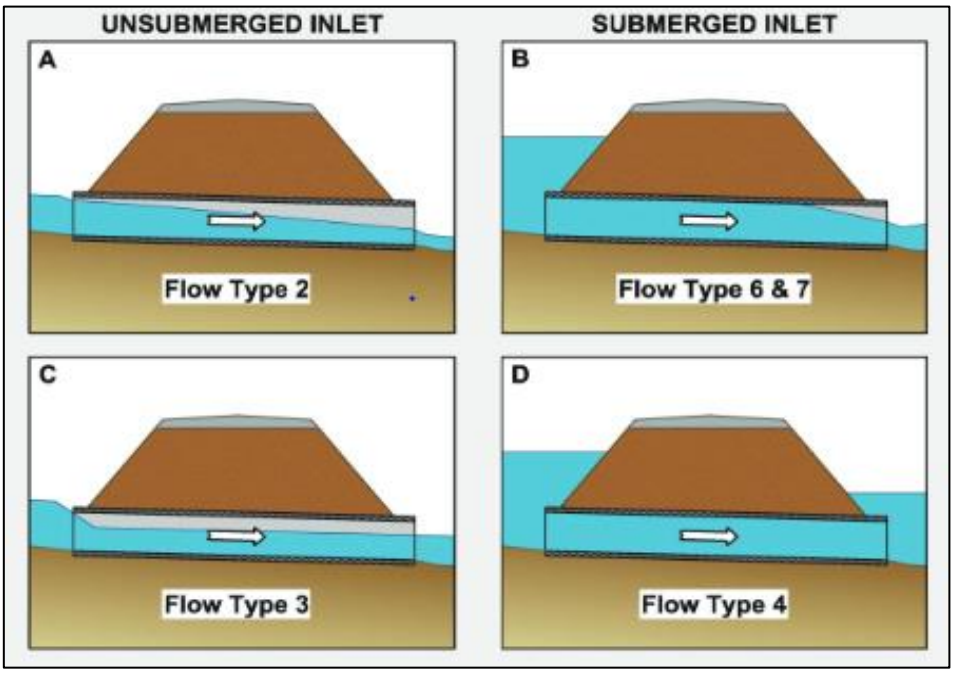

Figure 2-3: Flow types under outlet control (Schall et al., 2012).

the culvert performance under outlet control is affected by the following components:

1. Barrel roughness, area, shape, length, and slope
2. Tailwater elevation

To calculate the headwater elevation upstream of the control section and create performance curves for outlet control, there is one equation based on full barrel flow conditions. The culvert hydraulic efficiency of the inlet is inversely proportional to the *(Ke)* entrance loss coefficient, where a low efficiency is equivalent to high *(Ke)* values (Schall et al., 2012) . There are other factors influencing energy losses such as (*He)* as the entrance loss, *(Hf)* as the friction loss through the barrel, and Ho as the exit loss (*Equation 5*), each case must be considered separately.

$$H_w = H_e + H_f + H_o$$

$$H_w = K_e * \left(\frac{V^2}{2g}\right) + \left[\frac{19.63 * n^2 * L}{R^{1.33}}\right] * \left(\frac{V^2}{2g}\right) + \left(\frac{V^2}{2g} - \frac{V_d^2}{2g}\right)$$

Equation 5: Total energy loss in outlet control.

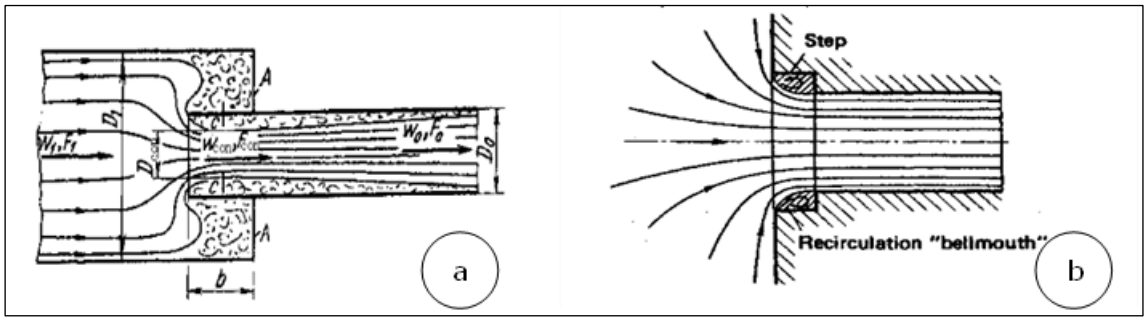

Figure 2-4: a) Sudden Flow Contraction, b) Smooth Flow Transition (Idelchik et al., 2007).

The hydraulic efficiency based on *(Ke)* values is also dependent of other factors. In turbulent flow conditions where the Reynolds number is large, a low friction factor and negligible viscous forces occur, and *(Ke)* value is greatly affected by flow area contractions when the flow transitions from the approach channel into the culvert structure (Idelchik et al., 2007).

Furthermore, culvert inlet structures with suitable edge geometry and installation help reduce flow separation, see Figure 2-4, which directly lowers *(Ke)* values (Idelchik et al., 2007). This flow separation enhances flow contractions and high *(Ke)* values, this is caused by the formation of Eddy currents at the inlet (Smith & Oak, 1995).

For submerged inlets, it was noted that *(Ke)* varies at low headwater levels when *(H*)* is less than 1.5 However, *(Ke)* remains constant at *(H*)* values higher or equal to 1.5 (Tullis et al., 2008). Nevertheless, this assumption overestimates energy losses for unsubmerged inlets under outlet control condition (Sellevold, Bruland, et al., 2023).

2.3 Culvert Design Methodology by French

John. L French produced earlier works on culvert hydraulics for the Bureau of Public Roads U.S. Department of commerce from 1955 to 1961. His investigations encompassed the hydraulic improvements and evaluation of a large set of culvert inlets under inlet control conditions. Throughout his experimental and analytical process, the following equations (*Equation 6)* and (*Equation 7*) for unsubmerged and submerged flows under inlet control conditions were generated.

$$\frac{Hw'}{D} = \frac{k(C_\eta)^{0.5}}{2}\left(\frac{1}{k(C_\eta)^{2.5}\left(\frac{A_\eta}{A}\right)^2\left(\frac{D_\eta}{D}\right)}\right)^{0.304}\left(\frac{K_u Q}{AD^{0.5}}\right)^{0.607}$$

Equation 6: Unsubmerged Flow

$$\frac{Hw'}{D} = \frac{k(C_\eta)^{0.5}}{2}\left(\frac{1}{k(C_\eta)^{2.5}\left(\frac{A_\eta}{A}\right)^2\left(\frac{D_\eta}{D}\right)}\right)^{0.304}\left(\frac{K_u Q}{AD^{0.5}}\right)^{0.607}$$

Equation 7: Submerged Flow.

$$C_D = \min\left(C_\eta \frac{A_\eta}{A}\right)$$

Equation 8: Discharge Coefficient for Entire Inlet Structure.

(Equation 6) was not stated in French's progress reports, however (Sellevold, Bruland, et al., 2023) generated this algorithm by using regression on the data found by French. It was assumed that the inlets had a constant taper angle, negligible shape effects, a 3%-barrel slope in all experiment calculations for inlet control, and a dimensionless pressure term *(Kp)* equivalent to 0.92, see Figure 2-5 from French's fourth progress report. Additionally, the discharge coefficient of the entire inlet structure and geometry is calculated using *(Equation 8)* (Sellevold, Bruland, et al., 2023), and it is assumed to be constant for all the sections within the inlet structure.

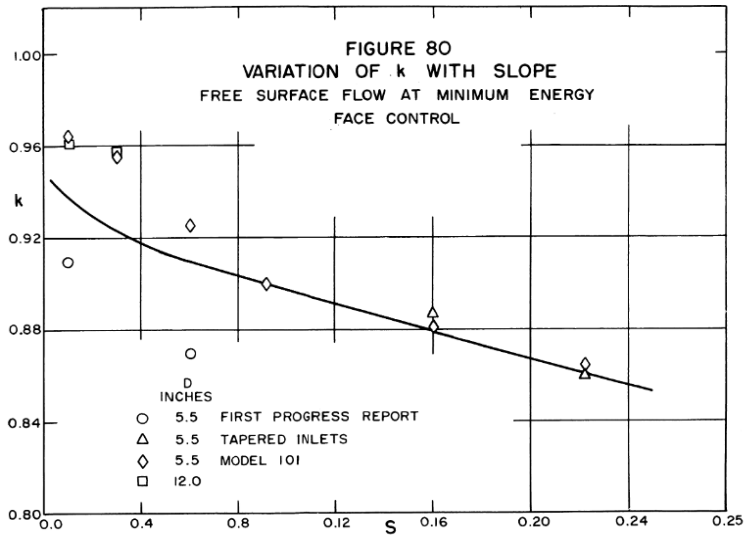

Figure 2-5: Variation of Kp, Dimensionless Pressure Term, with Slope (French, 1961).

Furthermore, French tested the performance for tapered inlets, beveled edges, and rounded edges where he found discharge coefficients and control sections at the inlet face, inlet throat, and curvatures of the rounded edges. For the control section at the face, the inlet performance is influenced by the face area, face section shape, flare angle and edge geometry. However, when the control section is at the inlet throat, the inlet performance is affected by the throat geometry and flare angle (French, 1961).

Based on (French, 1961) it was found that best inlet performance, for tapered inlets, occurs when the control section is at inlet throat and low flow separation effects occurs, leading to a lower H*/Q*-relationship.

2.4 Blockage Effects

Blockages can cause significant problems when present at culvert structures (Sellevold, Norem, et al., 2023). Blockages can severely increase water levels able to inundate neighboring properties, overtop roads or railways, damage infrastructure and increase repair and maintenance costs (Weeks et al., 2009).

Under outlet control, it is necessary to determine the entry energy losses (*Equation 9*) and energy loss coefficients. These culverts energy loss values will be further influenced by obstruction or blockages.

$$\Delta H_e = K_e \left(\frac{V_o^2}{2g} \right)$$

Equation 9: Energy loss at entrance of culvert (Weeks et al., 2009).

When analyzing blockage effects under outlet control conditions, full flow inside the culvert barrel is assumed, and the energy loss coefficient under conditions of partial blockage is calculated *(Keb)*. The regular entrances loss coefficient for a culvert without blockages *(Ke)* is divided by a blockage area ratio. This ratio is calculated by subtracting the ratio of free cross-sectional area at the inlet entrance divided by the full culvert barrel cross sectional minus one (*Equation 10*) (Weeks et al., 2009).

$$k_{eb} = \left[\left(\frac{1 + k_e^{1/2}}{1 - \frac{A_b}{A}} \right) - 1 \right]^2$$

Equation 10: Blockage Effects Under Outlet Control (Weeks et al., 2009).

When analyzing blockage effects in culverts under inlet control condition, discharge reduction factors are introduced. This factor is represented by the ratio of discharge with blockage divided by the discharge without blockage. In addition, the dishcarge reduction factor equals to blockage area ratio raised to the power of 5/4 (Weeks et al., 2009). *(Qb/Q)* is equal to (*Qb/AD^0.5)/(Q/AD^0.5)* for the same value of A and D, see *(Equation 11).*

$$\frac{Q_b}{Q} = (1 - A_b/A)^{5/4} \quad \leftrightarrow \quad \frac{Q_b}{AD^{0.5}} = (1 - A_b/A)^{5/4} \frac{Q}{AD^{0.5}}$$

Equation 11: Blockage Effects Under Inlet Control (Weeks et al., 2009).

2.5 Scale Effects in Hydraulic Experiments

To physically represent and prototype hydraulic systems, such as culverts, researchers aim to re-create these systems in physical scale models. Consequently, a scale factor *(λ) (Equation 12)* must be determined for the model-prototype system. It is the ratio of a specific length in the prototype *(Lp)* divided by its representative length in the model *(Lm)* (Heller, 2011).

$$\lambda = \frac{L_P}{L_m}$$

Equation 12: Scale Factor

To successfully build models that behave and function as their prototypes, the model to prototype relationship must fulfill the mechanical similarity criteria. However, if force ratios are not identical this requirement will not be satisfied. As a result, model scale effects shall occur (Heller, 2011). Scale effects can negatively alter the results generated by a model, causing a mismatch between the model and prototype behaviors. And the higher the scale factor the higher the scale effects. Thus, to avoid scale effects in a model, a model-prototype system needs to achieve mechanical similarity.

Within mechanical similarity the geometrical, kinematic, and dynamic similarities must be satisfied. In geometrical similarity, the model and prototype must have the same shape even if the model size changes by its scale factor. Kinematic similarity requires geometrical similarity and that the rates of motion such as velocity, acceleration and discharge are constant in the model-prototype system. Moreover, in dynamic similarity the geometric and kinematic similarities must occur and all force ratios in Table 2-1 must be the same in the model-prototype system (Heller, 2011).

Table 2-1: Forces and Force Ratios in a Model-Prototype System.

Forces	***Force Ratios***
$Inertial\ Force\ (IF) = mass * acceleration$ $\boldsymbol{\rho L^2 V^2}$	$\frac{IF_P}{IF_m}$
$Gravitational\ \ Force\ (GF) = mass * gravitational\ acceleration$ $\boldsymbol{\rho L^3 g}$	$\frac{GF_P}{GF_m}$
$Viscous\ Force\ (VF) = Dinamic\ viscosity * \left(\frac{Velocity}{Distance}\right) * area$ $\boldsymbol{\mu VL}$	$\frac{VF_P}{VF_m}$
$Surface\ Tension\ Force = Unit\ surface\ tension * length$ $\boldsymbol{\sigma L}$	$\frac{STF_P}{STF_m}$
$Elastic\ Force = Young's\ modulus * area$ $\boldsymbol{EL^2}$	$\frac{EF_P}{EF_m}$
$Pressure\ Force = Unit\ pressure\ x\ area$ $\boldsymbol{pL^2}$	$\frac{PF_P}{PF_m}$

If the same fluid is present in the prototype and model, only one of the force ratio combinations or dimensionless numbers shown in Table 2-2 will be identical in the model-prototype system (Heller, 2011). Based on the governing force in a physical model, there shall be a correlating dimensionless number that will remain equal between the model and prototype. All remaining non-identical dimensionless numbers shall generate significant or negligible scale effects, to obtain results suitable for design at prototype scale.

Table 2-2: *Dimensionless Numbers and Equations.*

Dimensionless Number	***Expression***	***Governing Force***	***Equations***
Froude (F)	$\left(\frac{Inertial\ Force}{Gravity\ Force}\right) = \left(\frac{V}{(gL)^{\frac{1}{2}}}\right)$	Gravitational Force	*Equation 13*
Reynolds (Re)	$\left(\frac{Inertial\ Force}{Viscous\ Force}\right) = \left(\frac{LV}{v}\right)$	Viscous Force	*Equation 14*
Weber (W)	$\left(\frac{Inertial\ Force}{Surface\ Tension\ Force}\right) = \left(\frac{\rho V^2 L}{\sigma}\right)$	Surface Tension Force	*Equation 15*
Mach (M)	$\left(\frac{Inertial\ Force}{Elastic\ Force}\right) = \left(\frac{\rho V^2}{E}\right)$	Elastic Force	*Equation 16*
Euler (Eu)	$\left(\frac{Inertial\ Force}{Pressure\ Force}\right) = \left(\frac{\rho V^2}{p}\right)$	Pressure Force	*Equation 17*

The Froude similarity is applicable in models where gravitational forces govern (Equation 13), for example when the motion of fluid is driven by gravity. It is applicable at free surface flow or open water-channel hydraulic models where scale effects are negligible (Hager, 2010).

To determine the values for each dimensionless number and quantify scale effects in a model-prototype system, there are different methods that can be followed such as inspectional analysis, dimensional analysis, calibration, and scale series (Heller, 2011).

Froude similarity was used for experiments under inlet control conditions as previously performed by similar research done by (French, 1961), (Schall et al., 2012) and (Tullis et

al., 2008). No scaling was used for outlet control, and according to (Tullis et al., 2008) scale effects are negligible when using a barrel diameter higher than 300 mm. The barrels outside diameter used in the model setup for this research was 315 mm.

For inlet control experiments, a vented inlet was installed right downstream of the throat to reduce sub atmospheric pressures in the culvert system and allow to consider pressure effects negligible (French, 1961).

2.6 Uncertainty Analysis

An important part in physical modeling when it comes to data collection and result presentation, is their evaluation through an uncertainty analysis. The uncertainty can be defined as "a potential value an error might have" and an error is "the difference between the true and measured values" (Kline & McClintock, 1953).

Errors can be introduced through the assumptions and steps taken when performing physical hydraulic modeling. Thus, an uncertainty analysis is essential to quantify those errors. Consequently, the analysis shall help the researcher evaluate the quality and reliability of the results (Moffat, 1988).

To calculate the uncertainty of the variables the experimental procedure must be classified as single sample experiments when "uncertainty is not found by repetition" or multi sample experiments (Kline & McClintock, 1953). In this research, the single-sample experiment approach was used. And the second-power equation or root sum square method *(Equation 18)*, developed by (Kline & McClintock, 1953), was the mathematical algorithm used to calculate the uncertainty intervals for the results. Where P is the function of the measured variable, and (u_i) and (u_p) are the uncertainty intervals for the variable and result, respectively.

$$u_P = \left[\sum_{i}^{n} \left(\frac{dP}{dp_i} u_i \right)^2 \right]^{1/2}$$

Equation 18: Second-Power Equation or Root Sum Square Method.

As a sample, an uncertainty interval would be represented as *(Ke ± uKe)*, for outlet control. To calculate the uncertainty interval for Ke *(Equation 19)*, the uncertainty of the *(Ke)*-parameters must be found and added by following this second-power equation process (*Equation 20*).

$$K_e = \frac{H_e * 2g}{V^2}$$

Equation 19: Entrance Head Loss Coefficient

$$uKe = \left[\left(\frac{\partial K_e}{\partial H_e} * uH_e \right)^2 + \left(\frac{\partial K_e}{\partial V} * uV \right)^2 + \left(\frac{\partial K_e}{\partial g} * ug \right)^2 \right]^{0.5}$$

$$= \left[\left(\frac{2g}{V^2} * uH_e \right)^2 + \left(\frac{-2He * 2g}{V^3} * uV \right)^2 + \left(\left(\frac{2H_e}{V^2} \right) * ug \right)^2 \right]^{0.5}$$

Equation 20: Uncertainty Interval for Ke Using the Second-Power Equation.

Under inlet-controlled conditions, the hydraulic efficiency of an inlet is evaluated through the ratio of dimensionless headwater to dimensionless discharge. When discharges produce low headwater elevations, high hydraulic efficiency is achieved. Therefore, to determine the uncertainty for results representing hydraulic efficiency is necessary. Due to the lengthy process of finding uncertainty intervals for *(H*)*, *(Q*)* and coefficients for

submerged K, M and unsubmerged flow c, Y constants, the main steps are outlined below. A template calculation sheet from (Sellevold, 2023) was used and it shall outline the full mathematical procedure in its research report.

1. Calculate the uncertainty for *(Q*)* using these parameters *(Q, A and D).*
2. Calculate the uncertainty for *(H*)* using these parameters *(Hw, D and S).*
3. Calculate the uncertainty of K, M, c, Y, C_D and K_D coefficients, first by performing regression using the maximum and minimum values of *(H*)* and *(Q*)* to find coefficient values representing high and low hydraulic efficiency. High hydraulic efficiency was found by having a min H for a max Q, and low hydraulic efficiency was found by having a max H for a min Q. Secondly subtract these high and low efficiency coefficients from their respective measured coefficient values. Finally, select the highest value between e.g. (Measured K – High Efficiency K) and (Measured K – Low Efficiency K). This value shall represent the uncertainty interval for these coefficients.

3 Inlet Geometries

3.1 Conventional Inlets

The experimental portion of this research was based on testing the performance of six culvert inlet geometries where the entrance loss coefficients and head-discharge relationships were determined. The first group of structures included three beveled edge linear inlets with geometries replicated from (French, 1961), and a culvert barrel with a 295 mm internal diameter. Table 3-1 outlines all the linear inlet geometries used and Figure 3-1 shows their edge dimensions.

Table 3-1: Inlet Geometry Characteristics for Conventional Linear Inlets.

No.	*Classification*	*Type*	*Bevel Angle*	*Design By*	*Δl (mm)*	*Δr (mm)*
i	Conventional	Beveled – Linear	33.7^0	(French, 1961)	44.2	29.5
ii	Conventional	Beveled – Linear	20^0	(French, 1961)	99.5	36.2
iii	Conventional	Beveled – Linear	10^0	(French, 1961)	243.7	43.0

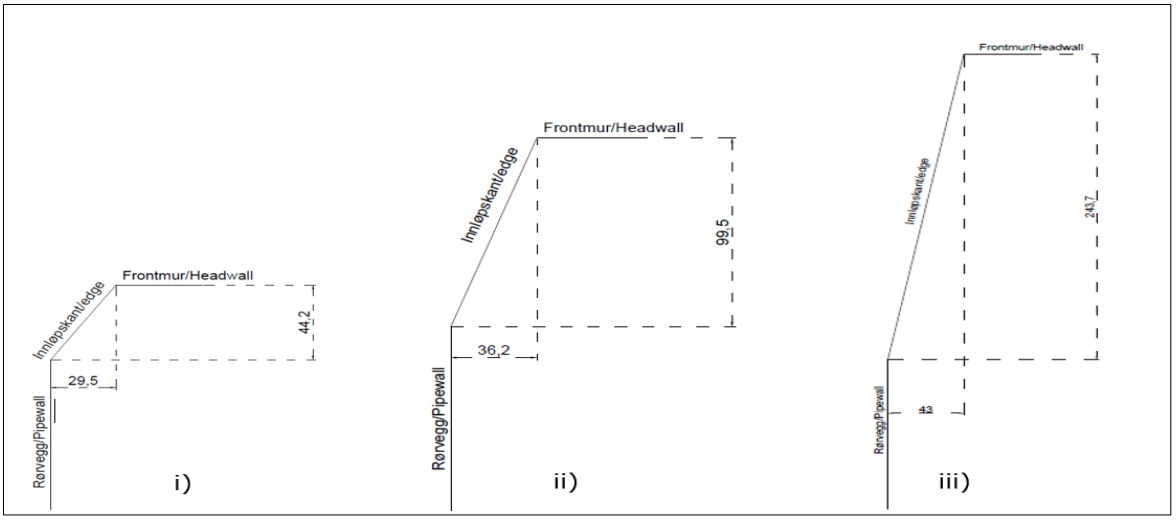

Figure 3-1: Dimensions for Linear Inlets with Beveled Edges (Sellevold, Bruland, et al., 2023).

3.2 Optimized Inlets

The second group of structures encompassed three optimized non-linear with an elliptical arc edge inlets designed by (Sellevold, Bruland, et al., 2023). Table 3-2 outlines all the inlet edge geometries used, and Figure 3-2 shows the edges dimensions determined by (Sellevold, Bruland, et al., 2023).

Table 3-2: Inlet Geometry Characteristics for Optimized Inlets.

No.	*Classification*	*Type*	*Taper Angle*	*Design By*	*Δl (mm)*	*Δr (mm)*
iv	Optimized	Tapered – Non-Linear	33.7^0	(Sellevold, Bruland, et al., 2023)	20.7	25.8
v	Optimized	Tapered – Non-Linear	20^0	(Sellevold, Bruland, et al., 2023)	40.1	35.4
vi	Optimized	Tapered – Non-Linear	10^0	(Sellevold, Bruland, et al., 2023)	80.8	38.4

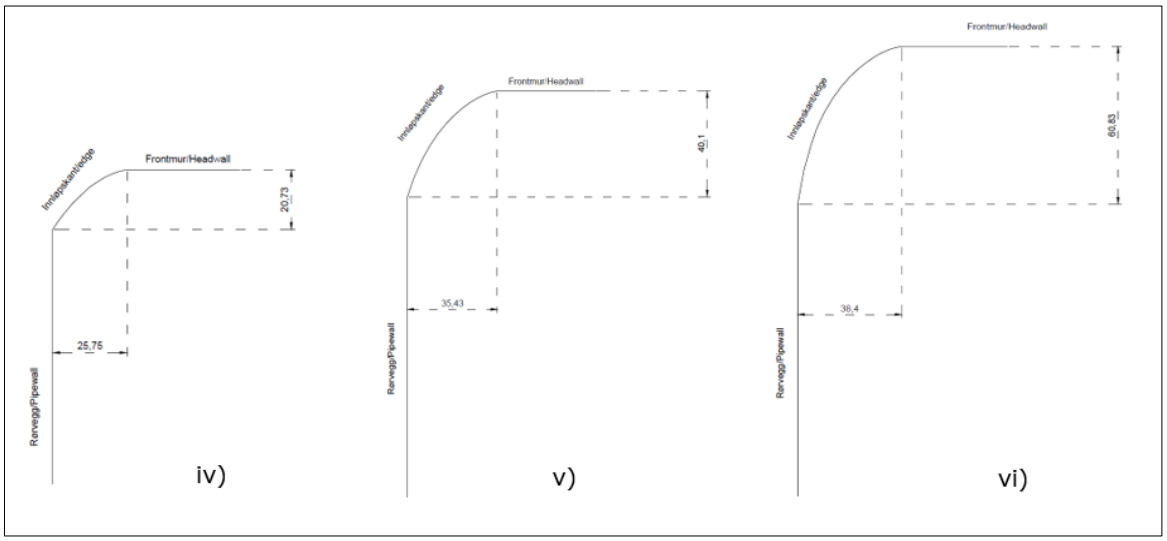

Figure 3-2: Dimensions for Optimized Non Linear Inlet with Elliptical Arc Edges (Sellevold, Bruland, et al., 2023).

The inlets were tested under outlet control and flow type 4, and under inlet control with flow type 1 and 5. The limiting flow section was at the throat. To design the elliptical arc edged inlets and their throat control sections, it was necessary to calculate their area and edge-width ratios at 5º intervals. For flush inverts, (*Equation 8*) and (*Equation 21*) were used to calculate the edge-width ratio and the ratio of the cross-sectional throat area to the cross-sectional area of a control surface upstream of the throat (Sellevold et al., 2023).

$$\frac{A_\eta}{A} = \left(1 + \frac{2\Delta r}{D}\right)^2 - \frac{\left(1 + \frac{2\Delta r}{D}\right)^2 (\alpha - \sin\alpha)}{2\pi}$$

Equation 21: Area Ratio for Flush Invert Non-Linear Inlets.

Additional assumptions were made by (Sellevold et al., 2023) to achieve the above-mentioned non-linear inlet designs. For experiments under inlet control a 3% slope and a pressure term *(k)* equivalent to 0.92 were adopted to ensure supercritical flow. The pressure term was considered constant throughout the inlet, and friction losses negligible. Additional geometrical data for the elliptical arc inlets can be found in Table 9 in (Sellevold et al., 2023).

4 Experimental Setup

The following chapter describes the procedure and methodology utilized to perform the experimental portion of this research. The location where the physical tests were carried out was at the hydrotechnical laboratory at NTNU. In addition, this section shall provide a thorough description of the model setup, materials used, calibration, testing and data collection procedures.

4.1 Model Setup

An earlier version of the physical model set up was built in 2021 by (Sellevold et al., 2023). The physical model was modified to fulfill the aim of this research. The model set up was used to carry out physical experiments to evaluate the performance of the linear and non-linear edge inlets presented in Chapter 3. The experiments were performed under outlet and inlet control configurations including the study of blockage effects.

The physical model was a simple setup constituted by an intake pipeline of 300 mm in diameter, able to discharge up to 200 l/s into an inlet tank. The inlet tank was connected to an outlet tank by an 8 m long culvert barrel of 296 mm in internal diameter. The weir plate at the downstream end of the outlet tank was used to control the tailwater, and the elevation of the outlet tank was varied to achieved different barrel slopes. These two factors allowed to satisfactorily achieve subcritical and supercritical flow for the different experiments. Figure 4-1 shows a graphical representation of the general model set up for inlet and outlet control.

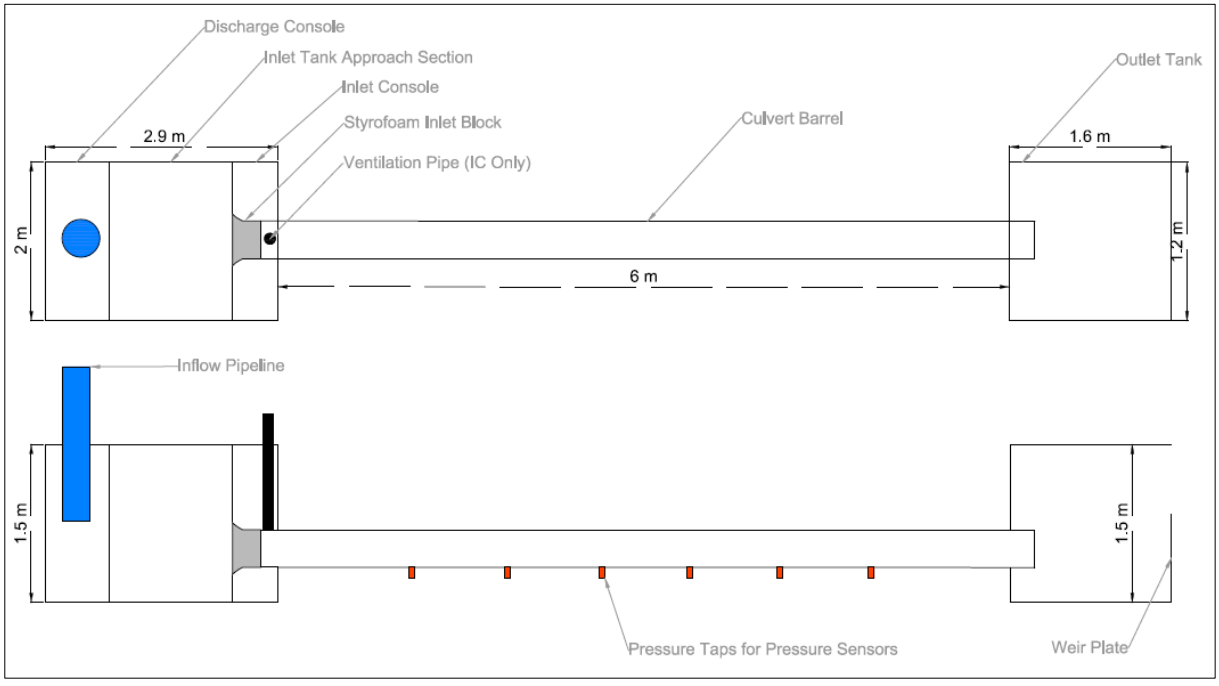

Figure 4-1: Model Set Up.

A set of six beveled and tapered inlet blocks were tested in the model set up under inlet and outlet control conditions. There were three linear tapered inlets with bevel edges at 10º, 20º and 33.7º, and three non-linear tapered inlets with elliptical arc edges at 10º, 20º, and 33.7º. Inlet CAD drawings and specifications, made by (Sellevold, et al., 2023), were given to a company, BASAL, to produce the six inlet blocks in Styrofoam.

Once delivered, the edge surfaces, at the inlet blocks, were further adjusted by the application of a cementitious membrane and polyester putty to protect their physical integrity and shape from continuous use. Furthermore, to determine the blockage effects on the inlet's performances, two wood veneer plates were created. The plates were sized to provide a blockage ratio *(Ab/A)* of 37.5% and 75% when attached to the fronts of the inlet blocks.

The inlet tank was 2.9 m in length, 2 m in width and 1.5 m in height. The tank was structured by a transparent glass pane and three wood veneer plates. The glass pane was used to allow manual measurements of headwater elevations and flow behavior observations at the inlet invert. The inlet tank was consecutively connected to an inlet console room. In this room the new inlet block was secured and attached to the upstream end of the culvert barrel and connected to the inlet tank headwall. Digital headwater elevation measurements were also recorded by using a Microsonic mic+340/IU/TC ultrasonic sensor located at the top of the inlet tank.

The culvert barrel was a PVC pipe having a 315 mm outer diameter and 296 mm internal diameter and 9.3 mm in thickness. The total length between the upstream and downstream end of the pipeline was 8 m, and the length between the outlet and inlet tank walls was 6 m. There were five pressure gauges attached under the culvert barrel inlet to measure piezometric pressures, Figure 4-3 shows the location of the pressure taps. To perform experiments under inlet control and ensure supercritical flow in the culvert barrel, it was tilted to acquire a 3% slope. Furthermore, a ventilation pipe was installed downstream of the throat to reduce sub atmospheric pressures inside the culvert structure and avoid pressure scale effects (French, 1961) . For outlet control experiments, the model set up remained at a zero slope.

The outlet tank was 1.6 m in length, 1.2 m in width and 1.5 m in height. The tank was structured by a transparent glass pane and three wood veneer plates. The glass pane was used to allow tailwater observations and ensure full culvert outlet submergence. For inlet control experiments, the weir plate perpendicular to the flow direction was removed to allow flow to free fall at the outlet. For outlet control experiments, the wood veneer plate behaved as a weir to ensure tailwater formation and full culvert outlet submergence.

A data logging and controls platform was already built next to the inlet tank, see Figure 4-2. A desktop computer, circuit board and voltmeter were installed in this space to run and obtain the digital measurements from the physical model simulations. The pressure sensors, WIKA S-11, attached to the culvert barrel, flow meters at the discharge pipe, SITRANS FM MAG 5000 Transmitter, and headwater elevation sensor at the inlet tank produced electrical signals, in volts, which were sent to an Agilent U2355A model data acquisition apparatus. The voltage readings were graphically displayed on the monitor through the Agilent Measurement Manager software.

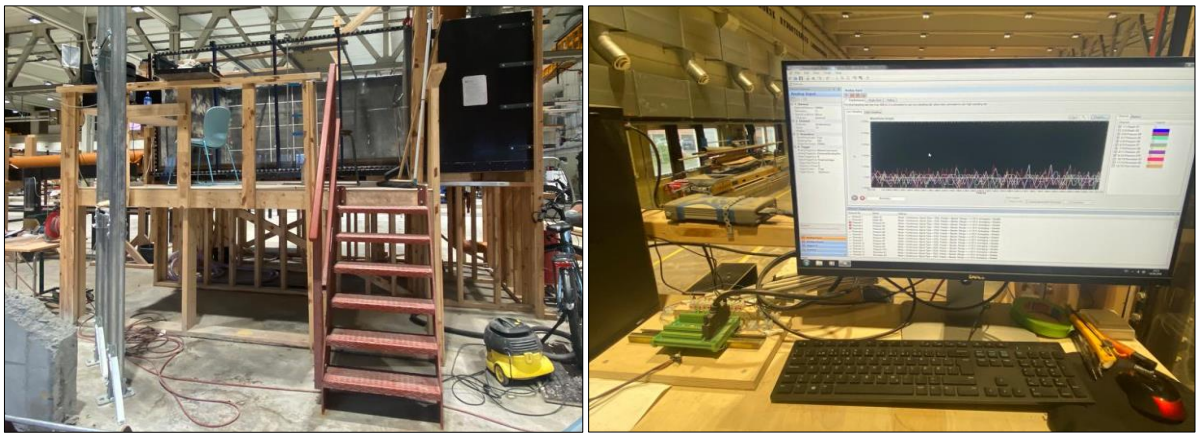

Figure 4-2: Data Logging and Controls Platform.

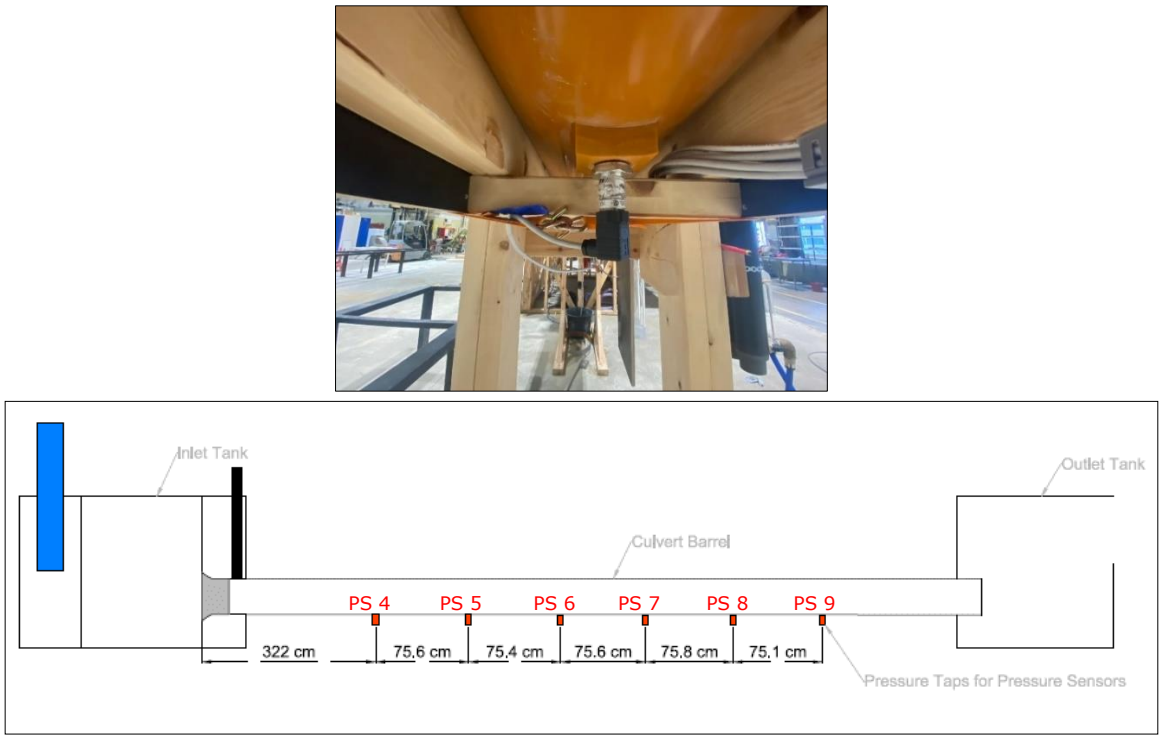

Figure 4-3: Pressure Sensor Locations from Culvert Inlet Invert.

Furthermore, at the inlet tank, a new inlet console was built for the installation of the inlet Styrofoam block. The back face of the inlet block was securely attached to the upstream end of the barrel, while the block's front face merged with the inlet tank headwall and flushed with the inlet tank floor. The front face of the inlet block was the only side exposed to water and to avoid any misplacements, the top face of the inlet block was pressed against metal plates that were lowered by a manual system of pulleys and screws.

For the calibration equipment, plastic transparent pipes and two black PVC pipes with known lengths (0.5m, 0.5m, 1m, 1.5m) were set up vertically, see Figure 4-4. The pipe ends were drilled and adjusted so a pressure sensor could be attached.

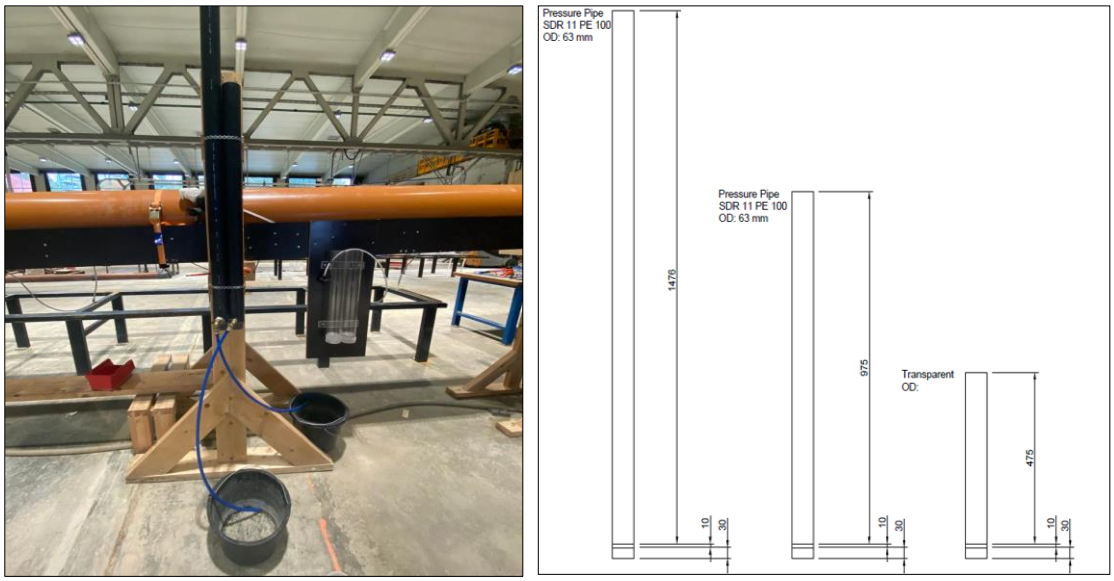

Figure 4-4: Calibration Setup.

The inlet edges were not completely shaped into the Styrofoam blocks due to BASAL's machinery limitations, therefore excess material was removed by carefully cutting and sanding the existing edges. This was done by printing the inlet edges, from the CAD drawings from (Sellevold, Bruland, et al., 2023), into plastic molds. Once the correct edge geometries were achieved, their surfaces were coated with a Weber Membrane 1-component and a second layer of Wurth VAKU 50 plastic putty. The plastic putty had a cementitious texture, hence after 12 hours drying time the surface was sanded to maintain correct and smooth edge geometries, see Figure 4-5 and Figure Figure 4-6.

Figure 4-5: Sample of Finalized Linear and Non-Linear Inlets with Bevel Angle 20º.

Figure 4-6: Comparing Edge Geometry to Edge Mold for 20⁰ Linear Inlet.

To ensure the integrity of the inlet edge geometries, the inlet edge surfaces were measured against their respective edge molds. To check that the inlet edges were correct and even, the edge molds were positioned at 45 degrees at continuous locations, 10 centimeters apart, along the inlet edge circumference.

For the experiments evaluating blockage effects, it was necessary to create two veneer plates. One of the plates was 119 cm high and 810 cm long and represented a 37.5% blockage ratio. The second plate was 208 cm high and 810 cm long, and it represented a 75% blockage ratio, see Figure 4-7.

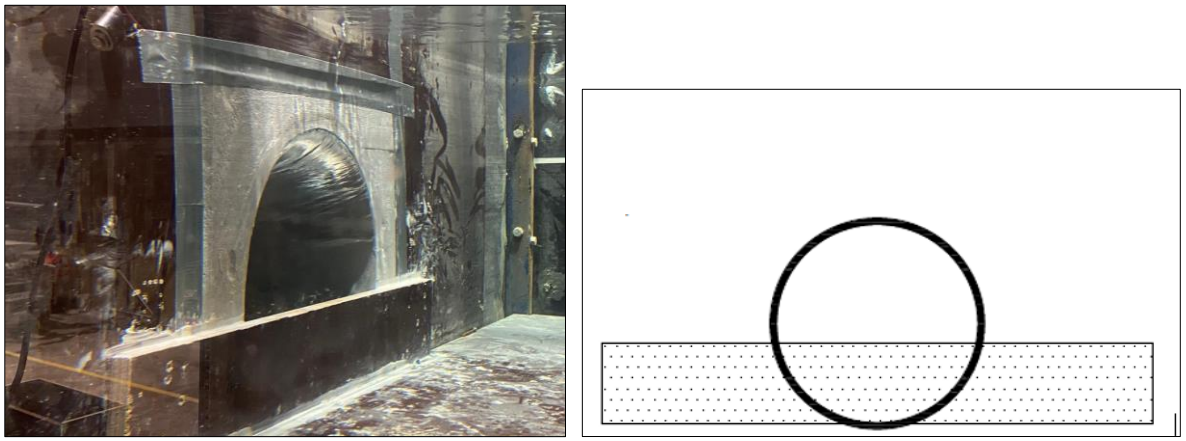

Figure 4-7: Block Element Setup.

Table 4-1 and Table 4-2 below provide a summary of the experiments performed under outlet and inlet control and the time taken to conduct readings per experiment. The construction and experiment processes were very lengthy and involved a great deal of steps. Consequently, there is a total of 30 experiments performed under outlet control conditions, it is equivalent to 150 readings that were carried out during a non-continuous 38-hour period.

Additionally, there is a total of 30 experiments performed under inlet control conditions, it is equivalent to 300 readings carried out during a non-continuous 40-hour period. The time taken to perform the experiments under inlet and outlet control conditions does not include the time it took to adjust the model set up, inlet blocks and numerous installations of blockage plates, it took 5 months to complete all the experimental efforts.

Table 4-1: Outlet Control Experiments.

Test Round	***Inlet type***	***Edge***	***Experiments Without Blockage in Test Round***	***Experiments With Blockage in Test Round***	***Readings Per Single Experiment***	***Time per Reading (min)***
OC-I	Linear tapered	Bevel Edge 10^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15
OC-II	Linear tapered	Bevel Edge 20^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15
OC-III	Linear tapered	Bevel Edge 33.7^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15
OC-IV	Non-linear tapered	Elliptical Arc Edge 10^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15
OC-V	Non-linear tapered	Elliptical Arc Edge 20^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15
OC-VI	Non-linear tapered	Elliptical Arc Edge 33.7^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	5	15

Table 4-2: Inlet Control Experiments.

Test Round	***Inlet type***	***Edge***	***Experiments Without Blockage in Test Round***	***Experiments With Blockage in Test Round***	***Readings Per Single Experiment***	***Time per Reading (min)***
IC-I	Linear tapered	Bevel Edge 10^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8
IC-II	Linear tapered	Bevel Edge 20^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8
IC-III	Linear tapered	Bevel Edge 33.7^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8
IC-IV	Non-linear tapered	Elliptical Arc Edge 10^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8
IC-V	Non-linear tapered	Elliptical Arc Edge 20^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8
IC-VI	Non-linear tapered	Elliptical Arc Edge 33.7^0	3	1 with 37.5% Blockage Ratio 1 with 75% Blockage Ratio	10	8

4.2 Calibration

The pressure sensors were used in all the experiments performed. It was of great importance to consistently calibrate all the sensors to obtain reliable results. The pressure sensors calibrated for outlet control experiments was a set of five (PS4, PS5, PS6, PS7 and PS8), and a set of three sensors for inlet control experiments (PS5, PS7, PS9).

Initially, the pressure sensor was attached to the bottom of the first calibration pipe, then the atmospheric pressure was recorded. The process continued by measuring the piezometric heads at the remaining calibration pipes (0.5m, 1m and 1.5m). Each of the calibration's pipes were carefully filled with water using a graduated cylinder and later, they were emptied by opening their valves. The same procedure was repeated for each of the following four pressure sensors.

For a test round under outlet control, the five sensors generated four pressure measurements each, totaling twenty calibration measurements, this process took 2.5 hours to complete. And for a test round under inlet control, the three sensors generated four pressure measurements each, totaling twelve calibration measurements, this process took 1.5 hours to complete. One calibration measurement was recorded over a sixty second period using the Agilent U2355A data acquisition device.

The atmospheric and piezometric head digital results were plotted against the known calibration water column to check their linear correlation, see Figure 4-8. Appendix C and D contains all the calibration data for inlet and outlet control experiments. Additionally, pressure calibration equations were generated for the conversion of the digital measurements, in volts, to pressure head values in meters.

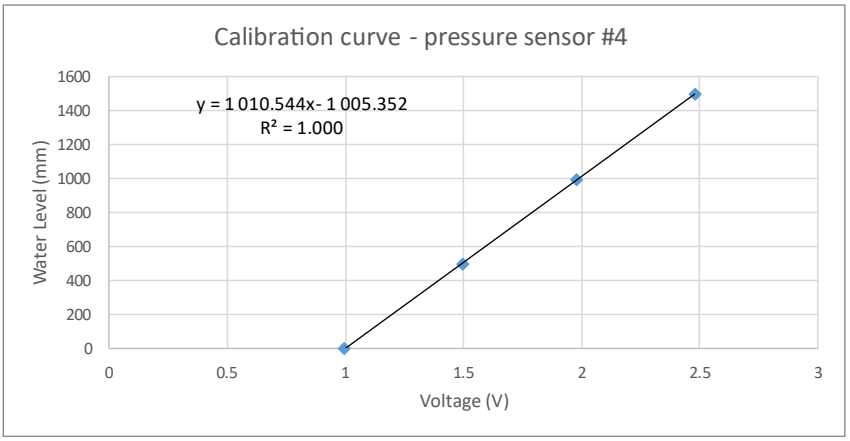

Figure 4-8: Sample of Calibration Graph for Sensor 4, 10º Non-Linear Inlet.

4.3 Testing Procedure

Twelve test rounds were performed, six for outlet control and six for inlet control. The experimental section of this research was set to start with the outlet control test rounds (OC-I, OC-II, OC-III, OC-IV, OC-V, OC-VI). The testing was often done after the calibration procedure, sediment removal, new inlet installation and reference measurements were completed.

To avoid sediment clogging in the holes at the pressure taps, in the culvert barrel, a metallic rod was introduced through the hole and later flushed with water. Furthermore, for the first test round OC-I, a linear tapered bevel edge 10º inlet was installed in the

inlet console, and the side edges of the inlet front face was sealed with duct tape and clay when connected to the inlet tank headwall and floor.

A measurement tape, glued onto the glass pane at the inlet tank, was used to manually measure the headwater elevation in the tank from the inlet invert. Therefore, any elevation difference between the inlet invert and the measurement tape's bottom end was important. Before every test round this elevation offset was measured by using a multi-line Bosch self-leveling laser.

Before the inlet tank was filled and the discharge pipelines opened, all the sensors were activated, and a zero reading was taken. This allowed to record the current state and baseline values for each sensor in all the test rounds.

The first experiment without blockage was performed, five readings with increasingly varying flow rates and headwater elevations were taken. The minimum flow discharge had to provide some headwater elevation above inlet invert and its fifth maximum flow discharge had to provide a H*>3. Before each reading, there was a fifteen-minute water level stabilization period. Later, a sixty second digital reading and a manual reading were recorded. Two additional experiments without blockages were executed for repeatability purposes.

Subsequently, there were two experiments with blockage elements for test round OC-I. The first experiment had a 35.7% blockage ratio. A flat veneer plate was positioned in front of the inlet face and tightly screwed on the sides. Five readings with increasingly varying flow rates and headwater elevations were taken. The minimum flow discharge had to provide some headwater elevation above blockage element, and its fifth maximum flow discharge had to provide a headwater elevation equivalent H*>3. The second experiment had a 75% blockage ratio, and the same testing procedure was followed.

During the maximum flow discharge reading, at the third experiment without blockage, the pressure sensors' elevation, and horizontal values with reference to the inlet invert were measured using a multi-line Bosch self-leveling.

The remaining five test rounds, under outlet control conditions, also followed the same procedure done in test round OC-I.

Table *4-1* shows the different inlets used at each test round.

Under inlet control conditions, six test rounds were performed (IC-I, IC-II, IC-III, IC-IV, IC-V, IC-VI), Table 4-2. The calibration steps, sediment removal and new inlet installation were completed before testing. However, for inlet control conditions, the model set up had a 3% slope and only 3 pressure sensors were used (PS5, PS7 and PS9) to verify supercritical flow in the barrel.

For each of the test rounds under inlet control conditions a zero reading, three experiments without blockage and two experiments with blockage elements were performed. The blockage elements had 37.5% and 75% blockage ratios respectively. The experiments had ten readings each. The first five readings correlated to unsubmerged flow and the last five reaming readings correlated to submerged flow. Before each reading, there was an eight-minute water level stabilization period. To determine if there was supercritical flow in the barrel, the three pressure sensors measured piezometric heads throughout the barrel. Those results were used to calculate the Froude number for all the readings at each experiment.

All the data and measurements collected during each test round under outlet and inlet control conditions, were longed in excel data sheets, see Appendix A and B for data sheets.

5 Results

The following section provides an overview of the results obtained from the test rounds performed for each of the linear and non-linear optimized inlets. It is a quite extensive summary given that 60 experiments were performed under outlet and inlet control condition. The results are displayed as tables and graphs.

5.1 Outlet Control Results

For outlet control experiments, results were displayed in terms of the entrance head loss coefficient *(Ke)* vs. the headwater level to barrel diameter ratio. This relationship was shown for each of the six inlets, linear and nonlinear, and classified by their taper angle. Error bars had been added to display the reliability of the results. The results shall be discussed in chapter 6 of this report.

5.1.1 Linear and Elliptical Arc Edges.

5.1.1.1 10 Deg Inlets

Table 5-1: Outlet Control Results for 10 Deg Linear Inlet, Unblocked Cases.

RESULTS - 10 deg linear			
H_w/D	***k_e***	***u_{ke} [-]***	***u_{ke} [%]***
1.562	0.237	0.102	42.95
1.910	0.149	0.069	46.50
2.311	0.148	0.065	43.96
2.716	0.146	0.064	43.82
3.006	0.133	0.064	47.63
1.562	0.261	0.102	38.97
1.910	0.174	0.070	40.02
2.315	0.155	0.065	42.13
2.710	0.138	0.064	46.37
3.006	0.122	0.064	52.03
1.562	0.249	0.102	41.02
1.913	0.195	0.070	35.78
2.315	0.144	0.065	45.17
2.716	0.145	0.064	44.24
3.015	0.134	0.064	47.51
Average			
Hw/D	***ke***	***uke [-]***	***uke [%]***
0	0.169	0.07	43.88
4	0.169		

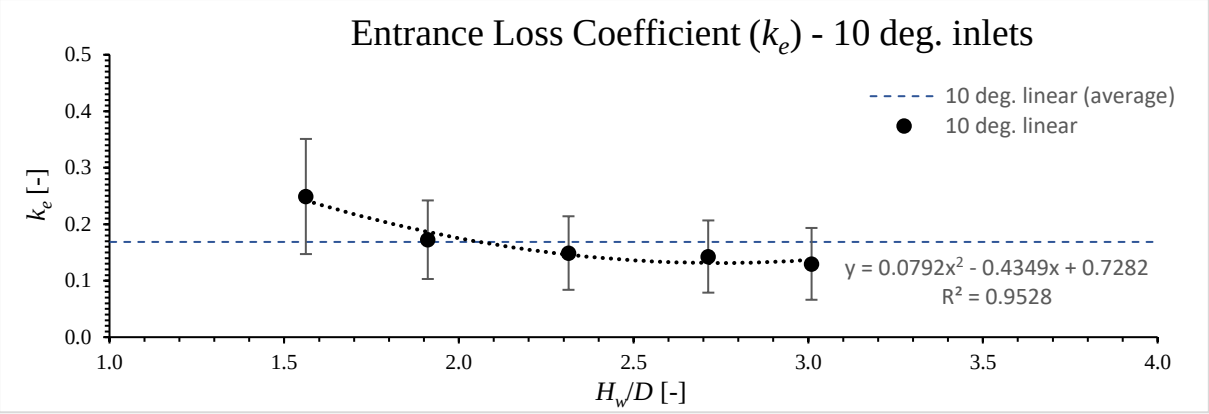

Figure 5-1: Entrance Loss Coefficients for 10 Deg Linear Inlets, Unblocked Cases.

Table 5-2: Outlet Control Results for 10 Deg Non-Linear Inlet, Unblocked Cases.

RESULTS - 10 deg Non linear			
H_w/D	***k_e***	***u_{ke} [-]***	***u_{ke} [%]***
1.582	0.277	0.098	35.50
1.917	0.182	0.067	36.59
2.328	0.111	0.062	55.69
2.716	0.095	0.061	64.34
3.032	0.080	0.060	75.40
1.582	0.292	0.098	33.68
1.910	0.160	0.067	41.59
2.328	0.118	0.062	52.39
2.723	0.087	0.061	69.80
3.033	0.088	0.060	68.40
1.586	0.354	0.098	27.80
1.923	0.157	0.067	42.27
2.332	0.115	0.062	53.73
2.726	0.117	0.061	52.20
3.040	0.092	0.060	65.61
Average			
Hw/D	**ke**	**uke [-]**	**uke [%]**
0	0.155	0.07	51.67
4	0.155		

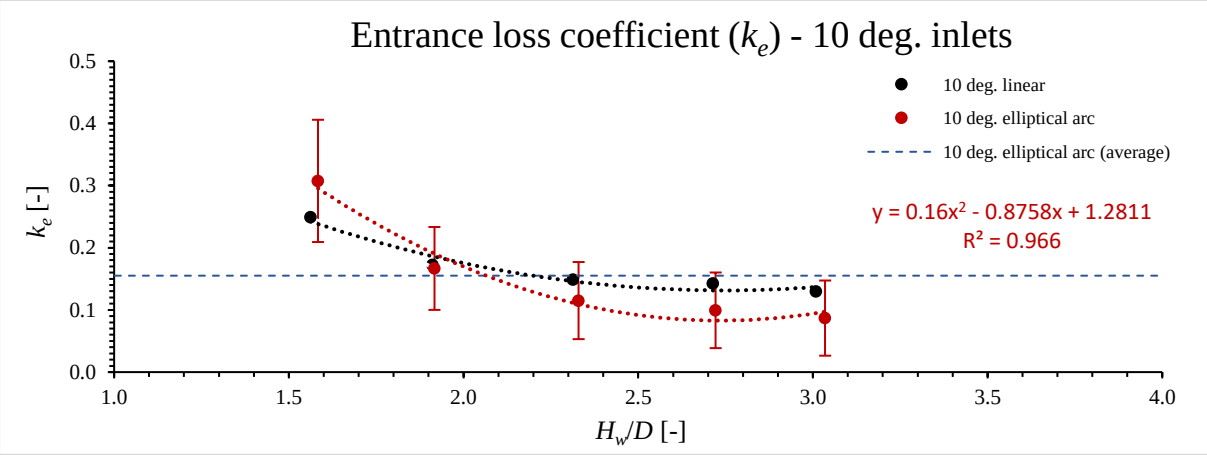

Figure 5-2: Entrance Loss Coefficients for 10 Deg Non-Linear Inlet, Unblocked Cases.

5.1.1.2 20 Deg Inlets

Table 5-3: Outlet Control Results for 20 Deg Linear Inlet, Unblocked Cases.

RESULTS - 20 deg linear			
H_w/D	k_e	u_{ke} [-]	u_{ke} [%]
1.481	0.314	0.158	50.3
1.938	0.149	0.088	59.1
2.289	0.125	0.083	66.4
2.717	0.100	0.081	81.0
2.987	0.094	0.080	85.1
1.480	0.277	0.158	57.0
1.933	0.121	0.088	72.7
2.290	0.103	0.083	80.6
2.696	0.105	0.081	77.1
2.991	0.090	0.080	88.9
1.482	0.241	0.157	65.1
1.931	0.128	0.088	68.8
2.299	0.115	0.083	72.2
2.706	0.097	0.081	83.5
2.988	0.100	0.080	80.0
Average			
Hw/D	***ke***	***uke [-]***	***uke [%]***
0	0.144	0.10	72.52
4	0.144		

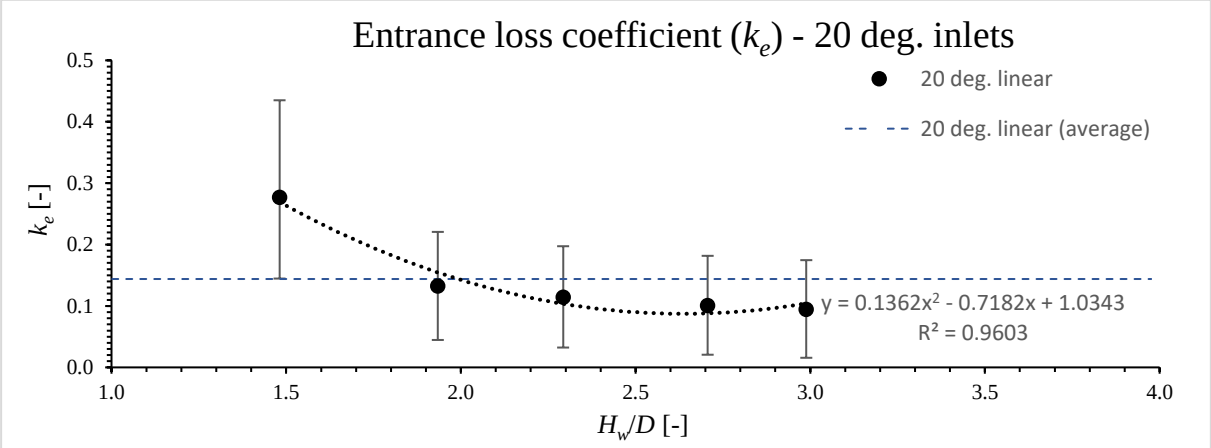

Figure 5-3: Entrance Loss Coefficients for 20 Deg Linear Inlets, Unblocked Cases, Unblocked Cases.

Table 5-4: Outlet Control Results for 20 Deg Non-Linear Inlet, Unblocked Cases.

RESULTS - 20 Non deg linear			
H_w/D	***k_e***	***u_{ke} [-]***	***u_{ke} [%]***
1.583	0.132	0.133	100.8
1.924	0.048	0.088	183.3
2.326	0.099	0.082	82.8
2.719	0.072	0.08	111.1
3.026	0.056	0.079	141.1
1.593	0.129	0.132	102.3
1.926	0.106	0.088	83.0
2.326	0.085	0.082	96.5
2.723	0.084	0.08	95.2
3.034	0.067	0.079	117.9
1.59	0.074	0.133	179.7
1.938	0.092	0.088	95.7
2.324	0.092	0.082	89.1
2.721	0.074	0.08	108.1
3.034	0.066	0.079	119.7
Average			
Hw/D	**ke**	**uke [-]**	**uke [%]**
0	0.085	0.092	113.75
4	0.085		

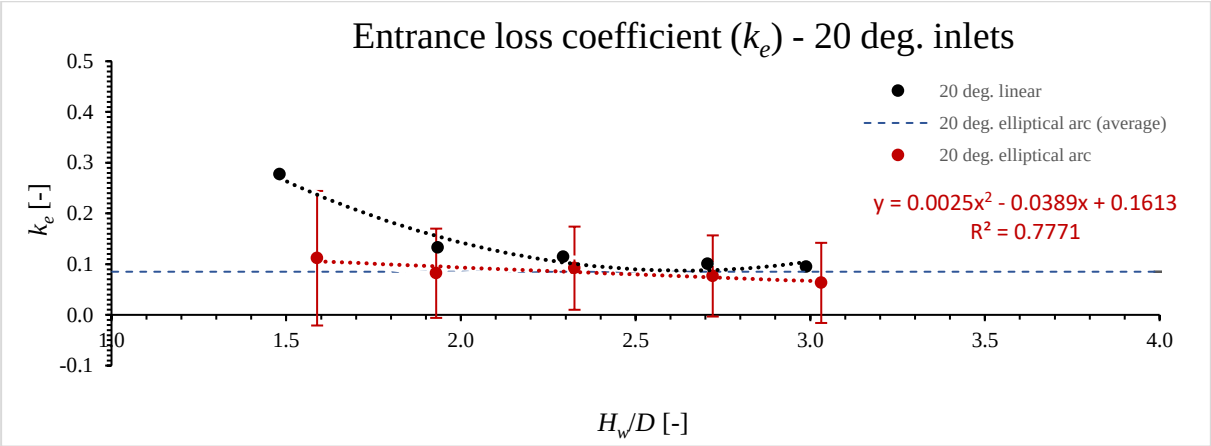

Figure 5-4: Entrance Loss Coefficients for 10 Deg Non-Linear Inlets, Unblocked Cases.

5.1.1.3 33.7 Deg Inlets

Table 5-5: Outlet Control Results for 33.7 Deg Linear Inlet, Unblocked Cases.

RESULTS - 33.7 deg linear			
H_w/D	***k_e***	***u_{ke} [-]***	***u_{ke} [%]***
1.566	0.405	0.099	24.5
1.930	0.210	0.067	31.8
2.310	0.163	0.063	38.6
2.726	0.132	0.062	46.7
3.021	0.109	0.061	55.9
1.564	0.369	0.099	26.9
1.931	0.204	0.067	32.7
2.315	0.152	0.063	41.2
2.733	0.129	0.062	47.7
3.033	0.124	0.061	49.2
1.572	0.512	0.099	19.4
1.930	0.238	0.067	28.0
2.321	0.156	0.063	40.3
2.733	0.128	0.062	48.0
3.017	0.107	0.061	57.3
Average			
Hw/D	***ke***	***uke [-]***	***uke [%]***
0	0.209	0.07	39.22
4	0.209		

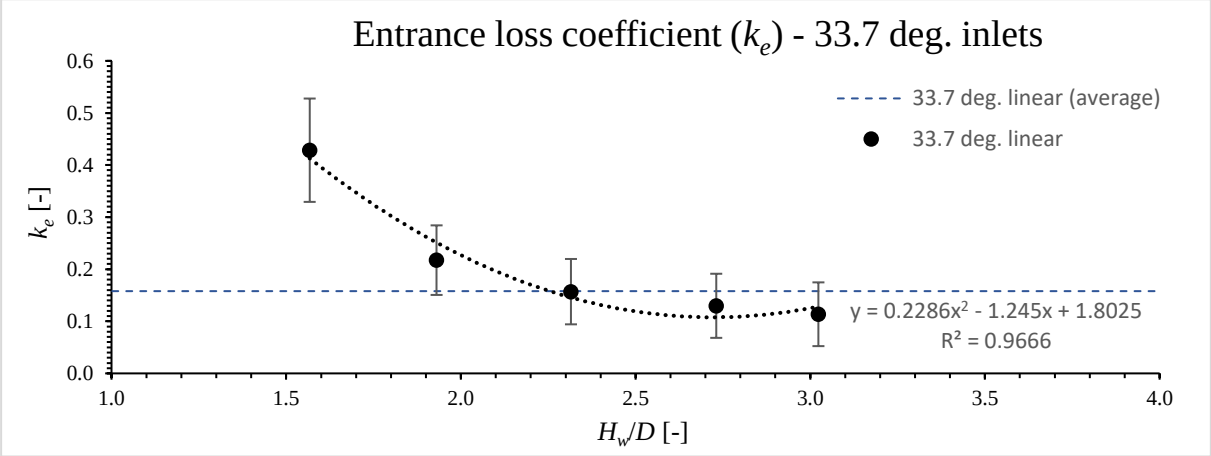

Figure 5-5: Entrance Loss Coefficients for 33.7 Deg Linear Inlets, Unblocked Cases

Table 5-6: Outlet Control Results for 33.7 Deg Non-Linear Inlet, Unblocked Cases.

RESULTS - 33.7 deg Non linear			
H_w/D	***k_e***	***u_{ke} [-]***	***u_{ke} [%]***
1.552	0.115	0.100	86.8
1.903	0.203	0.067	32.8
2.291	0.128	0.062	48.3
2.689	0.096	0.061	63.1
2.998	0.083	0.060	72.6
1.549	0.286	0.100	35.1
1.901	0.150	0.066	44.3
2.298	0.125	0.062	49.5
2.708	0.091	0.061	66.5
2.990	0.091	0.060	66.3
1.549	0.032	0.100	317.1
1.898	0.163	0.066	40.8
2.301	0.134	0.062	46.4
2.686	0.109	0.061	55.8
2.996	0.089	0.060	68.0
Average			
Hw/D	**ke**	**uke [-]**	**uke [%]**
0	0.126	0.070	72.89
4	0.126		

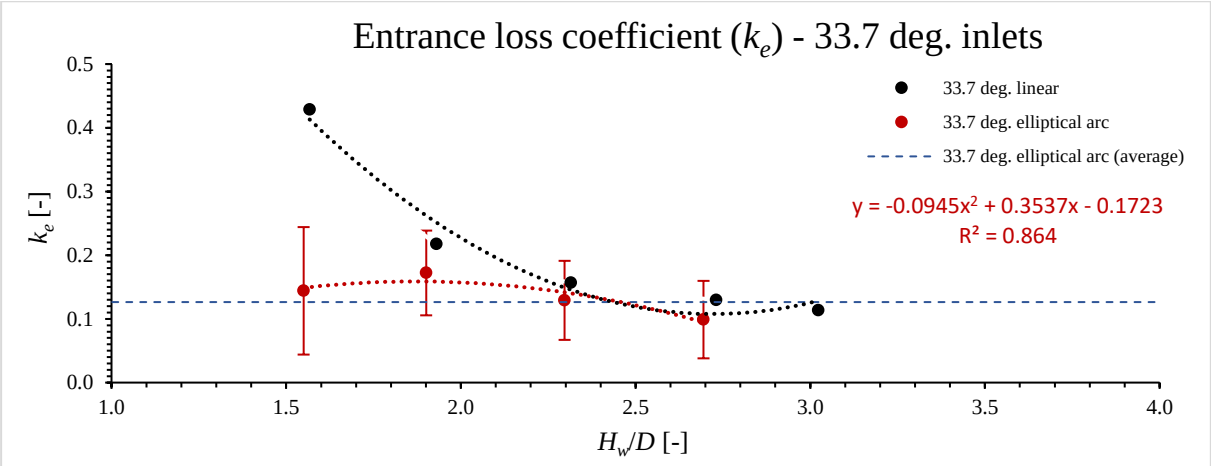

Figure 5-6: Entrance Loss Coefficients for 33.7 Deg Non-Linear Inlets, Unblocked Cases.

5.1.1.4 Additional Results

The experimental data for outlet control experiments without blockage elements was compared to (French, 1961) results in Figure 5-7. The comparison shows that Ke values obtained for the 10º, 20º, and 33.7º inlets are very close to those of French.

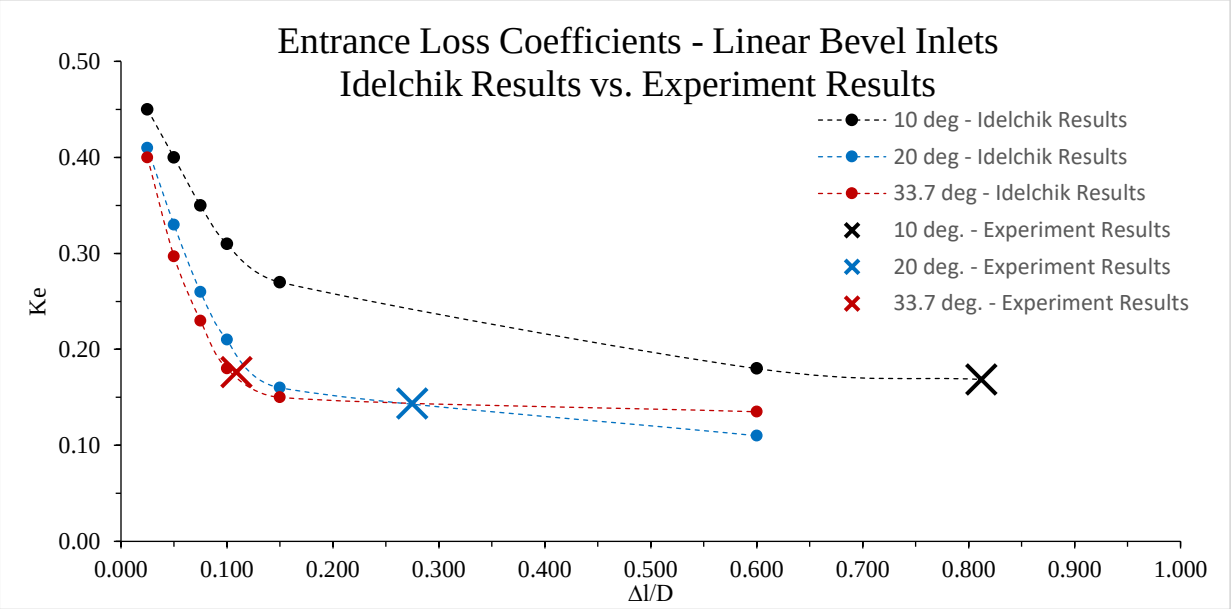

Figure 5-7: Comparison of Linear Inlet Results vs. (Idelchik et al., 2007) Results.

Additional correlations were analyzed to find possible relationships factors affecting the entrance head loss values for outlet control experiments without blockage elements. In this case, a relationship between the Reynold number at the approach channel and the Reynolds number for the flow inside the culvert barrel are displayed in Figure 5-8.

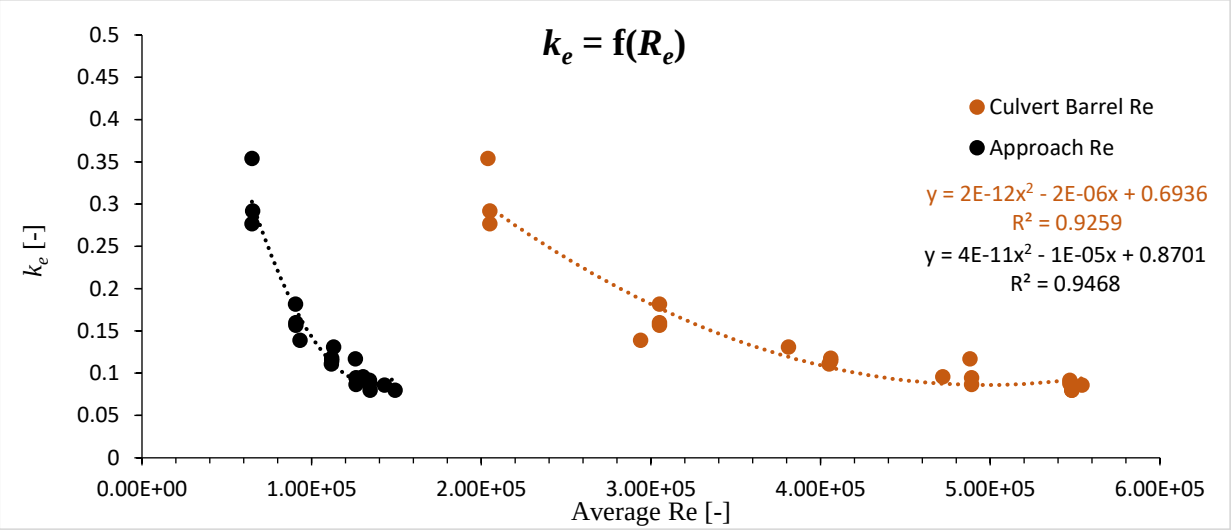

Figure 5-8: Correlation Between the Approach and Barrel Reynolds No. With Ke Values for 10 Deg Non-Linear Inlet.

5.1.2 Inlet Blockage Effects

The hydraulic efficiencies of linear and non-linear optimized inlets using blockage elements were also analyzed. Two blockage ratios of 37.5% and 75% were selected to observe their influences and results in terms of *(Keb)* vs the area ratio *(Ab/A)*. The experimental results were also compared to those obtained through (Weeks et al., 2009) methodology for blockage elements, (Weeks et al., 2009) methodology was described in section 2.4. The result comparison has been included for both linear and non-linear optimize inlets.

Table 5-7: Blockage Effect Results for 10 Deg Linear and 10 Deg Non-Linear Inlets.

Blockage Effects							
10 deg linear				**10 deg non-linear**			
A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]	A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]
0.000	0.169	0.169	0.073	0.000	0.155	0.155	0.070
0.375	0.518	0.202	0.074	0.375	0.811	0.317	0.073
0.750	3.938	0.246	0.109	0.750	8.367	0.523	0.176
Measured		**AAR (Weeks et al.)**		**Measured**		**AAR (Weeks et al.)**	
$k_{eb}(v_b)$	Ab/A	$k_{eb}(v_b)$	Error	$k_{eb}(v_b)$	Ab/A	$k_{eb}(v_b)$	Error
0.17	0.000	0.17	0.0	0.16	0.000	0.16	0.0
0.20	0.375	0.62	204.9	0.32	0.375	0.59	86.6
0.25	0.750	1.35	447.3	0.52	0.750	1.31	150.2

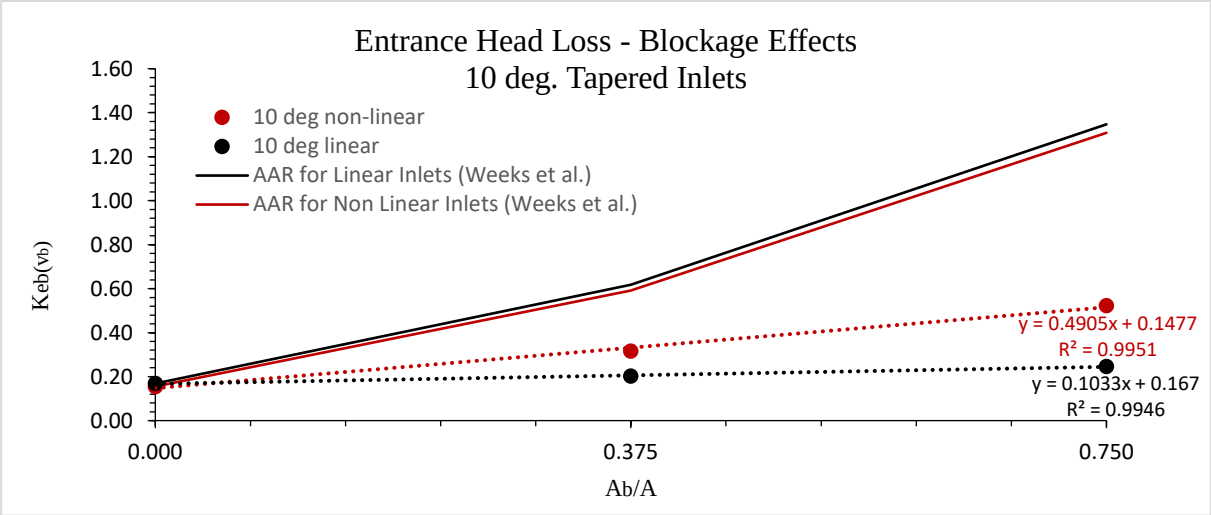

Figure 5-9: Blockage Effects – Correlation of Keb(vb) with Ab/A for 10 Deg Tapered Inlets.

Table 5-8: Blockage Effect Results for 20 Deg Linear and 20 Deg Non-Linear Inlets.

Blockage Effects							
20 deg linear				**20 deg non-linear**			
A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]	A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]
0.000	0.144	0.144	0.098	0.000	0.085	0.085	0.092
0.375	0.541	0.211	0.101	0.375	0.795	0.311	0.098
0.750	5.036	0.315	0.175	0.750	9.205	0.575	0.240
Measured		**AAR**		**Measured**		**AAR**	
$k_{eb}(v_b)$	A_b/A	$k_{eb}(v_b)$	**Error**	ke,b(vb)	A_b/A	$k_{eb}(v_b)$	**Error**
0.14	0.000	0.14	0.0	0.09	0.000	0.09	0.0
0.21	0.375	0.57	168.8	0.31	0.375	0.44	43.0
0.31	0.750	1.27	305.0	0.58	0.750	1.08	88.6

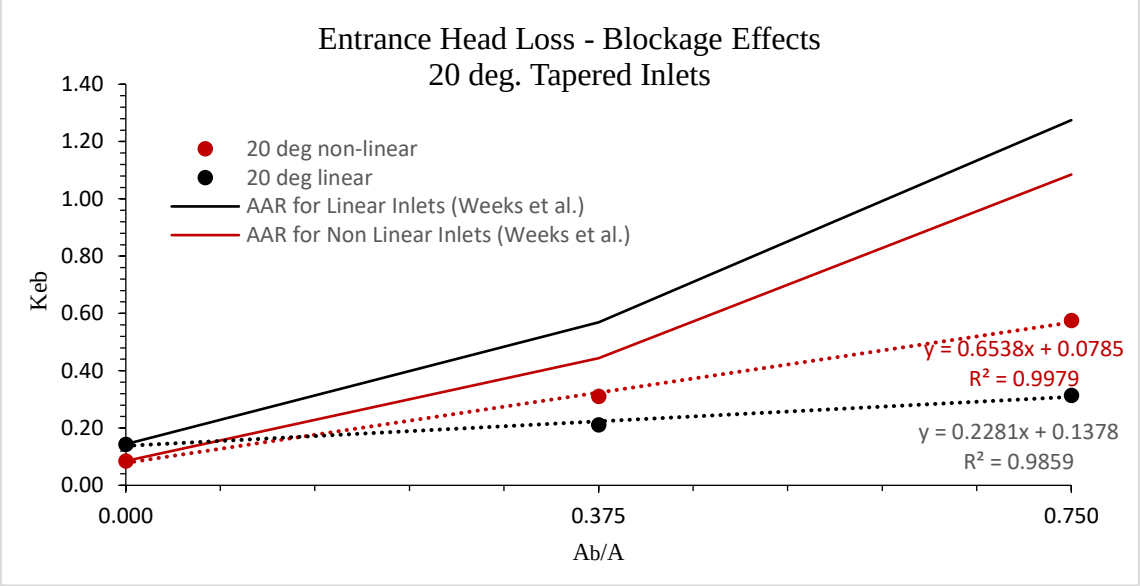

Figure 5-10: Blockage Effects – Correlation of Keb(vb) with Ab/A for 20 Deg Tapered Inlets.

Table 5-9: Blockage Effect Results for 33.7 Deg Linear and 33.7 Deg Non Linear Inlets.

Blockage Effects							
33.7 deg linear				**33.7 deg non-linear**			
A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]	A_b/A	k_{eb}	$k_{eb}(v_b)$	u_{ke} [-]
0.000	0.209	0.209	0.070	0.000	0.126	0.126	0.070
0.375	0.603	0.235	0.072	0.375	1.028	0.402	0.075
0.750	5.151	0.322	0.123	0.750	14.240	0.890	0.280
Measured		**AAR**		**Measured**		**AAR**	
$k_{eb}(v_b)$	A_b/A	$k_{eb}(v_b)$	**Error**	$k_{eb}(v_b)$	A_b/A	$k_{eb}(v_b)$	**Error**
0.21	0.000	0.21	0.0	0.13	0.000	0.13	0.0
0.24	0.375	0.69	194.3	0.40	0.375	0.53	32.8
0.32	0.750	1.46	352.8	0.89	0.750	1.22	37.3

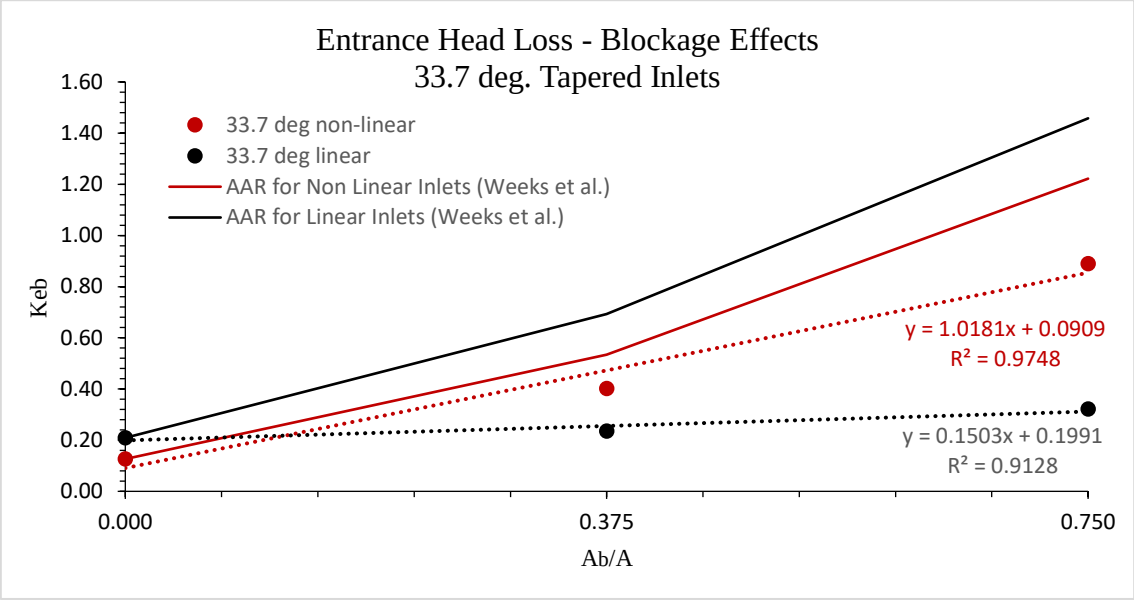

Figure 5-11: Blockage Effects – Correlation of Keb(vb) with Ab/A for 33.7 Deg Tapered Inlets.

5.1.3 Uncertainty

Errors for each of the average (Ke) values have been included in the previous results in the shape of error bars at each of the data points for the unlocked cases. However, Table 5-10 shows the basic parameters included in the uncertainty calculations performed. The scope of this research does not include an extended uncertainty analysis, but the basic components are shown below in Table 5-10.

Table 5-10: Uncertainty Intervals for Basic Parameters for Outlet Control Calculations.

Parameter	***Definition***	***Uncertainty Interval***
D	Barrel Diameter	0.001
V	Water Velocity	0.007
eps	Epsilon	3.70E-06
p	Pressure	0.010

5.2 Inlet Control Results

This section includes the results for experiments performed under inlet control conditions for unblocked and blocked cases. The tables and graphs aim to provide an overview on the hydraulic efficiencies for each of the linear and not linear optimized inlets, and further classified by their taper angle. Large tables are depicted below, where the calculated regression constants for submerged and unsubmerged flow are shown, as well as the calculated dimensionless H* and Q*. A comparison with (French, 1961) data results is also included. Moreover, additional results on blockage effects under inlet control conditions are included.

5.2.1 Linear and Elliptical Arc Edges.

5.2.1.1 10 Deg Inlets

Table 5-11: Inlet Control Results for 10 Deg Linear and 10 Deg Non-Linear Inlet, Unblocked Cases.

Experimental and Theoretical (French, 1961) Results for 10 Deg Inlet															
Non Linear 10 Deg Coefficients															
K	0.5432		**K**	0.5428		**K**	0.5285		**K**	0.5382					
M	0.5318		**M**	0.5368		**M**	0.5427		**M**	0.5371					
c	0.0190		**c**	0.0172		**c**	0.0195		**c**	0.0186					
Y	0.8767		**Y**	0.9177		**Y**	0.8780		**Y**	0.8908					
Linear 10 Deg Coefficients												**French, 1961 Results**			
K	0.5260		**K**	0.5314		**K**	0.5285		**K**	0.5286		**K**	0.4579	**K**	0.5061
M	0.5429		**M**	0.5359		**M**	0.5427		**M**	0.5405		**M**	0.6070	**M**	0.6070
c	0.0199		**c**	0.0196		**c**	0.0195		**c**	0.0197		**c**	0.0183	**c**	0.0183
Y	0.8699		**Y**	0.8706		**Y**	0.8780		**Y**	0.8728		**Y**	0.9300	**Y**	0.9300
Experiment #1			**Experiment #2**			**Experiment #3**			**Average exp.**			**Theoretical - min**		**Theoretical - max**	
$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D	$K_uQ/AD^{0.5}$	H'/D
0.02	0.07	0.06	0.02	0.07	0.06	0.02	0.06	0.06	0.02	0.06	0.06	0.02	0.04	0.02	0.05
0.08	0.14	0.13	0.08	0.14	0.13	0.08	0.13	0.13	0.08	0.14	0.13	0.08	0.10	0.08	0.11
0.17	0.21	0.20	0.17	0.21	0.21	0.17	0.20	0.20	0.17	0.21	0.20	0.17	0.16	0.17	0.17
0.30	0.29	0.27	0.30	0.29	0.28	0.30	0.28	0.28	0.30	0.28	0.28	0.30	0.22	0.30	0.24

0.47	0.36	0.35	0.47	0.36	0.35	0.47	0.35	0.35	0.47	0.36	0.35	0.47	0.29	0.47	0.32
0.67	0.44	0.42	0.67	0.44	0.43	0.67	0.42	0.42	0.67	0.43	0.42	0.67	0.36	0.67	0.40
0.91	0.52	0.50	0.91	0.51	0.50	0.91	0.50	0.50	0.91	0.51	0.50	0.91	0.43	0.91	0.48
1.16	0.59	0.57	1.16	0.59	0.58	1.16	0.57	0.57	1.16	0.58	0.57	1.16	0.50	1.16	0.55
1.45	0.66	0.64	1.45	0.66	0.65	1.45	0.65	0.65	1.45	0.66	0.65	1.45	0.57	1.45	0.64
1.81	0.75	0.73	1.81	0.75	0.73	1.81	0.73	0.73	1.81	0.74	0.73	1.81	0.66	1.81	0.73
2.13	0.81	0.79	2.13	0.82	0.80	2.13	0.80	0.80	2.13	0.81	0.80	2.13	0.73	2.13	0.80
2.52	0.89	0.87	2.52	0.89	0.87	2.52	0.87	0.87	2.52	0.88	0.87	2.52	0.80	2.52	0.89
2.72	0.92	0.90	2.72	0.93	0.91	2.72	0.91	0.91	2.72	0.92	0.91	2.72	0.84	2.72	0.93
3.40	1.04	1.02	3.40	1.05	1.02	3.40	1.03	1.03	3.40	1.04	1.02	3.40	0.96	3.40	1.06
4.00	1.18	1.19	4.00	1.19	1.18	4.00	1.19	1.19	4.00	1.19	1.19	4.00	1.22	4.00	1.22
4.25	1.22	1.23	4.25	1.23	1.23	4.25	1.23	1.23	4.25	1.23	1.23	4.25	1.26	4.25	1.26
4.50	1.26	1.27	4.50	1.27	1.27	4.50	1.27	1.27	4.50	1.27	1.27	4.50	1.30	4.50	1.30
4.75	1.30	1.32	4.75	1.31	1.31	4.75	1.32	1.32	4.75	1.31	1.32	4.75	1.34	4.75	1.34
5.00	1.35	1.37	5.00	1.35	1.36	5.00	1.37	1.37	5.00	1.35	1.36	5.00	1.39	5.00	1.39
5.25	1.40	1.42	5.25	1.39	1.41	5.25	1.42	1.42	5.25	1.40	1.41	5.25	1.44	5.25	1.44
5.50	1.45	1.47	5.50	1.44	1.46	5.50	1.47	1.47	5.50	1.45	1.47	5.50	1.48	5.50	1.48
5.75	1.50	1.53	5.75	1.49	1.52	5.75	1.52	1.52	5.75	1.50	1.52	5.75	1.54	5.75	1.54
6.00	1.56	1.59	6.00	1.54	1.58	6.00	1.58	1.58	6.00	1.56	1.58	6.00	1.59	6.00	1.59
6.25	1.62	1.65	6.25	1.59	1.64	6.25	1.64	1.64	6.25	1.62	1.64	6.25	1.65	6.25	1.65
6.50	1.68	1.71	6.50	1.64	1.70	6.50	1.70	1.70	6.50	1.67	1.70	6.50	1.70	6.50	1.70
6.75	1.74	1.78	6.75	1.70	1.77	6.75	1.77	1.77	6.75	1.74	1.77	6.75	1.76	6.75	1.76
7.00	1.81	1.84	7.00	1.76	1.83	7.00	1.83	1.83	7.00	1.80	1.84	7.00	1.83	7.00	1.83
7.25	1.87	1.91	7.25	1.82	1.90	7.25	1.90	1.90	7.25	1.87	1.91	7.25	1.89	7.25	1.89
7.50	1.94	1.99	7.50	1.88	1.97	7.50	1.97	1.97	7.50	1.93	1.98	7.50	1.96	7.50	1.96
7.75	2.02	2.06	7.75	1.95	2.05	7.75	2.05	2.05	7.75	2.01	2.05	7.75	2.03	7.75	2.03
8.00	2.09	2.14	8.00	2.02	2.13	8.00	2.13	2.13	8.00	2.08	2.13	8.00	2.10	8.00	2.10
8.25	2.17	2.22	8.25	2.09	2.21	8.25	2.21	2.21	8.25	2.15	2.21	8.25	2.18	8.25	2.18
8.50	2.25	2.31	8.50	2.16	2.29	8.50	2.29	2.29	8.50	2.23	2.29	8.50	2.25	8.50	2.25
8.75	2.33	2.39	8.75	2.23	2.37	8.75	2.37	2.37	8.75	2.31	2.38	8.75	2.33	8.75	2.33
9.00	2.41	2.48	9.00	2.31	2.46	9.00	2.46	2.46	9.00	2.39	2.47	9.00	2.41	9.00	2.41
9.25	2.50	2.57	9.25	2.39	2.55	9.25	2.55	2.55	9.25	2.48	2.56	9.25	2.50	9.25	2.50

9.50	2.59	2.66	9.50	2.47	2.64	9.50	2.64	2.64	9.50	2.57	2.65	9.50	2.58	9.50	2.58
9.75	2.68	2.76	9.75	2.55	2.74	9.75	2.73	2.73	9.75	2.65	2.74	9.75	2.67	9.75	2.67
10.00	2.77	2.86	10.00	2.64	2.83	10.00	2.83	2.83	10.00	2.75	2.84	10.00	2.76	10.00	2.76
10.25	2.87	2.96	10.25	2.72	2.93	10.25	2.93	2.93	10.25	2.84	2.94	10.25	2.86	10.25	2.86
10.50	2.97	3.06	10.50	2.81	3.03	10.50	3.03	3.03	10.50	2.94	3.04	10.50	2.95	10.50	2.95
10.75	3.07	3.17	10.75	2.90	3.14	10.75	3.13	3.13	10.75	3.04	3.15	10.75	3.05	10.75	3.05
11.00	3.17	3.27	11.00	3.00	3.25	11.00	3.24	3.24	11.00	3.14	3.25	11.00	3.15	11.00	3.15
11.25	3.28	3.38	11.25	3.09	3.36	11.25	3.35	3.35	11.25	3.24	3.36	11.25	3.25	11.25	3.25
11.50	3.39	3.50	11.50	3.19	3.47	11.50	3.46	3.46	11.50	3.34	3.47	11.50	3.35	11.50	3.35
11.75	3.50	3.61	11.75	3.29	3.58	11.75	3.57	3.57	11.75	3.45	3.59	11.75	3.46	11.75	3.46
12.00	3.61	3.73	12.00	3.39	3.70	12.00	3.69	3.69	12.00	3.56	3.70	12.00	3.57	12.00	3.57
12.25	3.72	3.85	12.25	3.50	3.82	12.25	3.80	3.80	12.25	3.68	3.82	12.25	3.68	12.25	3.68
12.50	3.84	3.97	12.50	3.60	3.94	12.50	3.92	3.92	12.50	3.79	3.95	12.50	3.79	12.50	3.79

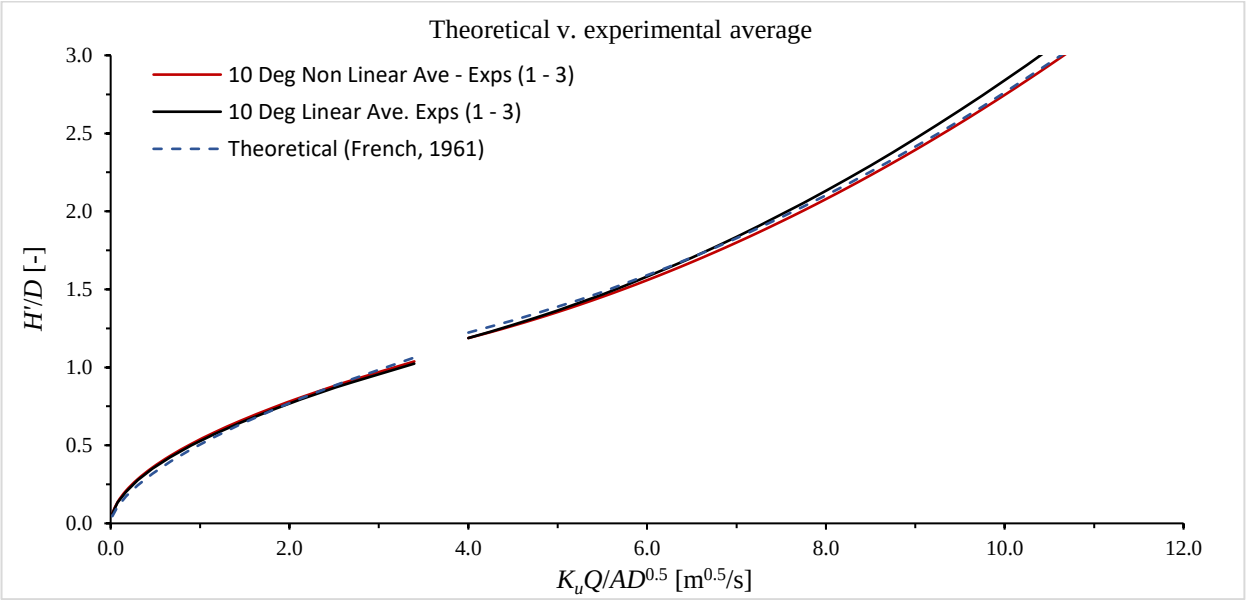

Figure 5-12: Inlet Control Results for 10 Deg Tapered Inlets vs (French, 1961) Data Results, Unblocked Cases.

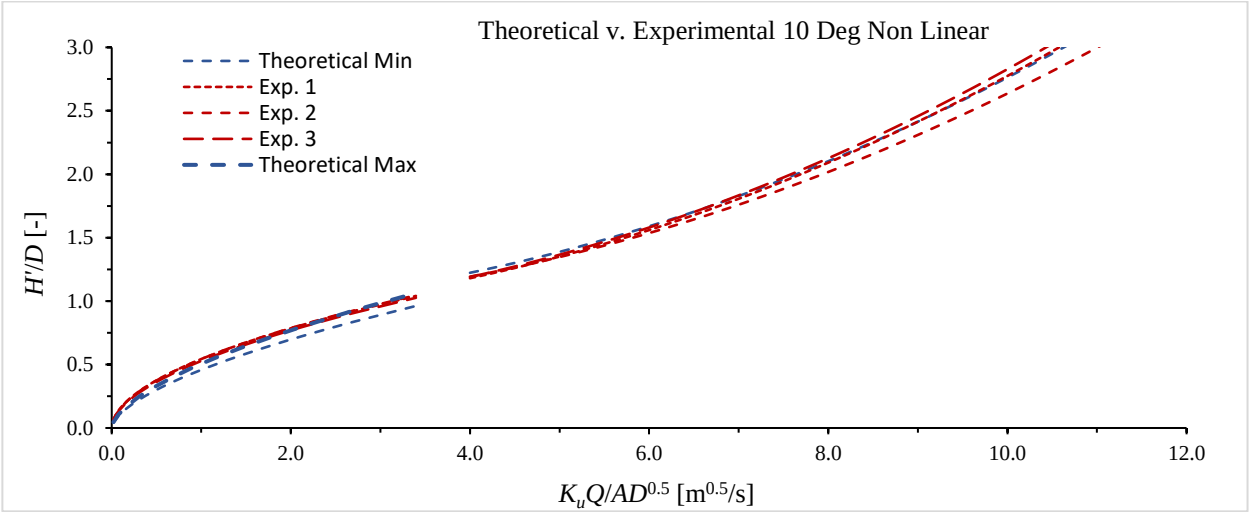

Figure 5-13: Inlet Control Results for 10 Deg Non-Linear Inlet, Unblocked Cases.

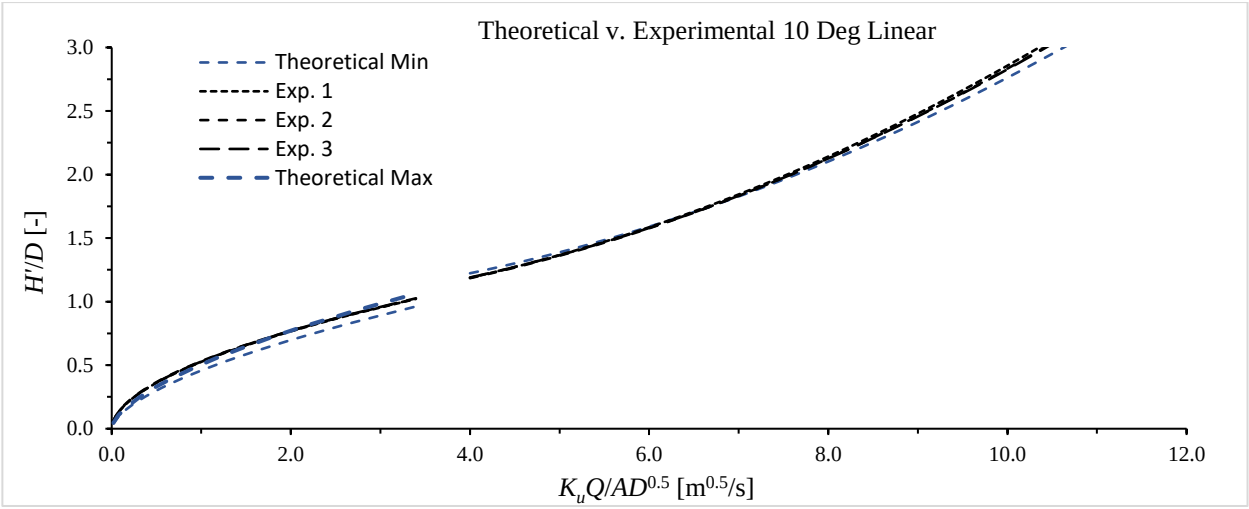

Figure 5-14: Inlet Control Results for 10 Deg Linear Inlet, Unblocked Cases

5.2.1.2 20 Deg Inlet

Table 5-12: Inlet Control Results for 20 Deg Linear and 20 Deg Non-Linear Inlets, Unblocked Cases.

Experimental and Theoretical (French, 1961) Results for 20 Deg Inlet															
Non Linear 20 Deg Coefficients															
K	0.5362		**K**	0.5408		**K**	0.5441		**K**	0.5404					
M	0.5485		**M**	0.5444		**M**	0.5340		**M**	0.5423					
c	0.0210		**c**	0.0218		**c**	0.0227		**c**	0.0218					
Y	0.8162		**Y**	0.7979		**Y**	0.7814		**Y**	0.7985					
Linear 20 Deg Coefficients												**French, 1961 Results**			
K	0.5262		**K**	0.5239		**K**	0.5263		**K**	0.5255		**K**	0.4645	**K**	0.5134
M	0.5576		**M**	0.5609		**M**	0.5561		**M**	0.5582		**M**	0.6070	**M**	0.6070
c	0.0159		**c**	0.0156		**c**	0.0156		**c**	0.0157		**c**	0.0204	**c**	0.0204
Y	0.9821		**Y**	0.9975		**Y**	1.0121		**Y**	0.9972		**Y**	0.8800	**Y**	0.8800
Experiment #1			**Experiment #2**			**Experiment #3**			**Average exp.**			**Theoretical - min**		**Theoretical - max**	
$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D	$K_uQ/AD^{0.5}$	H'/D
0.02	0.06	0.06	0.02	0.06	0.06	0.02	0.07	0.06	0.02	0.06	0.06	0.02	0.04	0.02	0.05
0.08	0.13	0.13	0.08	0.13	0.12	0.08	0.14	0.13	0.08	0.13	0.13	0.08	0.10	0.08	0.11
0.17	0.20	0.20	0.17	0.21	0.19	0.17	0.21	0.20	0.17	0.21	0.20	0.17	0.16	0.17	0.18
0.30	0.28	0.27	0.30	0.28	0.27	0.30	0.29	0.27	0.30	0.28	0.27	0.30	0.22	0.30	0.25
0.47	0.35	0.34	0.47	0.36	0.34	0.47	0.36	0.34	0.47	0.36	0.34	0.47	0.29	0.47	0.32
0.67	0.43	0.42	0.67	0.43	0.42	0.67	0.44	0.42	0.67	0.43	0.42	0.67	0.36	0.67	0.40
0.91	0.51	0.50	0.91	0.51	0.50	0.91	0.52	0.50	0.91	0.51	0.50	0.91	0.44	0.91	0.48
1.16	0.58	0.57	1.16	0.59	0.57	1.16	0.59	0.57	1.16	0.59	0.57	1.16	0.51	1.16	0.56
1.45	0.66	0.65	1.45	0.66	0.65	1.45	0.66	0.65	1.45	0.66	0.65	1.45	0.58	1.45	0.64
1.81	0.74	0.73	1.81	0.75	0.73	1.81	0.75	0.73	1.81	0.75	0.73	1.81	0.67	1.81	0.74
2.13	0.81	0.80	2.13	0.82	0.80	2.13	0.82	0.80	2.13	0.81	0.80	2.13	0.74	2.13	0.81
2.52	0.89	0.88	2.52	0.89	0.88	2.52	0.89	0.88	2.52	0.89	0.88	2.52	0.81	2.52	0.90
2.72	0.93	0.92	2.72	0.93	0.92	2.72	0.93	0.92	2.72	0.93	0.92	2.72	0.85	2.72	0.94

3.40	1.05	1.04	3.40	1.05	1.04	3.40	1.05	1.04	3.40	1.05	1.04	3.40	0.98	3.40	1.08
4.00	1.15	1.24	4.00	1.15	1.25	4.00	1.15	1.26	4.00	1.15	1.25	4.00	1.21	4.00	1.21
4.25	1.20	1.27	4.25	1.19	1.28	4.25	1.19	1.29	4.25	1.19	1.28	4.25	1.25	4.25	1.25
4.50	1.24	1.30	4.50	1.24	1.31	4.50	1.24	1.33	4.50	1.24	1.32	4.50	1.29	4.50	1.29
4.75	1.29	1.34	4.75	1.29	1.35	4.75	1.29	1.36	4.75	1.29	1.35	4.75	1.34	4.75	1.34
5.00	1.34	1.38	5.00	1.34	1.39	5.00	1.35	1.40	5.00	1.34	1.39	5.00	1.39	5.00	1.39
5.25	1.40	1.42	5.25	1.40	1.43	5.25	1.41	1.44	5.25	1.40	1.43	5.25	1.44	5.25	1.44
5.50	1.45	1.46	5.50	1.46	1.47	5.50	1.47	1.48	5.50	1.46	1.47	5.50	1.50	5.50	1.50
5.75	1.51	1.51	5.75	1.52	1.51	5.75	1.53	1.53	5.75	1.52	1.52	5.75	1.56	5.75	1.56
6.00	1.57	1.55	6.00	1.58	1.56	6.00	1.60	1.57	6.00	1.58	1.56	6.00	1.62	6.00	1.62
6.25	1.64	1.60	6.25	1.65	1.61	6.25	1.67	1.62	6.25	1.65	1.61	6.25	1.68	6.25	1.68
6.50	1.70	1.65	6.50	1.72	1.66	6.50	1.74	1.67	6.50	1.72	1.66	6.50	1.74	6.50	1.74
6.75	1.77	1.71	6.75	1.79	1.71	6.75	1.82	1.72	6.75	1.79	1.71	6.75	1.81	6.75	1.81
7.00	1.85	1.76	7.00	1.86	1.76	7.00	1.90	1.78	7.00	1.87	1.77	7.00	1.88	7.00	1.88
7.25	1.92	1.82	7.25	1.94	1.82	7.25	1.98	1.83	7.25	1.95	1.82	7.25	1.95	7.25	1.95
7.50	2.00	1.88	7.50	2.02	1.88	7.50	2.06	1.89	7.50	2.03	1.88	7.50	2.03	7.50	2.03
7.75	2.08	1.94	7.75	2.11	1.94	7.75	2.15	1.95	7.75	2.11	1.94	7.75	2.11	7.75	2.11
8.00	2.16	2.00	8.00	2.19	2.00	8.00	2.24	2.01	8.00	2.20	2.00	8.00	2.19	8.00	2.19
8.25	2.25	2.06	8.25	2.28	2.06	8.25	2.33	2.08	8.25	2.29	2.07	8.25	2.27	8.25	2.27
8.50	2.34	2.13	8.50	2.37	2.13	8.50	2.42	2.14	8.50	2.38	2.13	8.50	2.36	8.50	2.36
8.75	2.43	2.20	8.75	2.46	2.19	8.75	2.52	2.21	8.75	2.47	2.20	8.75	2.44	8.75	2.44
9.00	2.52	2.27	9.00	2.56	2.26	9.00	2.62	2.28	9.00	2.57	2.27	9.00	2.54	9.00	2.54
9.25	2.61	2.34	9.25	2.66	2.33	9.25	2.73	2.35	9.25	2.67	2.34	9.25	2.63	9.25	2.63
9.50	2.71	2.42	9.50	2.76	2.41	9.50	2.83	2.42	9.50	2.77	2.42	9.50	2.72	9.50	2.72
9.75	2.81	2.49	9.75	2.87	2.48	9.75	2.94	2.50	9.75	2.87	2.49	9.75	2.82	9.75	2.82
10.00	2.92	2.57	10.00	2.97	2.56	10.00	3.05	2.57	10.00	2.98	2.57	10.00	2.92	10.00	2.92
10.25	3.02	2.65	10.25	3.09	2.64	10.25	3.17	2.65	10.25	3.09	2.65	10.25	3.03	10.25	3.03
10.50	3.13	2.73	10.50	3.20	2.72	10.50	3.29	2.73	10.50	3.21	2.73	10.50	3.13	10.50	3.13
10.75	3.25	2.82	10.75	3.31	2.80	10.75	3.41	2.82	10.75	3.32	2.81	10.75	3.24	10.75	3.24
11.00	3.36	2.91	11.00	3.43	2.89	11.00	3.53	2.90	11.00	3.44	2.90	11.00	3.35	11.00	3.35
11.25	3.48	2.99	11.25	3.55	2.98	11.25	3.66	2.99	11.25	3.56	2.99	11.25	3.47	11.25	3.47
11.50	3.60	3.08	11.50	3.68	3.06	11.50	3.79	3.08	11.50	3.69	3.08	11.50	3.58	11.50	3.58

11.75	3.72	3.18	11.75	3.80	3.15	11.75	3.92	3.17	11.75	3.81	3.17	11.75	3.70	11.75	3.70
12.00	3.84	3.27	12.00	3.93	3.25	12.00	4.05	3.26	12.00	3.94	3.26	12.00	3.82	12.00	3.82
12.25	3.97	3.37	12.25	4.06	3.34	12.25	4.19	3.36	12.25	4.08	3.36	12.25	3.95	12.25	3.95
12.50	4.10	3.47	12.50	4.20	3.44	12.50	4.33	3.45	12.50	4.21	3.45	12.50	4.07	12.50	4.07

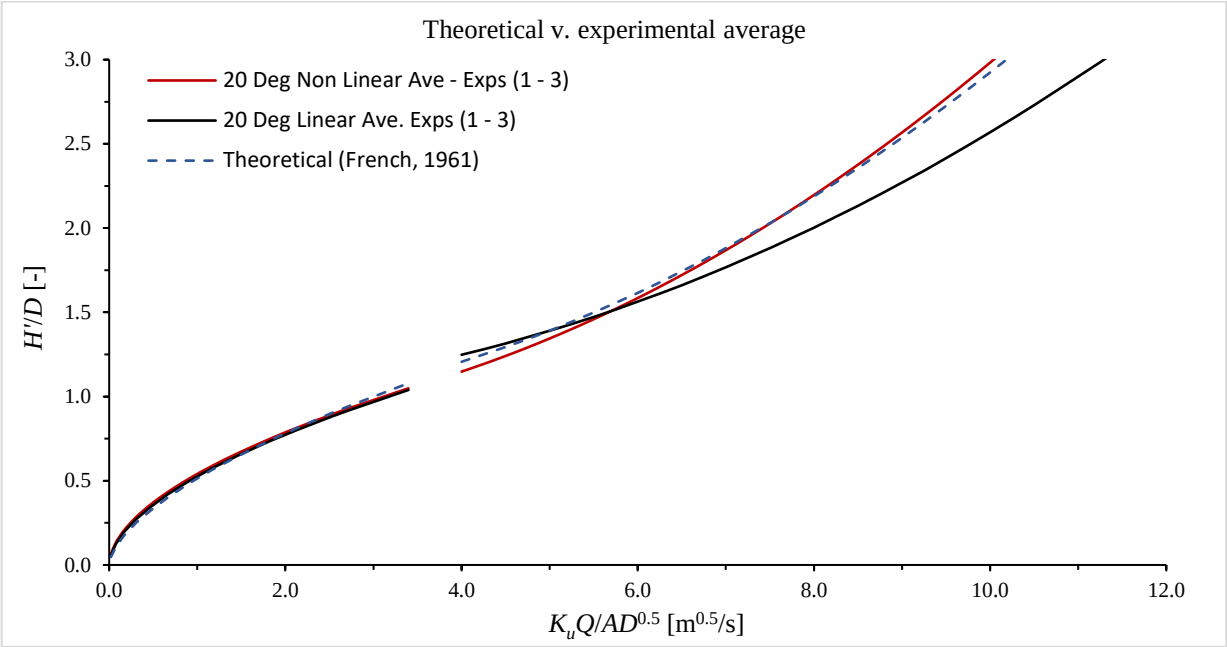

Figure 5-15: Inlet Control Results for 20 Deg Tapered Inlets vs (French, 1961) Data Results, Unblocked Cases.

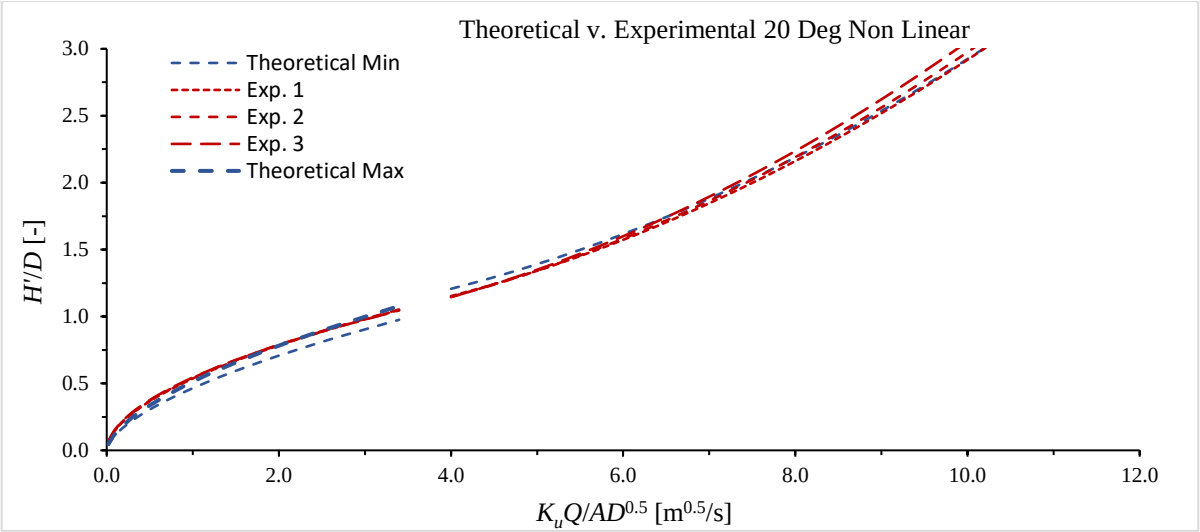

Figure 5-16: Inlet Control Results for 20 Deg Non-Linear Inlet, Unblocked Cases.

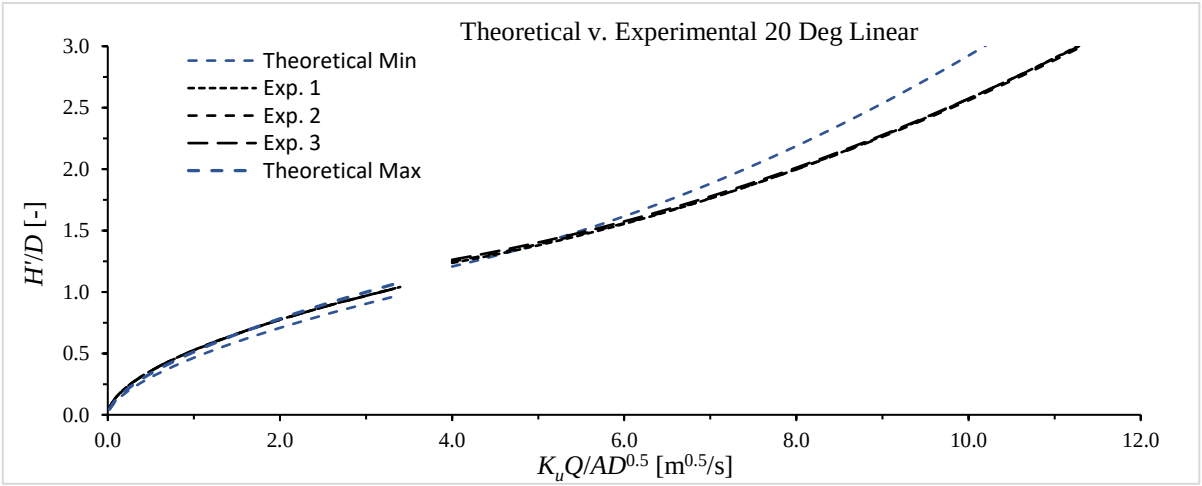

Figure 5-17: Inlet Control Results for 20 Deg Linear Inlet, Unblocked Cases.

5.2.1.3 33.7 Deg Inlet

Table 5-13: Inlet Control Results for 33.7 Deg Linear and 33.7 Deg Non-Linear Inlets, Unblocked Cases.

Experimental and Theoretical (French, 1961) Results for 33.7 Deg Inlet															
Non Linear 33.7 Deg Coefficients															
K	0.5458		**K**	0.5505		**K**	0.5474		**K**	0.5479					
M	0.5510		**M**	0.5484		**M**	0.5597		**M**	0.5530					
c	0.0257		**c**	0.0260		**c**	0.0259		**c**	0.0259					
Y	0.7996		**Y**	0.8019		**Y**	0.8087		**Y**	0.8034					
Linear 33.7 Deg Coefficients												**French, 1961 Results**			
K	0.5356		**K**	0.5328		**K**	0.5312		**K**	0.5332		**K**	0.4790	**K**	0.5294
M	0.5463		**M**	0.5514		**M**	0.5545		**M**	0.5507		**M**	0.6070	**M**	0.6070
c	0.0239		**c**	0.0237		**c**	0.0238		**c**	0.0238		**c**	0.0241	**c**	0.0241
Y	0.8112		**Y**	0.8107		**Y**	0.8077		**Y**	0.8099		**Y**	0.8197	**Y**	0.8197
Experiment #1			**Experiment #2**			**Experiment #3**			**Average exp.**			**Theoretical - min**		**Theoretical - max**	
$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D Non Linear Inlet	H'/D Linear Inlet	$K_uQ/AD^{0.5}$	H'/D	$K_uQ/AD^{0.5}$	H'/D
0.02	0.06	0.06	0.02	0.06	0.06	0.02	0.06	0.06	0.02	0.06	0.06	0.02	0.04	0.02	0.05
0.08	0.13	0.13	0.08	0.14	0.13	0.08	0.13	0.13	0.08	0.13	0.13	0.08	0.10	0.08	0.11
0.17	0.21	0.20	0.17	0.21	0.20	0.17	0.20	0.20	0.17	0.21	0.20	0.17	0.16	0.17	0.18
0.30	0.28	0.28	0.30	0.29	0.28	0.30	0.28	0.27	0.30	0.28	0.28	0.30	0.23	0.30	0.26
0.47	0.36	0.35	0.47	0.36	0.35	0.47	0.36	0.35	0.47	0.36	0.35	0.47	0.30	0.47	0.33
0.67	0.44	0.43	0.67	0.44	0.43	0.67	0.44	0.42	0.67	0.44	0.43	0.67	0.37	0.67	0.41
0.91	0.52	0.51	0.91	0.52	0.50	0.91	0.52	0.50	0.91	0.52	0.50	0.91	0.45	0.91	0.50
1.16	0.59	0.58	1.16	0.60	0.58	1.16	0.59	0.58	1.16	0.59	0.58	1.16	0.52	1.16	0.58
1.45	0.67	0.66	1.45	0.68	0.65	1.45	0.67	0.65	1.45	0.67	0.66	1.45	0.60	1.45	0.66
1.81	0.76	0.74	1.81	0.76	0.74	1.81	0.76	0.74	1.81	0.76	0.74	1.81	0.69	1.81	0.76
2.13	0.83	0.81	2.13	0.83	0.81	2.13	0.84	0.81	2.13	0.83	0.81	2.13	0.76	2.13	0.84
2.52	0.91	0.89	2.52	0.91	0.89	2.52	0.92	0.89	2.52	0.91	0.89	2.52	0.84	2.52	0.93
2.72	0.95	0.92	2.72	0.95	0.92	2.72	0.96	0.92	2.72	0.95	0.92	2.72	0.88	2.72	0.97

3.40	1.07	1.04	3.40	1.08	1.05	3.40	1.09	1.05	3.40	1.08	1.05	3.40	1.01	3.40	1.11
4.00	1.21	1.19	4.00	1.22	1.19	4.00	1.22	1.19	4.00	1.22	1.19	4.00	1.21	4.00	1.21
4.25	1.26	1.24	4.25	1.27	1.24	4.25	1.28	1.24	4.25	1.27	1.24	4.25	1.26	4.25	1.26
4.50	1.32	1.29	4.50	1.33	1.29	4.50	1.33	1.29	4.50	1.33	1.29	4.50	1.31	4.50	1.31
4.75	1.38	1.35	4.75	1.39	1.34	4.75	1.39	1.34	4.75	1.39	1.35	4.75	1.36	4.75	1.36
5.00	1.44	1.41	5.00	1.45	1.40	5.00	1.46	1.40	5.00	1.45	1.40	5.00	1.42	5.00	1.42
5.25	1.51	1.47	5.25	1.52	1.46	5.25	1.52	1.46	5.25	1.52	1.47	5.25	1.48	5.25	1.48
5.50	1.58	1.53	5.50	1.59	1.53	5.50	1.59	1.53	5.50	1.59	1.53	5.50	1.55	5.50	1.55
5.75	1.65	1.60	5.75	1.66	1.59	5.75	1.67	1.59	5.75	1.66	1.60	5.75	1.62	5.75	1.62
6.00	1.73	1.67	6.00	1.74	1.66	6.00	1.74	1.66	6.00	1.74	1.67	6.00	1.69	6.00	1.69
6.25	1.80	1.74	6.25	1.82	1.74	6.25	1.82	1.74	6.25	1.81	1.74	6.25	1.76	6.25	1.76
6.50	1.89	1.82	6.50	1.90	1.81	6.50	1.90	1.81	6.50	1.90	1.81	6.50	1.84	6.50	1.84
6.75	1.97	1.90	6.75	1.99	1.89	6.75	1.99	1.89	6.75	1.98	1.89	6.75	1.92	6.75	1.92
7.00	2.06	1.98	7.00	2.08	1.97	7.00	2.08	1.97	7.00	2.07	1.97	7.00	2.00	7.00	2.00
7.25	2.15	2.07	7.25	2.17	2.05	7.25	2.17	2.06	7.25	2.16	2.06	7.25	2.09	7.25	2.09
7.50	2.25	2.15	7.50	2.27	2.14	7.50	2.27	2.14	7.50	2.26	2.15	7.50	2.18	7.50	2.18
7.75	2.35	2.25	7.75	2.37	2.23	7.75	2.36	2.24	7.75	2.36	2.24	7.75	2.27	7.75	2.27
8.00	2.45	2.34	8.00	2.47	2.33	8.00	2.47	2.33	8.00	2.46	2.33	8.00	2.36	8.00	2.36
8.25	2.55	2.44	8.25	2.57	2.42	8.25	2.57	2.43	8.25	2.57	2.43	8.25	2.46	8.25	2.46
8.50	2.66	2.54	8.50	2.68	2.52	8.50	2.68	2.53	8.50	2.67	2.53	8.50	2.56	8.50	2.56
8.75	2.77	2.64	8.75	2.80	2.62	8.75	2.79	2.63	8.75	2.79	2.63	8.75	2.67	8.75	2.67
9.00	2.88	2.75	9.00	2.91	2.73	9.00	2.91	2.73	9.00	2.90	2.74	9.00	2.77	9.00	2.77
9.25	3.00	2.85	9.25	3.03	2.84	9.25	3.03	2.84	9.25	3.02	2.84	9.25	2.88	9.25	2.88
9.50	3.12	2.97	9.50	3.15	2.95	9.50	3.15	2.95	9.50	3.14	2.96	9.50	3.00	9.50	3.00
9.75	3.25	3.08	9.75	3.28	3.06	9.75	3.27	3.07	9.75	3.27	3.07	9.75	3.11	9.75	3.11
10.00	3.37	3.20	10.00	3.41	3.18	10.00	3.40	3.19	10.00	3.39	3.19	10.00	3.23	10.00	3.23
10.25	3.50	3.32	10.25	3.54	3.30	10.25	3.53	3.31	10.25	3.52	3.31	10.25	3.35	10.25	3.35
10.50	3.64	3.44	10.50	3.67	3.42	10.50	3.66	3.43	10.50	3.66	3.43	10.50	3.48	10.50	3.48
10.75	3.77	3.57	10.75	3.81	3.55	10.75	3.80	3.56	10.75	3.80	3.56	10.75	3.61	10.75	3.61
11.00	3.91	3.70	11.00	3.95	3.67	11.00	3.94	3.68	11.00	3.94	3.69	11.00	3.74	11.00	3.74
11.25	4.06	3.83	11.25	4.10	3.81	11.25	4.09	3.82	11.25	4.08	3.82	11.25	3.87	11.25	3.87

11.50	4.20	3.97	11.50	4.25	3.94	11.50	4.23	3.95	11.50	4.23	3.95	11.50	4.01	11.50	4.01
11.75	4.35	4.11	11.75	4.40	4.08	11.75	4.39	4.09	11.75	4.38	4.09	11.75	4.15	11.75	4.15
12.00	4.51	4.25	12.00	4.55	4.22	12.00	4.54	4.23	12.00	4.53	4.23	12.00	4.29	12.00	4.29
12.25	4.66	4.39	12.25	4.71	4.36	12.25	4.70	4.38	12.25	4.69	4.38	12.25	4.44	12.25	4.44
12.50	4.82	4.54	12.50	4.87	4.51	12.50	4.86	4.52	12.50	4.85	4.52	12.50	4.59	12.50	4.59

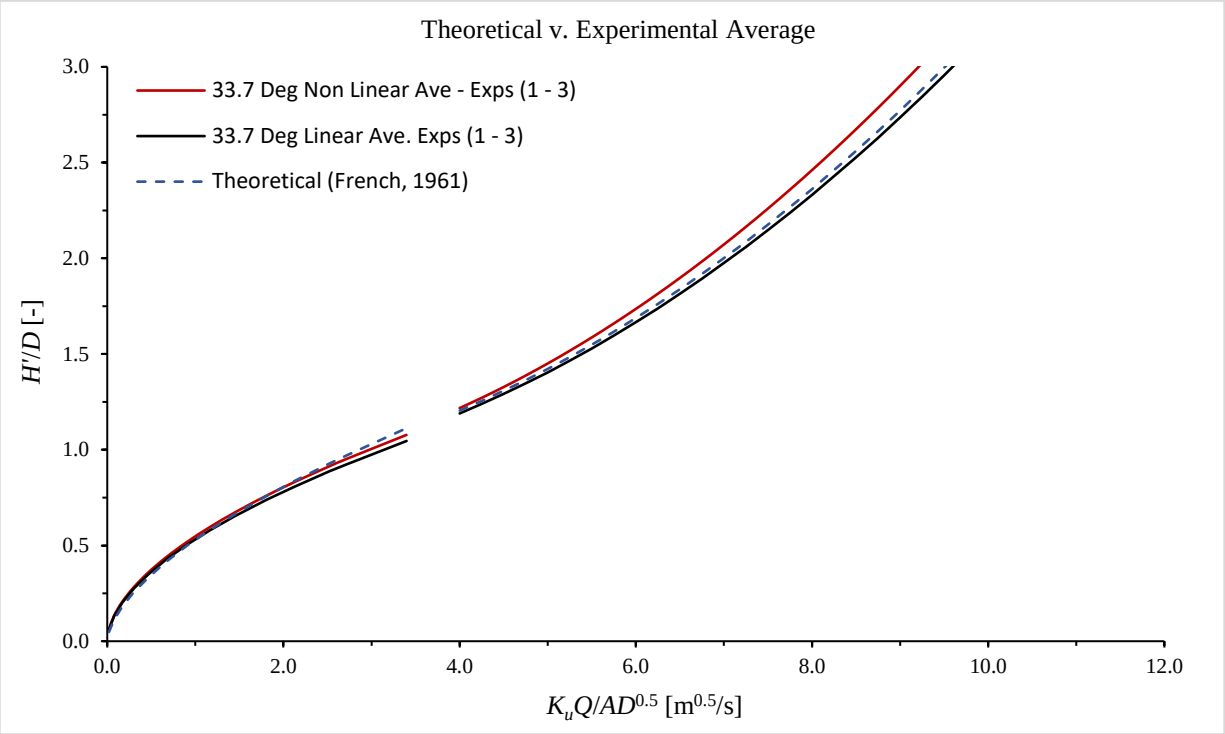

Figure 5-18 : Inlet Control Results for 33.7 Deg Tapered Inlets vs (French, 1961) Data Results, Unblocked Cases.

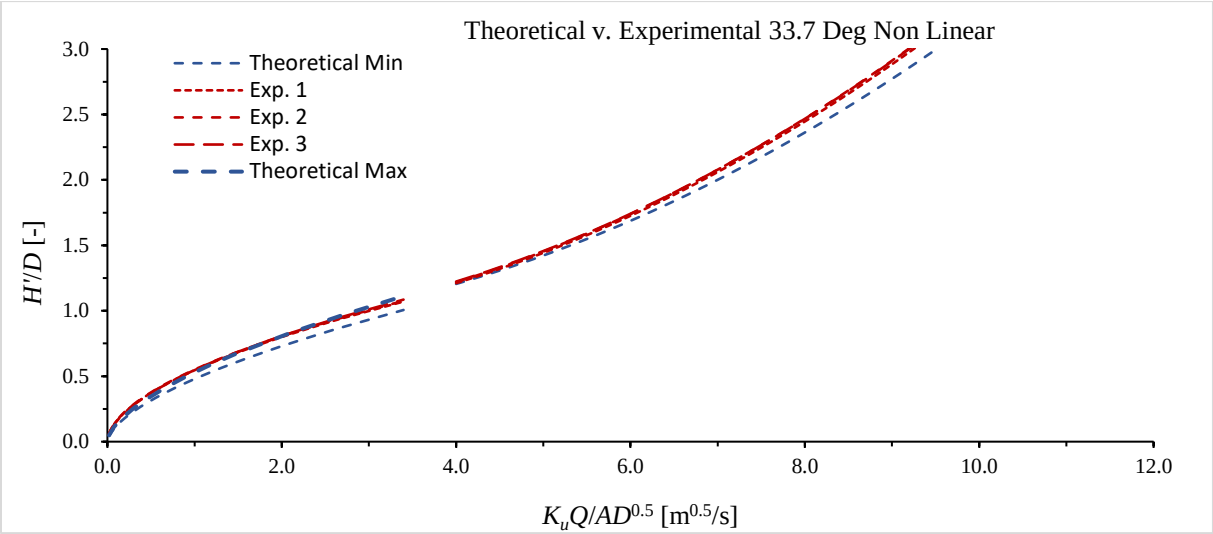

Figure 5-19: Inlet Control Results for 33.7 Deg Non-Linear Inlet, Unblocked Cases.

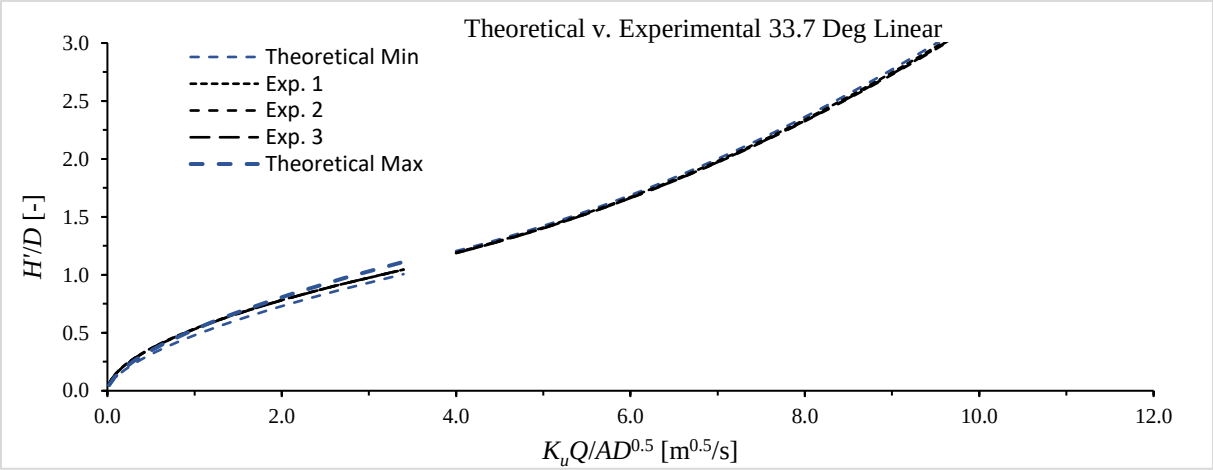

Figure 5-20: Inlet Control Results for 33.7 Deg Linear Inlet, Unblocked Cases.

5.2.2 Inlet Blockage Effects

The hydraulic efficiencies of linear and non-linear optimized inlets using blockage elements were also analyzed. Two blockage ratios of 37.5% and 75% were selected to observe their influences and results in terms of *(Qb/Q)* vs the dimensionless headwater elevation H*. The uncertainty intervals for the *(Qb/Q)* values are shown in the form of *(Qb/Q)* Max and *(Qb/Q)* Min at their respective results tables.

5.2.2.1 10 Deg Inlets

Table 5-14: Inlet Control Blockage Effects Results for 10 Deg Linear and 10 Deg Non-Linear Inlets.

10 Deg Linear								***10 Deg Non Linear***							
	Measured			***Max.***		***Min.***			***Measured***			***Max.***		***Min.***	
Case	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A	***Case***	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A
37.5%	0.738	0.00	0.375	0.83	0.369	0.65	0.381	37.5%	0.593	0.000	0.375	0.677	0.369	0.510	0.381
Block	0.738	3.00	0.375	0.83	0.369	0.65	0.381	Block	0.593	3.000	0.375	0.677	0.369	0.510	0.381
75%	0.374	0.00	0.750	0.42	0.741	0.33	0.758	75%	0.260	0.000	0.750	0.297	0.741	0.224	0.758
Block	0.374	3.00	0.750	0.42	0.741	0.33	0.758	Block	0.260	3.000	0.750	0.297	0.741	0.224	0.758

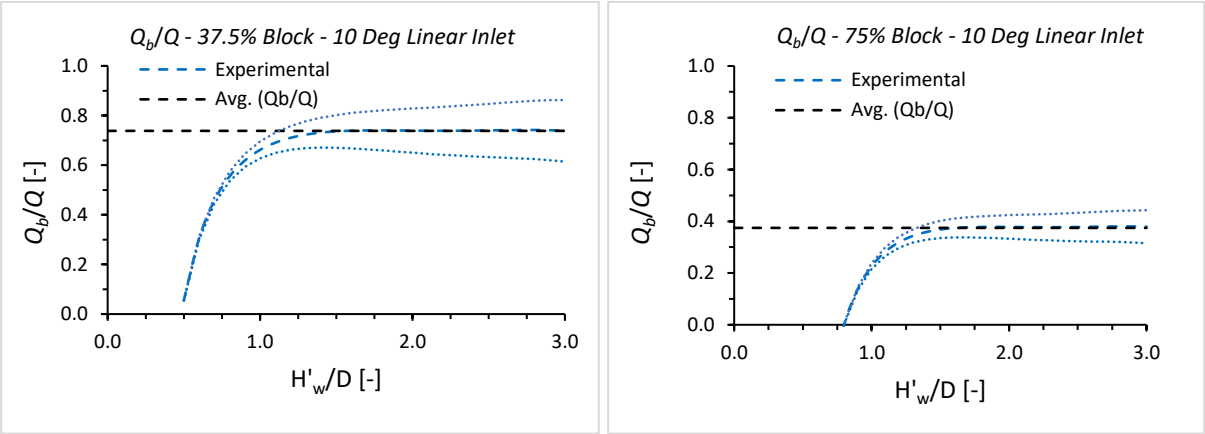

Figure 5-21: 37.5% and 75% Blockage Effects for 10 Deg Linear Inlets.

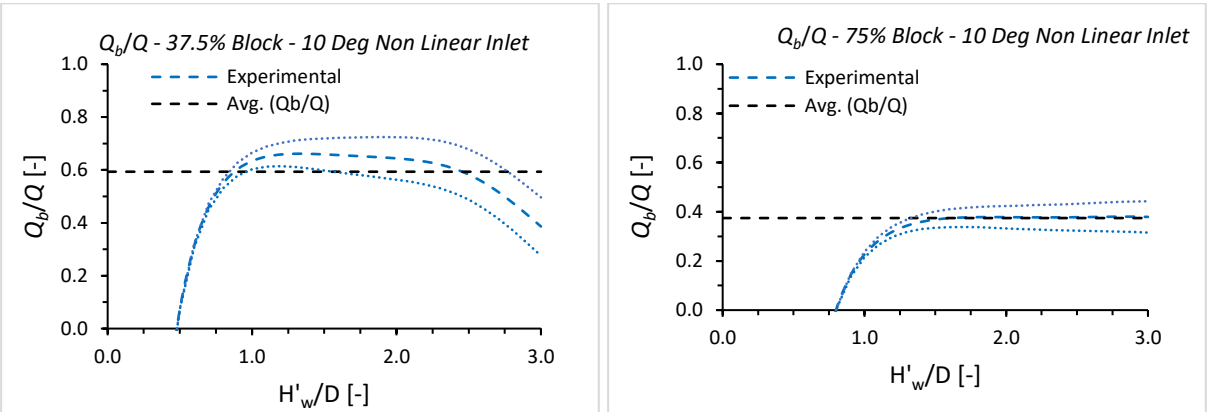

Figure 5-22: 37.5% and 75% Blockage Effects for 10 Deg Non-Linear Inlets.

5.2.2.2 20 Deg Inlets

Table 5-15: Inlet Control Blockage Effects Results for 20 Deg Linear and 20 Deg Non-Linear Inlets.

20 Deg Linear								20 Deg Non Linear							
	Measured			Max.		Min.			Measured			Max.		Min.	
Case	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A	Case	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A
37.5% Block	0.705	0.00	0.375	0.79	0.369	0.62	0.381	37.5% Block	0.646	0.00	0.375	0.72	0.369	0.57	0.381
	0.705	3.00	0.375	0.79	0.369	0.62	0.381		0.646	3.00	0.375	0.72	0.369	0.57	0.381
75% Block	0.339	0.00	0.750	0.37	0.741	0.29	0.758	75% Block	0.287	0.00	0.750	0.32	0.741	0.25	0.758
	0.339	3.00	0.750	0.37	0.741	0.29	0.758		0.287	3.00	0.750	0.32	0.741	0.25	0.758

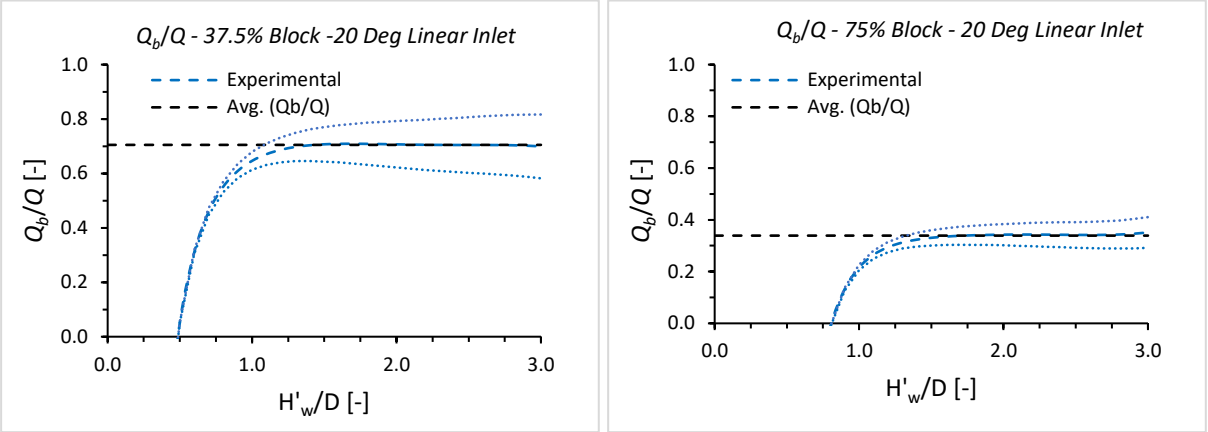

Figure 5-23: 37.5% and 75% Blockage Effects for 20 Deg Linear Inlets.

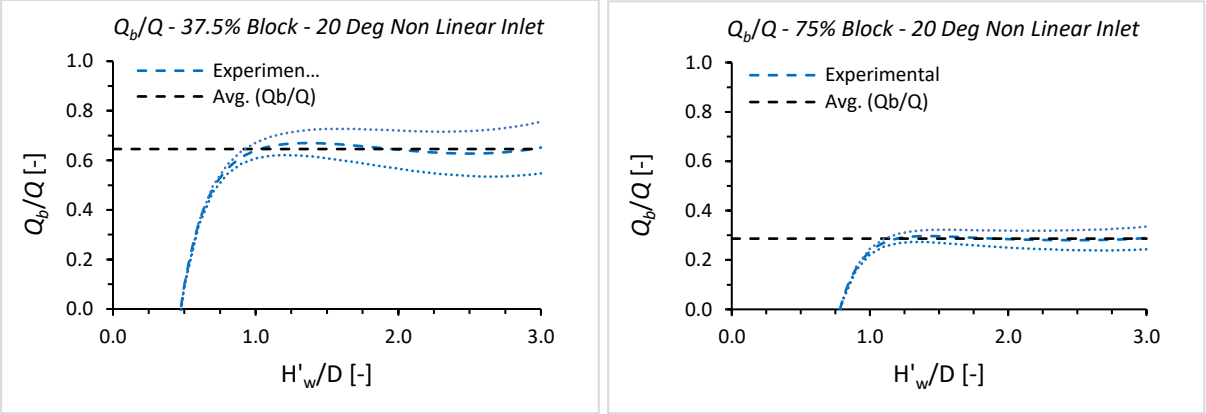

Figure 5-24: 37.5% and 75% Blockage Effects for 20 Deg Non-Linear Inlet.

5.2.2.3 33.7 Deg Inlets

Table 5-16: Inlet Control Blockage Effects Results for 33.7 Deg Linear and 33.7 Deg Non-Linear Inlets.

33.7 Deg Linear								33.7 Deg Non Linear							
	Measured			Max.		Min.			Measured			Max.		Min.	
Case	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A	Case	Q_b/Q	H_w'/D	A_b/A	Q_b/Q	A_b/A	Q_b/Q	A_b/A
37.5% Block	0.714	0.00	0.375	0.79	0.369	0.63	0.381	37.5% Block	0.650	0.00	0.375	0.72	0.369	0.58	0.381
	0.714	3.00	0.375	0.79	0.369	0.63	0.381		0.650	3.00	0.375	0.72	0.369	0.58	0.381
75% Block	0.387	0.00	0.750	0.42	0.741	0.34	0.758	75% Block	0.269	0.00	0.750	0.29	0.741	0.23	0.758
	0.387	3.00	0.750	0.42	0.741	0.34	0.758		0.269	3.00	0.750	0.29	0.741	0.23	0.758

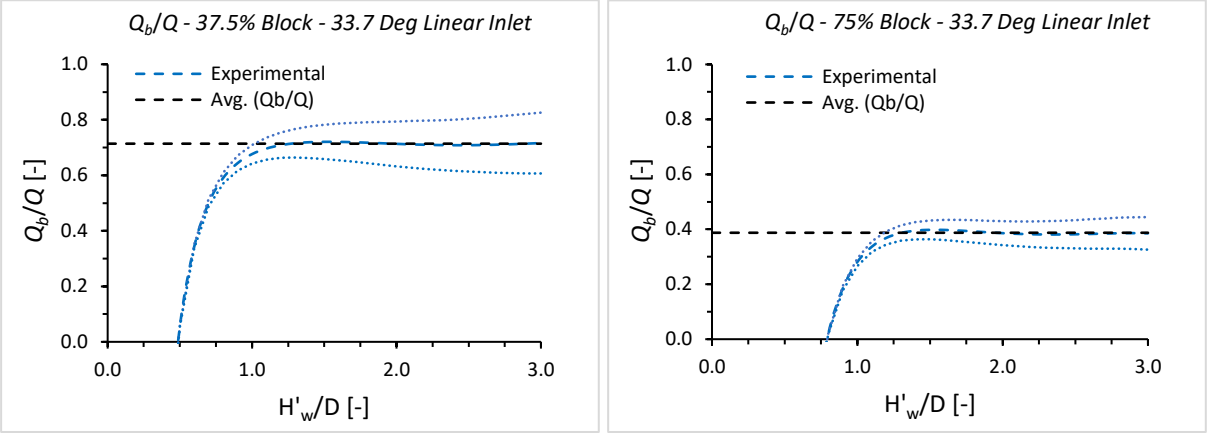

Figure 5-25: 37.5% and 75% Blockage Effects for 33.7 Deg Linear Inlets.

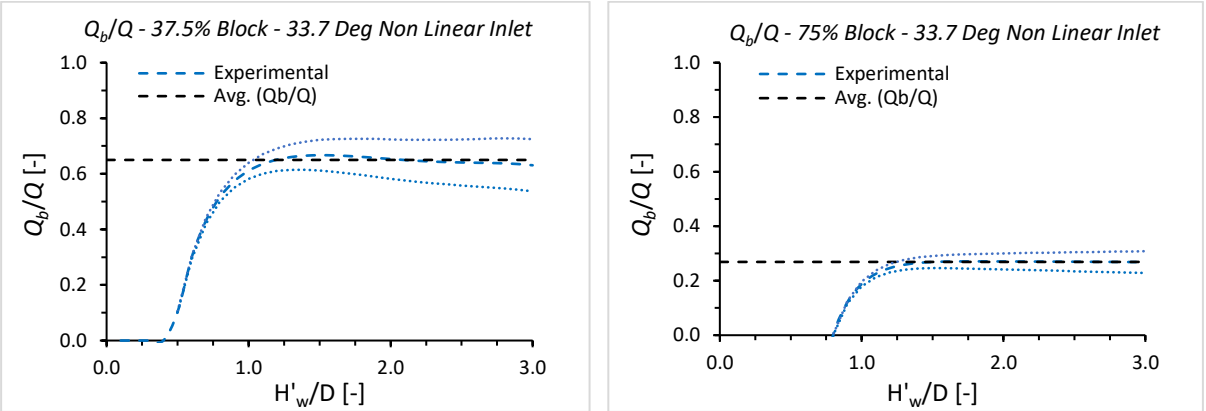

Figure 5-26: 37.5% and 75% Blockage Effects for 10 Deg Non-Linear Inlets.

5.2.3 Uncertainty

Errors for each of the average dimensionless Q* and H* values have been calculated for the blocked and unlocked cases. However, the scope of this research does not include an extended uncertainty analysis, but the basic components are shown below in Table 5-17.

Table 5-17: Uncertainty Intervals for Basic Parameters for Inlet Control Calculations.

Parameter	***Definition***	***Uncertainty Interval***
D	Barrel Diameter	0.001
S	Barrel Slope	0.003
z_a	Block Element Height	0.002
y_a	Headwater Height	0.00054
w_a	Tank Width	0.002
g	Gravity	0.010

6 Discussion

6.1 Outlet Control

Experiments were performed to evaluate the hydraulic efficiencies under unblocked and blocked inlet scenarios. For the unblocked cases, there were three experiments performed using the same discharges for each of the linear and non-linear inlets, this was done for repeatability purposes. For the blocked cases, only one experiment per each blocked area ratio block, 37.5% and 75%, where performed for each of the linear and non-linear inlets. For the experiments under outlet control conditions, type 4 flow was represented in the culvert. To ensure the culvert had full and subcritical flow, the results included in Appendix A, demonstrated the energy grade line to be on and above the culvert crown. In addition, the culvert outlet was fully submerged at the outlet tank.

The hydraulic efficiencies for the linear and elliptical arc inlets are depicted in Chapter 5. The results demonstrate that most of entrance head loss coefficients, as averaged values for the 10^0, 20^0, and 33.7^0 linear inlets are within uncertainty, and their R-square correlations, from a second order polynomial trendline, are well above 90%. However, for the first data point in Figure 5-5 for the 33.7 deg linear inlet, the value and error bars falls outside the averaged *(Ke)* value.

The blocked linear and non-linear scenarios, results were summarized from Figure 5-9 to Figure 5.11 in Chapter 5. It was observed that the hydraulic efficiencies of the inlets decreased as the blockage area ratio increased from 37.5% to 75%. And that the *(Ke)* values for the optimized inlets were higher than the ones from the conventional inlets. It was a surprising result given that the inlets were initially assumed to performed better than optimized. However, lower efficiencies at the optimized inlets when compared to the conventional inlets can be attributed to the varying inlet face's crossection area due to elliptical arc inlets (Sellevold, Norem, et al., 2023). Furthermore, the data obtained was compared to the blockage results using the algorithms from (Weeks, et al). The results obtained from the experiments show some significant differences when compared to (Weeks, et al). These differences could be attributed to errors in the experimental execution and different model settings. However, the correlation between the data points for each of the linear and non-linear inlets, from Figure 5-9 to Figure 5.11, seems to be strong based on their linear correlation and R-square values above 90%.

Figure 5.4 shows a result comparison for *(Ke)* values of linear and non-linear 20^0 inlets for the unblocked cases. It was noticed that the R-square correlation between the average *(Ke)* and (Hw/D) was below 80%. Initially, it was a point of concern however, R-square can be easily misplaced by outliers within the data. This outlier can be generated by the unstable headwater elevations at very low discharges or instrumental errors in the model setup. However, it was further concluded that R-square is a mathematical indicator that establishes correlations between two variables, and it does not take in consideration all the potential factors that can contribute the decrease or increase of entrance head loss coefficients.

It was observed during experiments and seen in the results that at very low discharges, the headwater elevations tended to behave very unstable and even after a long stabilization period the headwater levels fluctuated beyond its uncertainty value. Thus, the results showed very high *(Ke)* and uncertainty results.

Additional fluctuations within individual *(Ke)* values were observed therefore, to understand the possible influencing factors on *(Ke)* an additional experiment was performed. This additional experiment related to increasing discharge and maintaining the same headwater elevation by lowering the tailwater elevation at the outlet tank. Full flow inside the culvert barrel and full submergence at the outlet was maintained, and the weir plate was reduced by 7.5 cm.

The (Ke) values drastically decreased by lowering the tailwater. The result from this experiment is shown in Figure 5-8. The graph shows some correlations between the variation of *(Ke)* and the Reynolds number at the Approach channel and inside the barrel. It was found that the Ke values had a stronger correlation to the approach Reynolds number than to the barrel Reynolds number, hinting at the possibility of affecting the entrance head loss coefficient by turbulent flow at the approach channel. However, these relationships cannot be certified or taken as facts, the results used to determine these suspicions were generated from only one experiment without repeatability. Also, these two variables *(Ke)* and *(Re)* can coincidentally behave in a similar manner without any direct or real proven dependency.

Additionally, the fluctuation on the *(Ke)* values could be also attributed to potential errors in the experimental execution and instruments used. During the experimental process, it was found that some air could have been trapped at the pressure taps due to the way the pressure taps were built. Consequently, the pressure sensor could potentially provide erroneous readings. Issues with the pressure sensor readings have direct negative consequences on the Ke results, given that they provide the pressure heads need to calculate entrance head loss coefficients. Moreover, there was some leakage in the system and sediment were constantly removed from the orifices at the pressure taps during calibration. Thus, it is suggested that further research through computational fluid mechanics is performed to avoid potential scale effects and errors due to experimental execution or state of measurement instruments.

Overall, the results enclosed from Figure 5.1 to Figure 5-6 for linear and non-linear inlets show that most of the *(Ke)* values for each inlet, for unblocked cases, are within uncertainty. Additionally, to check if results for the conventional linear inlets were similar to other research efforts in the same area, they were compared against the data from (Idelchik et al., 2007) in Figure 5-7. The comparison showed that the *(Ke)* values for a given Δl/D (Edge Length/Diameter) ratio fitted in Idelchik's experimental results for tapered inlets.

6.2 Inlet Control

For inlet control experiments, efforts were done to make sure that supercritical flow was present in the culvert barrel. Piezometric heads were taken by using the pressure sensors and a Froude number above one was obtained for all the measurements. In addition, the barrel and the inlet tank were sloped to a 3% slope.

For the inlet control conditions, the results were summarized from Figure 5-12 to Figure 5-20 and for the unblocked cases results are shown from Figure 5-21 to Figure 5-26. The graphs demonstrate that the hydraulic efficiency of the optimized non-linear inlets was very high and superior to the conventional linear inlets for 20^{o} and 33.7^{o} taper angles. In additions the hydraulic efficiency for linear and non-linear inlets were within the theoretical maximum and minimum bounds, for unsubmerged and submerged flow, from to the results found by (French, 1961).

For the optimized inlets, the control section or flow limiting section was at the inlet throat which contributed towards the high hydraulic performance for the optimized non-linear inlets. This assumption coincides with (French, 1961) statements on inlets under inlet control conditions are being influenced by the geometry of the inlet and control section at the throat. It is assumed that the elliptical arc edge geometry in the optimized inlets and control section locations lowers the entrance head loss coefficients by reducing flow separation at the inlet edge. Figure 6-1 obtained during inlet control experiments using a 20^0 non-linear inlet shows smooth flow lines transitioning from the approach channel towards the culvert inlet under unsubmerged and submerged flow. Low flow separation is observed.

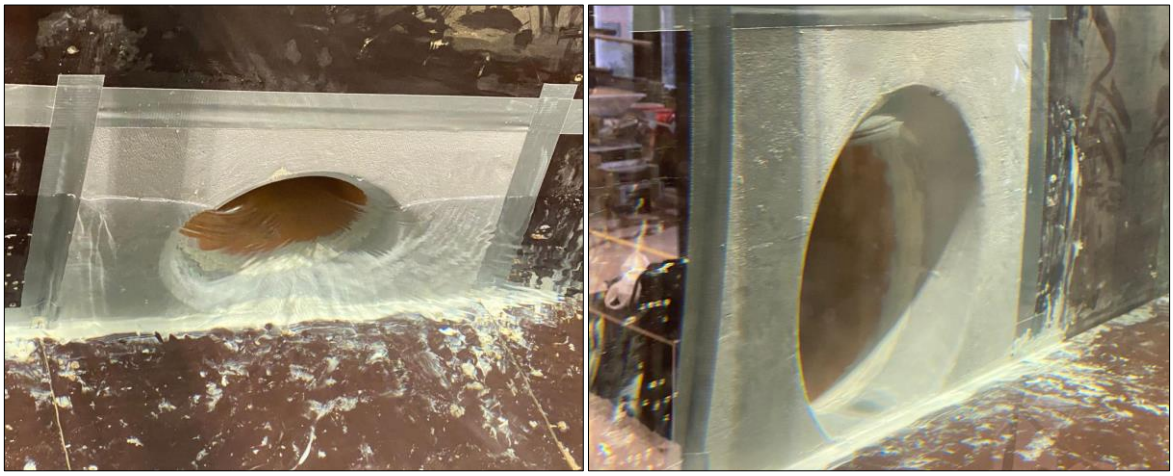

Figure 6-1: Experiment Using a 20^0 Non-Linear Inlet Under Inlet Control Condition.

For r the submerged and unsubmerged flows at blocked inlets, it was found that Qb/Q ratio is valid for submerged inlet control, type 5 flow (Sellevold, Norem, et al., 2023). And when the dimensions H* equaled Δz/D, the Qb/Q ratio increased rapidly to eventually becoming a constant value at a dimensionless H* equaling 1.3 (Sellevold, 2023). All inlets under inlet control showed lower Qb/Q ratios the higher the blockage element was.

Overall, the hydraulic efficiency of the non-linear inlets under inlet control experiments was satisfactory. Additional comparisons were done between the results obtained from the non-linear elliptical arc inlets to the side tapered inlets from (Shall et. all, 2012). It is observed that a using a 10^0 non-linear elliptical arc edged inlet generated a lower dimensionless headwater elevation for the same dimensionless discharge. And the 20^0 non-linear inlet behave very similar at to the (Shall et. all, 2012) side tapered inlet.

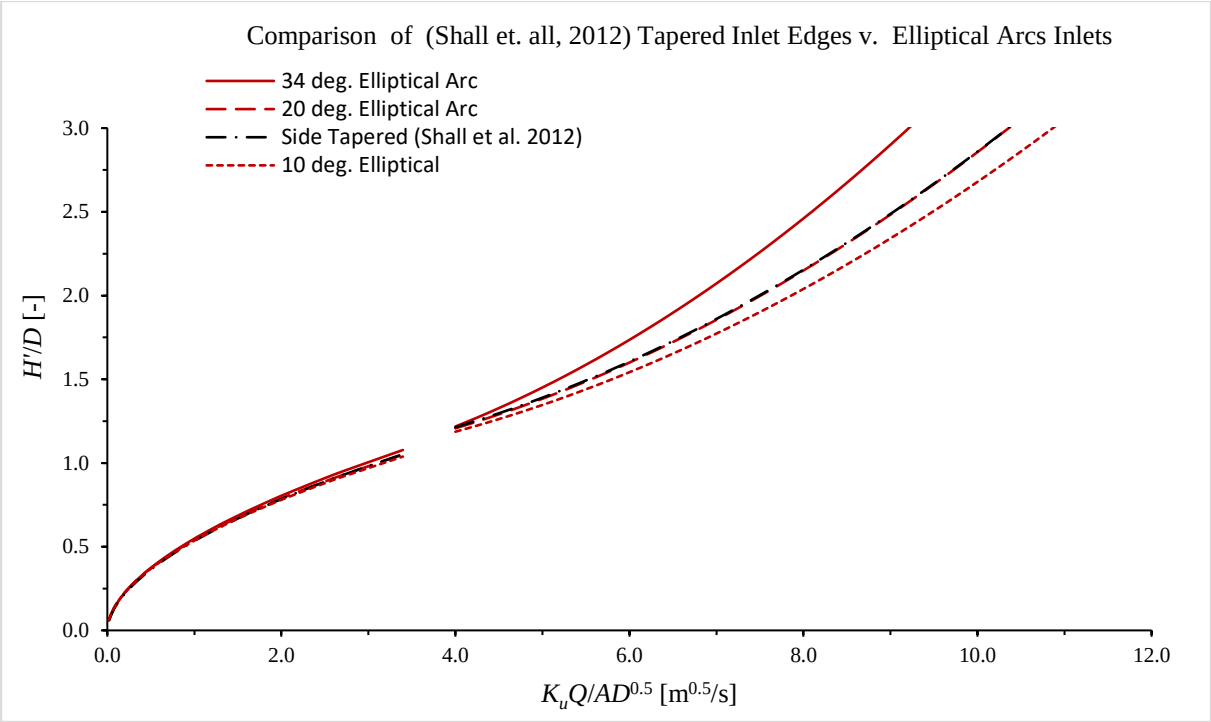

Figure 6-2: Tapered Inlet Edges from (Shall et. all, 2012) and Non-Linear Elliptical Arc Inlets.

Additional efforts were made to reduce scale effects in the model setup, for inlet control, a ventilation pipe was installed downstream of the throat to reduce sub-atmospheric pressures and therefore reduce pressure scale effects.

7 Conclusions

The experiments focused on evaluating hydraulic efficiencies under both unblocked and blocked inlet scenarios, with the unblocked cases demonstrating strong repeatability, while the blocked cases indicated that the optimized inlets had higher entrance head loss coefficients than the conventional inlets, potentially due to variations in the inlet face's cross-section area.

Anomalies in the data, such as fluctuations in the Ke values and unstable headwater elevations at very low discharges, were attributed to potential errors in experimental execution, instrumentation issues, and uncertainties caused by air trapped at the pressure taps, emphasizing the need for thorough investigation using computational fluid mechanics to mitigate scale effects and measurement errors.

The results indicated a correlation between the Ke values and the Reynolds number at the approach channel, hinting at the possibility of turbulent flow affecting the entrance head loss coefficient. However, this correlation was based on a single experiment without repeatability, and further investigations are necessary to validate this potential relationship. As well as further research through computational fluid mechanics needs to be performed for the optimized non-linear inlets under outlet control conditions.

The comparison of the Ke values for conventional linear inlets with the data from Idelchik et al. (2007) revealed that the Ke values for a given Δl/D ratio fitted within the experimental results for tapered inlets, suggesting consistency with prior research findings in the same area.

The experiments under inlet control conditions demonstrated that the optimized non-linear inlets exhibited superior hydraulic efficiency compared to the conventional linear inlets, attributed to the geometry of the inlet and the control section at the throat, which reduced flow separation and entrance head loss coefficients. Additional measures were taken to minimize scale effects in the model setup, including the installation of a ventilation pipe downstream of the throat to reduce sub-atmospheric pressures.

8 References

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Appendix A

Outlet Control Data Sheets

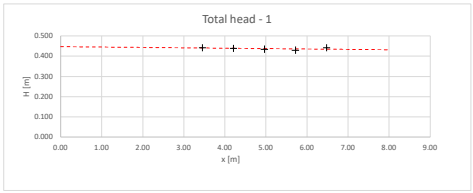
10 Deg Linear - Res 4 - 37%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

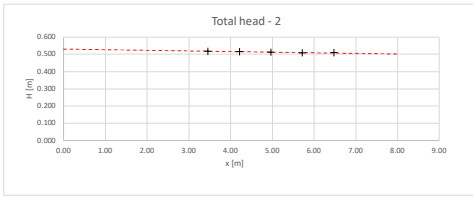
1		
Q	0.055	[m^3/s]
Approach		
y_a	0.468	[m]
w_a	2.000	[m]
A_a	0.936	[m^2]
v_a	0.059	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	6.04E+04	[-]
Linear interpolation		
H_a	0.467	[m]
S_f	0.002	[m/m]
H_0	0.448	[m]
ΔH_a	0.020	[m]
k_e	**0.605**	[-]
u_{be}	**0.104**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.415	0.797		0.032		0.448	
1.00	445.00	0.45			0.797	1.91E+05			0.447	0.001
2.00	1049.00	1.05			0.797	1.91E+05			0.446	0.002
3.00	1799.00	1.80			0.797	1.91E+05			0.444	0.003
4.00	3454.00	3.45	-0.026	0.436	0.797	1.91E+05	0.032	0.443	0.441	0.449
5.00	4209.00	4.21	-0.028	0.435	0.797	1.91E+05	0.032	0.439	0.439	0.447
6.00	4963.00	4.96	-0.029	0.432	0.797	1.91E+05	0.032	0.435	0.438	0.445
7.00	5718.00	5.72	-0.028	0.426	0.797	1.91E+05	0.032	0.431	0.437	0.442
8.00	6476.00	6.48	-0.026	0.436	0.797	1.91E+05	0.032	0.443	0.435	0.455
9.00	7227.00	7.23	-0.034	0.000	0.797	1.91E+05	0.032	-0.002	0.434	0.012
10.00	7983.00	7.98	-0.034	0.000	0.797	1.91E+05	0.032	-0.002	0.432	0.014
Area ratio	0.074									



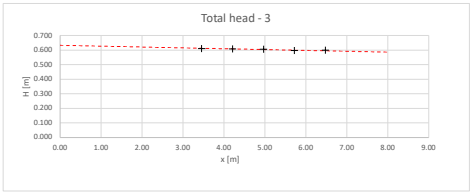
2		
Q	0.080	[m^3/s]
Approach		
y_a	0.566	[m]
w_a	2.000	[m]
A_a	1.132	[m^2]
v_a	0.071	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	8.26E+04	[-]
Linear interpolation		
H_a	0.565	[m]
S_f	0.0036	[m/m]
H_0	0.530	[m]
ΔH_a	0.035	[m]
k_e	**0.508**	[-]
u_{be}	**0.071**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.461	1.163		0.069		0.530	
1.00	445.00	0.45			1.163	2.78E+05			0.529	0.002
2.00	1049.00	1.05			1.163	2.78E+05			0.526	0.004
3.00	1799.00	1.80			1.163	2.78E+05			0.524	0.006
4.00	3454.00	3.45	-0.026	0.474	1.163	2.78E+05	0.069	0.517	0.518	0.529
5.00	4209.00	4.21	-0.028	0.474	1.163	2.78E+05	0.069	0.515	0.515	0.530
6.00	4963.00	4.96	-0.029	0.472	1.163	2.78E+05	0.069	0.512	0.512	0.530
7.00	5718.00	5.72	-0.028	0.467	1.163	2.78E+05	0.069	0.508	0.510	0.529
8.00	6476.00	6.48	-0.026	0.467	1.163	2.78E+05	0.069	0.510	0.507	0.533
9.00	7227.00	7.23	-0.034	0.000	1.163	2.78E+05	0.069	0.035	0.504	0.061
10.00	7983.00	7.98	-0.034	0.000	1.163	2.78E+05	0.069	0.035	0.502	0.063
Area ratio	0.061									



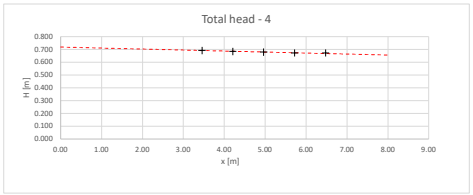
3		
Q	0.107	[m^3/s]
Approach		
y_a	0.696	[m]
w_a	2.000	[m]
A_a	1.392	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.02E+05	[-]
Linear interpolation		
H_a	0.695	[m]
S_f	0.0058	[m/m]
H_0	0.633	[m]
ΔH_a	0.062	[m]
k_e	**0.508**	[-]
u_{be}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.511	1.549		0.122		0.633	
1.00	445.00	0.45			1.549	3.70E+05			0.631	0.003
2.00	1049.00	1.05			1.549	3.70E+05			0.627	0.006
3.00	1799.00	1.80			1.549	3.70E+05			0.623	0.011
4.00	3454.00	3.45	-0.026	0.515	1.549	3.70E+05	0.122	0.611	0.613	0.631
5.00	4209.00	4.21	-0.028	0.514	1.549	3.70E+05	0.122	0.608	0.609	0.633
6.00	4963.00	4.96	-0.029	0.512	1.549	3.70E+05	0.122	0.605	0.604	0.634
7.00	5718.00	5.72	-0.028	0.503	1.549	3.70E+05	0.122	0.597	0.600	0.630
8.00	6476.00	6.48	-0.026	0.503	1.549	3.70E+05	0.122	0.599	0.595	0.637
9.00	7227.00	7.23	-0.034	0.000	1.549	3.70E+05	0.122	0.088	0.591	0.130
10.00	7983.00	7.98	-0.034	0.000	1.549	3.70E+05	0.122	0.088	0.587	0.135
Area ratio	0.050									



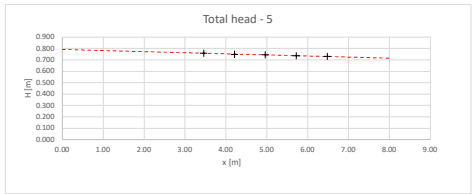
4		
Q	0.126	[m^3/s]
Approach		
y_a	0.802	[m]
w_a	2.000	[m]
A_a	1.604	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	1.13E+05	[-]
Linear interpolation		
H_a	0.801	[m]
S_f	0.0078	[m/m]
H_0	0.718	[m]
ΔH_a	0.083	[m]
k_e	**0.489**	[-]
u_{be}	**0.065**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.801		
Face	0	0	0.000	0.549	1.825		0.170		0.718	
1.00	445.00	0.45			1.825	4.36E+05		0.000	0.715	0.003
2.00	1049.00	1.05			1.825	4.36E+05		0.000	0.710	0.008
3.00	1799.00	1.80			1.825	4.36E+05		0.000	0.704	0.014
4.00	3454.00	3.45	-0.026	0.548	1.825	4.36E+05	0.170	0.691	0.691	0.718
5.00	4209.00	4.21	-0.028	0.542	1.825	4.36E+05	0.170	0.684	0.686	0.716
6.00	4963.00	4.96	-0.029	0.538	1.825	4.36E+05	0.170	0.679	0.680	0.717
7.00	5718.00	5.72	-0.028	0.530	1.825	4.36E+05	0.170	0.672	0.674	0.717
8.00	6476.00	6.48	-0.026	0.529	1.825	4.36E+05	0.170	0.672	0.668	0.723
9.00	7227.00	7.23	-0.034	0.000	1.825	4.36E+05	0.170	0.136	0.662	0.192
10.00	7983.00	7.98	-0.034	0.000	1.825	4.36E+05	0.170	0.136	0.656	0.198
Area ratio	0.043									



5		
Q	0.141	[m^3/s]
Approach		
y_a	0.895	[m]
w_a	2.000	[m]
A_a	1.790	[m^2]
v_a	0.079	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	1.20E+05	[-]
Linear interpolation		
H_a	0.894	[m]
S_f	0.0096	[m/m]
H_0	0.792	[m]
ΔH_a	0.102	[m]
k_e	**0.480**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.894		
Face	0	0	0.000	0.579	2.044		0.213		0.792	
1.00	445.00	0.45	0.000	-1.017	2.044	4.89E+05	0.213	-0.804	0.788	-0.800
2.00	1049.00	1.05	0.000	-1.022	2.044	4.89E+05	0.213	-0.809	0.782	-0.799
3.00	1799.00	1.80	0.000	-1.008	2.044	4.89E+05	0.213	-0.795	0.775	-0.777
4.00	3454.00	3.45	-0.026	0.573	2.044	4.89E+05	0.213	0.760	0.759	0.793
5.00	4209.00	4.21	-0.028	0.565	2.044	4.89E+05	0.213	0.750	0.752	0.790
6.00	4963.00	4.96	-0.029	0.561	2.044	4.89E+05	0.213	0.745	0.745	0.792
7.00	5718.00	5.72	-0.028	0.552	2.044	4.89E+05	0.213	0.737	0.737	0.792
8.00	6476.00	6.48	-0.026	0.544	2.044	4.89E+05	0.213	0.731	0.730	0.793
9.00	7227.00	7.23	-0.034	0.000	2.044	4.89E+05	0.213	0.179	0.723	0.248
10.00	7983.00	7.98	-0.034	0.000	2.044	4.89E+05	0.213	0.179	0.716	0.255
Area ratio	0.039									



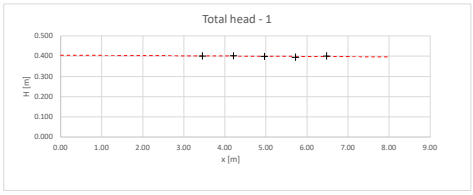
10 Deg Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

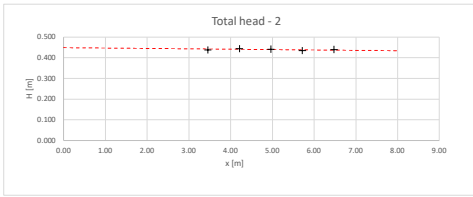
1		
Q	0.037	[m^3/s]
Approach		
y_a	0.467	[m]
w_a	2.000	[m]
A_a	0.934	[m^2]
v_a	0.040	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.019	[m]
Re	4.10E+04	[-]
Linear interpolation		
H_a	0.466	[m]
S_f	0.001	[m/m]
H_0	0.405	[m]
ΔH_a	0.061	[m]
k_e	**4.070**	[-]
u_{be}	**0.153**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.391	0.541		0.015		0.405	
1.00	445.00	0.45			0.541	1.29E+05			0.405	0.000
2.00	1049.00	1.05			0.541	1.29E+05			0.404	0.001
3.00	1799.00	1.80			0.541	1.29E+05			0.404	0.002
4.00	3454.00	3.45	-0.026	0.413	0.541	1.29E+05	0.015	0.402	0.402	0.406
5.00	4209.00	4.21	-0.028	0.416	0.541	1.29E+05	0.015	0.402	0.401	0.407
6.00	4963.00	4.96	-0.029	0.414	0.541	1.29E+05	0.015	0.400	0.400	0.405
7.00	5718.00	5.72	-0.028	0.408	0.541	1.29E+05	0.015	0.395	0.399	0.401
8.00	6476.00	6.48	-0.026	0.413	0.541	1.29E+05	0.015	0.402	0.399	0.409
9.00	7227.00	7.23	-0.034	0.000	0.541	1.29E+05	0.015	-0.019	0.398	-0.012
10.00	7983.00	7.98	-0.034	0.000	0.541	1.29E+05	0.015	-0.019	0.397	-0.011
Area ratio	0.074									



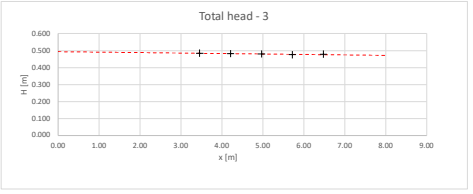
2		
Q	0.053	[m^3/s]
Approach		
y_a	0.568	[m]
w_a	2.000	[m]
A_a	1.137	[m^2]
v_a	0.047	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.020	[m]
Re	5.50E+04	[-]
Linear interpolation		
H_a	0.568	[m]
S_f	0.0018	[m/m]
H_0	0.449	[m]
ΔH_a	0.119	[m]
k_e	**3.886**	[-]
u_{be}	**0.106**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.418	0.775		0.031		0.449	
1.00	445.00	0.45			0.775	1.85E+05			0.448	0.001
2.00	1049.00	1.05			0.775	1.85E+05			0.447	0.002
3.00	1799.00	1.80			0.775	1.85E+05			0.445	0.003
4.00	3454.00	3.45	-0.026	0.433	0.775	1.85E+05	0.031	0.438	0.442	0.444
5.00	4209.00	4.21	-0.028	0.441	0.775	1.85E+05	0.031	0.443	0.441	0.451
6.00	4963.00	4.96	-0.029	0.440	0.775	1.85E+05	0.031	0.441	0.440	0.450
7.00	5718.00	5.72	-0.028	0.432	0.775	1.85E+05	0.031	0.435	0.438	0.445
8.00	6476.00	6.48	-0.026	0.435	0.775	1.85E+05	0.031	0.440	0.437	0.452
9.00	7227.00	7.23	-0.034	0.000	0.775	1.85E+05	0.031	-0.003	0.435	0.010
10.00	7983.00	7.98	-0.034	0.000	0.775	1.85E+05	0.031	-0.003	0.434	0.011
Area ratio	0.061									



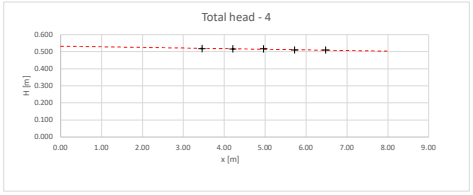
3		
Q	0.068	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.050	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.019	[m]
Re	6.51E+04	[-]
Linear interpolation		
H_a	0.687	[m]
S_f	0.0027	[m/m]
H_0	0.493	[m]
ΔH_a	0.194	[m]
k_e	**3.895**	[-]
u_{be}	**0.097**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.444	0.988		0.050		0.493	
1.00	445.00	0.45			0.988	2.36E+05			0.492	0.001
2.00	1049.00	1.05			0.988	2.36E+05			0.491	0.003
3.00	1799.00	1.80			0.988	2.36E+05			0.489	0.005
4.00	3454.00	3.45	-0.026	0.460	0.988	2.36E+05	0.050	0.484	0.484	0.494
5.00	4209.00	4.21	-0.028	0.460	0.988	2.36E+05	0.050	0.481	0.482	0.493
6.00	4963.00	4.96	-0.029	0.459	0.988	2.36E+05	0.050	0.480	0.480	0.494
7.00	5718.00	5.72	-0.028	0.454	0.988	2.36E+05	0.050	0.476	0.478	0.491
8.00	6476.00	6.48	-0.026	0.455	0.988	2.36E+05	0.050	0.479	0.476	0.496
9.00	7227.00	7.23	-0.034	0.000	0.988	2.36E+05	0.050	0.016	0.474	0.035
10.00	7983.00	7.98	-0.034	0.000	0.988	2.36E+05	0.050	0.016	0.472	0.037
Area ratio	0.050									



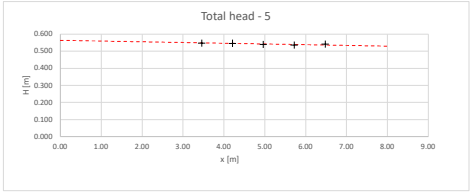
4		
Q	0.081	[m^3/s]
Approach		
y_a	0.809	[m]
w_a	2.000	[m]
A_a	1.618	[m^2]
v_a	0.050	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.018	[m]
Re	7.22E+04	[-]
Linear interpolation		
H_a	0.808	[m]
S_f	0.0036	[m/m]
H_0	0.532	[m]
ΔH_a	0.276	[m]
k_e	**3.933**	[-]
u_{be}	**0.094**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.808		
Face	0	0	0.000	0.462	1.173		0.070		0.532	
1.00	445.00	0.45			1.173	2.81E+05		0.000	0.531	0.002
2.00	1049.00	1.05			1.173	2.81E+05		0.000	0.528	0.004
3.00	1799.00	1.80			1.173	2.81E+05		0.000	0.526	0.007
4.00	3454.00	3.45	-0.026	0.474	1.173	2.81E+05	0.070	0.518	0.520	0.531
5.00	4209.00	4.21	-0.028	0.474	1.173	2.81E+05	0.070	0.516	0.517	0.531
6.00	4963.00	4.96	-0.029	0.476	1.173	2.81E+05	0.070	0.517	0.514	0.535
7.00	5718.00	5.72	-0.028	0.468	1.173	2.81E+05	0.070	0.510	0.511	0.531
8.00	6476.00	6.48	-0.026	0.466	1.173	2.81E+05	0.070	0.510	0.509	0.533
9.00	7227.00	7.23	-0.034	0.000	1.173	2.81E+05	0.070	0.036	0.506	0.062
10.00	7983.00	7.98	-0.034	0.000	1.173	2.81E+05	0.070	0.036	0.503	0.065
Area ratio	0.043									



5		
Q	0.089	[m^3/s]
Approach		
y_a	0.896	[m]
w_a	2.000	[m]
A_a	1.791	[m^2]
v_a	0.050	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.017	[m]
Re	7.57E+04	[-]
Linear interpolation		
H_a	0.895	[m]
S_f	0.0043	[m/m]
H_0	0.564	[m]
ΔH_a	0.331	[m]
k_e	**3.906**	[-]
u_{be}	**0.093**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.895		
Face	0	0	0.000	0.479	1.289		0.085		0.564	
1.00	445.00	0.45	0.000	-1.017	1.289	3.08E+05	0.085	-0.932	0.562	-0.930
2.00	1049.00	1.05	0.000	-1.022	1.289	3.08E+05	0.085	-0.937	0.559	-0.933
3.00	1799.00	1.80	0.000	-1.008	1.289	3.08E+05	0.085	-0.923	0.556	-0.915
4.00	3454.00	3.45	-0.026	0.489	1.289	3.08E+05	0.085	0.547	0.549	0.562
5.00	4209.00	4.21	-0.028	0.490	1.289	3.08E+05	0.085	0.547	0.546	0.564
6.00	4963.00	4.96	-0.029	0.484	1.289	3.08E+05	0.085	0.540	0.543	0.561
7.00	5718.00	5.72	-0.028	0.480	1.289	3.08E+05	0.085	0.537	0.540	0.561
8.00	6476.00	6.48	-0.026	0.484	1.289	3.08E+05	0.085	0.543	0.536	0.570
9.00	7227.00	7.23	-0.034	0.000	1.289	3.08E+05	0.085	0.051	0.533	0.081
10.00	7983.00	7.98	-0.034	0.000	1.289	3.08E+05	0.085	0.051	0.530	0.085
Area ratio	0.039									



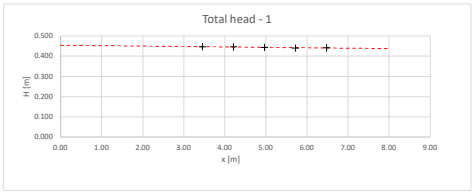
10 Deg Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

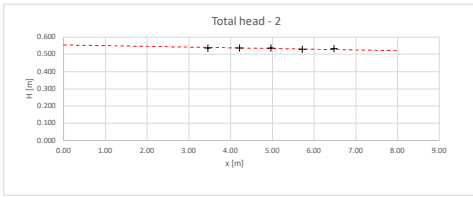
1		
Q	0.058	[m^3/s]
Approach		
y_a	0.464	[m]
w_a	2.000	[m]
A_a	0.928	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.39E+04	[-]
Linear interpolation		
H_a	0.463	[m]
S_f	0.002	[m/m]
H_0	0.455	[m]
ΔH_a	0.009	[m]
k_e	**0.237**	[-]
u_{be}	**0.102**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.419	0.841		0.036		0.455	
1.00	445.00	0.45			0.841	2.01E+05			0.454	0.001
2.00	1049.00	1.05			0.841	2.01E+05			0.452	0.002
3.00	1799.00	1.80			0.841	2.01E+05			0.451	0.004
4.00	3454.00	3.45	-0.026	0.438	0.841	2.01E+05	0.036	0.448	0.447	0.455
5.00	4209.00	4.21	-0.028	0.439	0.841	2.01E+05	0.036	0.447	0.446	0.455
6.00	4963.00	4.96	-0.029	0.437	0.841	2.01E+05	0.036	0.444	0.444	0.454
7.00	5718.00	5.72	-0.028	0.433	0.841	2.01E+05	0.036	0.441	0.443	0.453
8.00	6476.00	6.48	-0.026	0.432	0.841	2.01E+05	0.036	0.442	0.441	0.455
9.00	7227.00	7.23	-0.034	0.000	0.841	2.01E+05	0.036	0.002	0.440	0.017
10.00	7983.00	7.98	-0.034	0.000	0.841	2.01E+05	0.036	0.002	0.438	0.019
Area ratio	0.074									



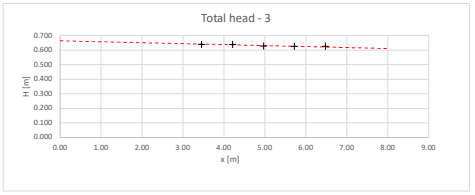
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	8.99E+04	[-]
Linear interpolation		
H_a	0.566	[m]
S_f	0.0041	[m/m]
H_0	0.554	[m]
ΔH_a	0.012	[m]
k_e	**0.149**	[-]
u_{be}	**0.069**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.472	1.265		0.082		0.554	
1.00	445.00	0.45			1.265	3.03E+05			0.552	0.002
2.00	1049.00	1.05			1.265	3.03E+05			0.550	0.004
3.00	1799.00	1.80			1.265	3.03E+05			0.547	0.007
4.00	3454.00	3.45	-0.026	0.480	1.265	3.03E+05	0.082	0.535	0.540	0.550
5.00	4209.00	4.21	-0.028	0.483	1.265	3.03E+05	0.082	0.537	0.537	0.554
6.00	4963.00	4.96	-0.029	0.483	1.265	3.03E+05	0.082	0.536	0.534	0.556
7.00	5718.00	5.72	-0.028	0.475	1.265	3.03E+05	0.082	0.528	0.531	0.552
8.00	6476.00	6.48	-0.026	0.476	1.265	3.03E+05	0.082	0.532	0.527	0.559
9.00	7227.00	7.23	-0.034	0.000	1.265	3.03E+05	0.082	0.048	0.524	0.077
10.00	7983.00	7.98	-0.034	0.000	1.265	3.03E+05	0.082	0.048	0.521	0.081
Area ratio	0.061									



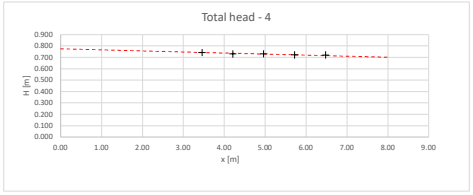
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.686	[m]
w_a	2.000	[m]
A_a	1.372	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.685	[m]
S_f	0.0066	[m/m]
H_0	0.664	[m]
ΔH_a	0.021	[m]
k_e	**0.148**	[-]
u_{be}	**0.065**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.523	1.666		0.141		0.664	
1.00	445.00	0.45			1.666	3.98E+05			0.661	0.003
2.00	1049.00	1.05			1.666	3.98E+05			0.657	0.007
3.00	1799.00	1.80			1.666	3.98E+05			0.652	0.012
4.00	3454.00	3.45	-0.026	0.523	1.666	3.98E+05	0.141	0.638	0.641	0.661
5.00	4209.00	4.21	-0.028	0.526	1.666	3.98E+05	0.141	0.639	0.636	0.667
6.00	4963.00	4.96	-0.029	0.515	1.666	3.98E+05	0.141	0.628	0.631	0.661
7.00	5718.00	5.72	-0.028	0.512	1.666	3.98E+05	0.141	0.626	0.626	0.664
8.00	6476.00	6.48	-0.026	0.511	1.666	3.98E+05	0.141	0.626	0.621	0.669
9.00	7227.00	7.23	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.616	0.155
10.00	7983.00	7.98	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.611	0.160
Area ratio	0.050									



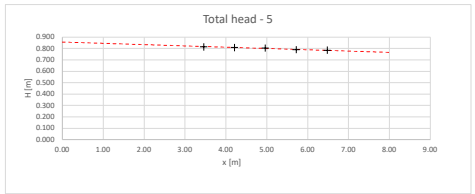
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.612	[m^2]
v_a	0.086	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.24E+05	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0093	[m/m]
H_0	0.775	[m]
ΔH_a	0.030	[m]
k_e	**0.146**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.805		
Face	0	0	0.000	0.569	2.012		0.206		0.775	
1.00	445.00	0.45			2.012	4.81E+05		0.000	0.771	0.004
2.00	1049.00	1.05			2.012	4.81E+05		0.000	0.766	0.010
3.00	1799.00	1.80			2.012	4.81E+05		0.000	0.759	0.017
4.00	3454.00	3.45	-0.026	0.562	2.012	4.81E+05	0.206	0.742	0.743	0.774
5.00	4209.00	4.21	-0.028	0.552	2.012	4.81E+05	0.206	0.730	0.736	0.769
6.00	4963.00	4.96	-0.029	0.554	2.012	4.81E+05	0.206	0.731	0.729	0.777
7.00	5718.00	5.72	-0.028	0.543	2.012	4.81E+05	0.206	0.722	0.722	0.775
8.00	6476.00	6.48	-0.026	0.541	2.012	4.81E+05	0.206	0.721	0.715	0.781
9.00	7227.00	7.23	-0.034	0.000	2.012	4.81E+05	0.206	0.172	0.708	0.239
10.00	7983.00	7.98	-0.034	0.000	2.012	4.81E+05	0.206	0.172	0.701	0.246
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.892	[m]
w_a	2.000	[m]
A_a	1.784	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.32E+05	[-]
Linear interpolation		
H_a	0.891	[m]
S_f	0.0113	[m/m]
H_0	0.857	[m]
ΔH_a	0.034	[m]
k_e	**0.133**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.891		
Face	0	0	0.000	0.600	2.247		0.257		0.857	
1.00	445.00	0.45	0.000	-1.017	2.247	5.37E+05	0.257	-0.760	0.852	-0.755
2.00	1049.00	1.05	0.000	-1.022	2.247	5.37E+05	0.257	-0.765	0.845	-0.753
3.00	1799.00	1.80	0.000	-1.008	2.247	5.37E+05	0.257	-0.750	0.837	-0.730
4.00	3454.00	3.45	-0.026	0.583	2.247	5.37E+05	0.257	0.815	0.818	0.854
5.00	4209.00	4.21	-0.028	0.580	2.247	5.37E+05	0.257	0.809	0.809	0.857
6.00	4963.00	4.96	-0.029	0.576	2.247	5.37E+05	0.257	0.804	0.801	0.860
7.00	5718.00	5.72	-0.028	0.562	2.247	5.37E+05	0.257	0.791	0.792	0.856
8.00	6476.00	6.48	-0.026	0.554	2.247	5.37E+05	0.257	0.786	0.784	0.859
9.00	7227.00	7.23	-0.034	0.000	2.247	5.37E+05	0.257	0.223	0.775	0.305
10.00	7983.00	7.98	-0.034	0.000	2.247	5.37E+05	0.257	0.223	0.767	0.314
Area ratio	0.039									



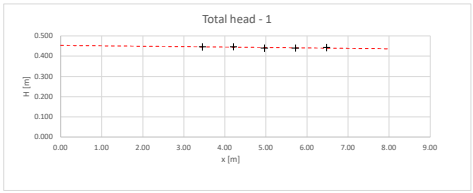
10 Deg Linear - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

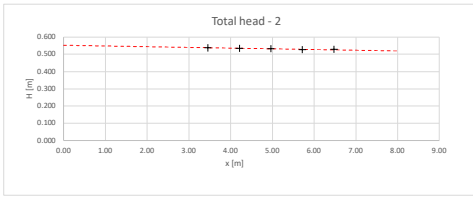
1		
Q	0.058	[m^3/s]
Approach		
y_a	0.464	[m]
w_a	2.000	[m]
A_a	0.928	[m^2]
v_a	0.062	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.39E+04	[-]
Linear interpolation		
H_a	0.463	[m]
S_f	0.002	[m/m]
H_0	0.454	[m]
ΔH_a	0.009	[m]
k_e	**0.261**	[-]
u_{ke}	**0.102**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.418	0.840		0.036		0.454	
1.00	445.00	0.45			0.840	2.01E+05			0.453	0.001
2.00	1049.00	1.05			0.840	2.01E+05			0.452	0.002
3.00	1799.00	1.80			0.840	2.01E+05			0.450	0.004
4.00	3454.00	3.45	-0.026	0.436	0.840	2.01E+05	0.036	0.446	0.447	0.454
5.00	4209.00	4.21	-0.028	0.439	0.840	2.01E+05	0.036	0.447	0.445	0.456
6.00	4963.00	4.96	-0.029	0.433	0.840	2.01E+05	0.036	0.440	0.443	0.450
7.00	5718.00	5.72	-0.028	0.433	0.840	2.01E+05	0.036	0.441	0.442	0.452
8.00	6476.00	6.48	-0.026	0.433	0.840	2.01E+05	0.036	0.443	0.440	0.457
9.00	7227.00	7.23	-0.034	0.000	0.840	2.01E+05	0.036	0.002	0.439	0.017
10.00	7983.00	7.98	-0.034	0.000	0.840	2.01E+05	0.036	0.002	0.437	0.019
Area ratio	0.074									



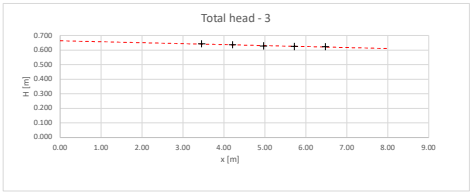
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	8.96E+04	[-]
Linear interpolation		
H_a	0.566	[m]
S_f	0.0041	[m/m]
H_0	0.552	[m]
ΔH_a	0.014	[m]
k_e	**0.174**	[-]
u_{ke}	**0.070**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.471	1.262		0.081		0.552	
1.00	445.00	0.45			1.262	3.02E+05			0.550	0.002
2.00	1049.00	1.05			1.262	3.02E+05			0.548	0.004
3.00	1799.00	1.80			1.262	3.02E+05			0.545	0.007
4.00	3454.00	3.45	-0.026	0.482	1.262	3.02E+05	0.081	0.537	0.538	0.551
5.00	4209.00	4.21	-0.028	0.482	1.262	3.02E+05	0.081	0.535	0.535	0.552
6.00	4963.00	4.96	-0.029	0.480	1.262	3.02E+05	0.081	0.532	0.532	0.553
7.00	5718.00	5.72	-0.028	0.473	1.262	3.02E+05	0.081	0.526	0.529	0.550
8.00	6476.00	6.48	-0.026	0.474	1.262	3.02E+05	0.081	0.529	0.526	0.555
9.00	7227.00	7.23	-0.034	0.000	1.262	3.02E+05	0.081	0.047	0.523	0.077
10.00	7983.00	7.98	-0.034	0.000	1.262	3.02E+05	0.081	0.047	0.519	0.080
Area ratio	0.061									



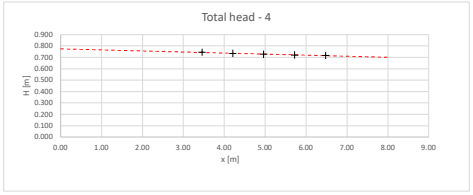
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.687	[m]
w_a	2.000	[m]
A_a	1.374	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.686	[m]
S_f	0.0067	[m/m]
H_0	0.664	[m]
ΔH_a	0.022	[m]
k_e	**0.155**	[-]
u_{ke}	**0.065**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.523	1.667		0.142		0.664	
1.00	445.00	0.45			1.667	3.99E+05			0.662	0.003
2.00	1049.00	1.05			1.667	3.99E+05			0.657	0.007
3.00	1799.00	1.80			1.667	3.99E+05			0.653	0.012
4.00	3454.00	3.45	-0.026	0.527	1.667	3.99E+05	0.142	0.643	0.641	0.666
5.00	4209.00	4.21	-0.028	0.523	1.667	3.99E+05	0.142	0.637	0.636	0.665
6.00	4963.00	4.96	-0.029	0.516	1.667	3.99E+05	0.142	0.628	0.631	0.661
7.00	5718.00	5.72	-0.028	0.511	1.667	3.99E+05	0.142	0.625	0.626	0.663
8.00	6476.00	6.48	-0.026	0.508	1.667	3.99E+05	0.142	0.624	0.621	0.667
9.00	7227.00	7.23	-0.034	0.000	1.667	3.99E+05	0.142	0.108	0.616	0.156
10.00	7983.00	7.98	-0.034	0.000	1.667	3.99E+05	0.142	0.108	0.611	0.161
Area ratio	0.050									



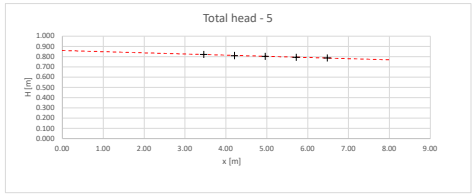
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.804	[m]
w_a	2.000	[m]
A_a	1.608	[m^2]
v_a	0.086	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.24E+05	[-]
Linear interpolation		
H_a	0.803	[m]
S_f	0.0093	[m/m]
H_0	0.775	[m]
ΔH_a	0.028	[m]
k_e	**0.138**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.803		
Face	0	0	0.000	0.569	2.012		0.206		0.775	
1.00	445.00	0.45			2.012	4.81E+05		0.000	0.771	0.004
2.00	1049.00	1.05			2.012	4.81E+05		0.000	0.765	0.010
3.00	1799.00	1.80			2.012	4.81E+05		0.000	0.758	0.017
4.00	3454.00	3.45	-0.026	0.564	2.012	4.81E+05	0.206	0.744	0.743	0.777
5.00	4209.00	4.21	-0.028	0.557	2.012	4.81E+05	0.206	0.735	0.736	0.774
6.00	4963.00	4.96	-0.029	0.550	2.012	4.81E+05	0.206	0.727	0.729	0.773
7.00	5718.00	5.72	-0.028	0.542	2.012	4.81E+05	0.206	0.720	0.722	0.774
8.00	6476.00	6.48	-0.026	0.537	2.012	4.81E+05	0.206	0.717	0.715	0.777
9.00	7227.00	7.23	-0.034	0.000	2.012	4.81E+05	0.206	0.172	0.708	0.239
10.00	7983.00	7.98	-0.034	0.000	2.012	4.81E+05	0.206	0.172	0.701	0.246
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.892	[m]
w_a	2.000	[m]
A_a	1.784	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.32E+05	[-]
Linear interpolation		
H_a	0.891	[m]
S_f	0.0113	[m/m]
H_0	0.860	[m]
ΔH_a	0.031	[m]
k_e	**0.122**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.891		
Face	0	0	0.000	0.602	2.248		0.258		0.860	
1.00	445.00	0.45	0.000	-1.017	2.248	5.38E+05	0.258	-0.759	0.855	-0.754
2.00	1049.00	1.05	0.000	-1.022	2.248	5.38E+05	0.258	-0.764	0.848	-0.753
3.00	1799.00	1.80	0.000	-1.008	2.248	5.38E+05	0.258	-0.750	0.840	-0.730
4.00	3454.00	3.45	-0.026	0.591	2.248	5.38E+05	0.258	0.822	0.821	0.861
5.00	4209.00	4.21	-0.028	0.581	2.248	5.38E+05	0.258	0.810	0.812	0.858
6.00	4963.00	4.96	-0.029	0.574	2.248	5.38E+05	0.258	0.803	0.804	0.859
7.00	5718.00	5.72	-0.028	0.565	2.248	5.38E+05	0.258	0.794	0.795	0.859
8.00	6476.00	6.48	-0.026	0.557	2.248	5.38E+05	0.258	0.788	0.786	0.862
9.00	7227.00	7.23	-0.034	0.000	2.248	5.38E+05	0.258	0.224	0.778	0.306
10.00	7983.00	7.98	-0.034	0.000	2.248	5.38E+05	0.258	0.224	0.769	0.314
Area ratio	0.039									



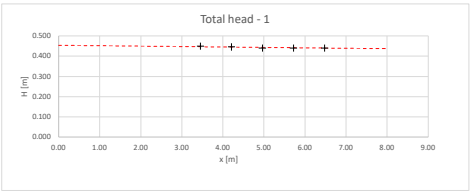
10 Deg Linear - Res 3 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

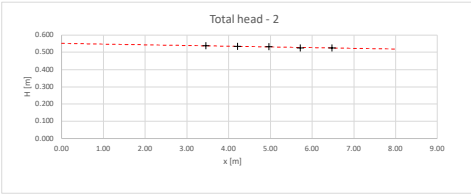
1		
Q	0.058	[m^3/s]
Approach		
y_a	0.464	[m]
w_a	2.000	[m]
A_a	0.928	[m^2]
v_a	0.062	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.38E+04	[-]
Linear interpolation		
H_a	0.463	[m]
S_f	0.002	[m/m]
H_0	0.454	[m]
ΔH_a	0.009	[m]
k_e	**0.249**	[-]
u_{ke}	**0.102**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.418	0.839		0.036		0.454	
1.00	445.00	0.45			0.839	2.01E+05			0.453	0.001
2.00	1049.00	1.05			0.839	2.01E+05			0.452	0.002
3.00	1799.00	1.80			0.839	2.01E+05			0.451	0.004
4.00	3454.00	3.45	-0.026	0.440	0.839	2.01E+05	0.036	0.450	0.447	0.458
5.00	4209.00	4.21	-0.028	0.439	0.839	2.01E+05	0.036	0.447	0.445	0.455
6.00	4963.00	4.96	-0.029	0.434	0.839	2.01E+05	0.036	0.441	0.444	0.451
7.00	5718.00	5.72	-0.028	0.433	0.839	2.01E+05	0.036	0.441	0.442	0.453
8.00	6476.00	6.48	-0.026	0.431	0.839	2.01E+05	0.036	0.441	0.441	0.454
9.00	7227.00	7.23	-0.034	0.000	0.839	2.01E+05	0.036	0.002	0.439	0.017
10.00	7983.00	7.98	-0.034	0.000	0.839	2.01E+05	0.036	0.002	0.438	0.019
Area ratio	0.074									



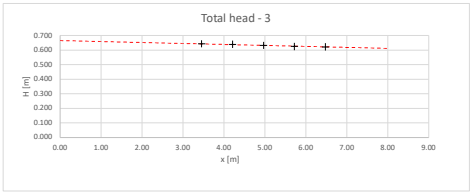
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.568	[m]
w_a	2.000	[m]
A_a	1.136	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	8.94E+04	[-]
Linear interpolation		
H_a	0.567	[m]
S_f	0.0041	[m/m]
H_0	0.552	[m]
ΔH_a	0.016	[m]
k_e	**0.195**	[-]
u_{ke}	**0.070**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.471	1.260		0.081		0.552	
1.00	445.00	0.45			1.260	3.01E+05			0.550	0.002
2.00	1049.00	1.05			1.260	3.01E+05			0.547	0.004
3.00	1799.00	1.80			1.260	3.01E+05			0.544	0.007
4.00	3454.00	3.45	-0.026	0.484	1.260	3.01E+05	0.081	0.538	0.537	0.553
5.00	4209.00	4.21	-0.028	0.481	1.260	3.01E+05	0.081	0.534	0.534	0.551
6.00	4963.00	4.96	-0.029	0.481	1.260	3.01E+05	0.081	0.532	0.531	0.553
7.00	5718.00	5.72	-0.028	0.473	1.260	3.01E+05	0.081	0.526	0.528	0.549
8.00	6476.00	6.48	-0.026	0.471	1.260	3.01E+05	0.081	0.526	0.525	0.552
9.00	7227.00	7.23	-0.034	0.000	1.260	3.01E+05	0.081	0.047	0.522	0.076
10.00	7983.00	7.98	-0.034	0.000	1.260	3.01E+05	0.081	0.047	0.519	0.080
Area ratio	0.061									



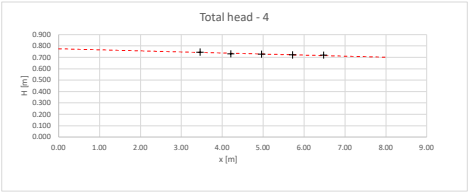
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.687	[m]
w_a	2.000	[m]
A_a	1.374	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.686	[m]
S_f	0.0067	[m/m]
H_0	0.666	[m]
ΔH_a	0.021	[m]
k_e	**0.144**	[-]
u_{ke}	**0.065**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.523	1.672		0.142		0.666	
1.00	445.00	0.45			1.672	4.00E+05			0.663	0.003
2.00	1049.00	1.05			1.672	4.00E+05			0.659	0.007
3.00	1799.00	1.80			1.672	4.00E+05			0.654	0.012
4.00	3454.00	3.45	-0.026	0.527	1.672	4.00E+05	0.142	0.644	0.643	0.667
5.00	4209.00	4.21	-0.028	0.526	1.672	4.00E+05	0.142	0.640	0.638	0.668
6.00	4963.00	4.96	-0.029	0.519	1.672	4.00E+05	0.142	0.632	0.633	0.666
7.00	5718.00	5.72	-0.028	0.510	1.672	4.00E+05	0.142	0.625	0.628	0.663
8.00	6476.00	6.48	-0.026	0.506	1.672	4.00E+05	0.142	0.622	0.623	0.665
9.00	7227.00	7.23	-0.034	0.000	1.672	4.00E+05	0.142	0.108	0.618	0.157
10.00	7983.00	7.98	-0.034	0.000	1.672	4.00E+05	0.142	0.108	0.612	0.162
Area ratio	0.050									



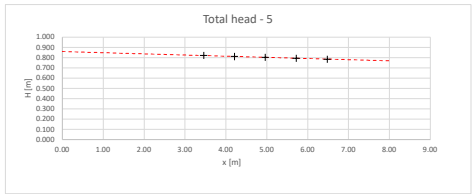
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.612	[m^2]
v_a	0.086	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.24E+05	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0093	[m/m]
H_0	0.776	[m]
ΔH_a	0.030	[m]
k_e	**0.145**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.569	2.013		0.206		0.776	
1.00	445.00	0.45			2.013	4.81E+05		0.000	0.771	0.004
2.00	1049.00	1.05			2.013	4.81E+05		0.000	0.766	0.010
3.00	1799.00	1.80			2.013	4.81E+05		0.000	0.759	0.017
4.00	3454.00	3.45	-0.026	0.566	2.013	4.81E+05	0.206	0.746	0.743	0.778
5.00	4209.00	4.21	-0.028	0.553	2.013	4.81E+05	0.206	0.732	0.736	0.771
6.00	4963.00	4.96	-0.029	0.551	2.013	4.81E+05	0.206	0.728	0.729	0.774
7.00	5718.00	5.72	-0.028	0.544	2.013	4.81E+05	0.206	0.722	0.722	0.775
8.00	6476.00	6.48	-0.026	0.539	2.013	4.81E+05	0.206	0.719	0.715	0.780
9.00	7227.00	7.23	-0.034	0.000	2.013	4.81E+05	0.206	0.172	0.708	0.240
10.00	7983.00	7.98	-0.034	0.000	2.013	4.81E+05	0.206	0.172	0.701	0.247
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.895	[m]
w_a	2.000	[m]
A_a	1.789	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.32E+05	[-]
Linear interpolation		
H_a	0.894	[m]
S_f	0.0113	[m/m]
H_0	0.860	[m]
ΔH_a	0.034	[m]
k_e	**0.134**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.603	2.246		0.257		0.860	
1.00	445.00	0.45	0.000	-1.017	2.246	5.37E+05	0.257	-0.760	0.855	-0.755
2.00	1049.00	1.05	0.000	-1.022	2.246	5.37E+05	0.257	-0.765	0.848	-0.753
3.00	1799.00	1.80	0.000	-1.008	2.246	5.37E+05	0.257	-0.751	0.839	-0.730
4.00	3454.00	3.45	-0.026	0.592	2.246	5.37E+05	0.257	0.823	0.821	0.862
5.00	4209.00	4.21	-0.028	0.583	2.246	5.37E+05	0.257	0.812	0.812	0.859
6.00	4963.00	4.96	-0.029	0.575	2.246	5.37E+05	0.257	0.803	0.803	0.859
7.00	5718.00	5.72	-0.028	0.565	2.246	5.37E+05	0.257	0.794	0.795	0.859
8.00	6476.00	6.48	-0.026	0.555	2.246	5.37E+05	0.257	0.786	0.786	0.859
9.00	7227.00	7.23	-0.034	0.000	2.246	5.37E+05	0.257	0.223	0.778	0.305
10.00	7983.00	7.98	-0.034	0.000	2.246	5.37E+05	0.257	0.223	0.769	0.313
Area ratio	0.039									



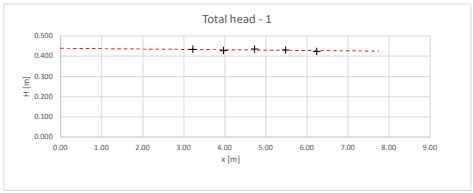
10 Deg Non Linear - Res 4 - 37.5%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

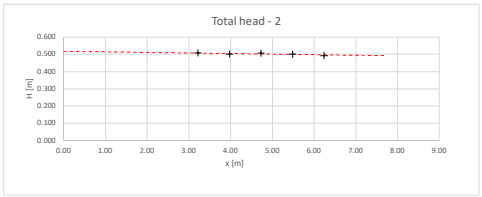
1		
Q	0.052	[m^3/s]
Approach		
y_a	0.466	[m]
w_a	2.000	[m]
A_a	0.932	[m^2]
v_a	0.056	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.026	[m]
Re	5.74E+04	[-]
Linear interpolation		
H_a	0.468	[m]
S_f	0.002	[m/m]
H_0	0.439	[m]
ΔH_a	0.029	[m]
k_e	**0.990**	[-]
u_{be}	**0.105**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.410	0.756		0.029		0.439	
1.00	445.00	0.45			0.756	1.81E+05			0.439	0.001
2.00	1049.00	1.05			0.756	1.81E+05			0.437	0.002
3.00	1799.00	1.80			0.756	1.81E+05			0.436	0.003
4.00	3216.00	3.22	-0.025	0.431	0.756	1.81E+05	0.029	0.435	0.434	0.441
5.00	3972.00	3.97	-0.027	0.427	0.756	1.81E+05	0.029	0.429	0.432	0.436
6.00	4726.00	4.73	-0.029	0.436	0.756	1.81E+05	0.029	0.436	0.431	0.444
7.00	5482.00	5.48	-0.031	0.433	0.756	1.81E+05	0.029	0.431	0.430	0.441
8.00	6240.00	6.24	-0.028	0.423	0.756	1.81E+05	0.029	0.424	0.428	0.435
9.00	6991.00	6.99	-0.034	0.000	0.756	1.81E+05	0.029	-0.005	0.427	0.007
10.00	7747.00	7.75	-0.034	0.000	0.756	1.81E+05	0.029	-0.005	0.426	0.009
Area ratio	0.074									



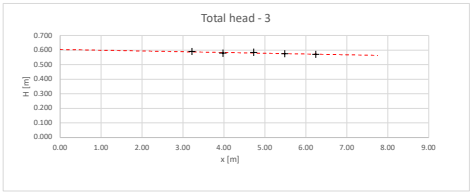
2		
Q	0.077	[m^3/s]
Approach		
y_a	0.568	[m]
w_a	2.000	[m]
A_a	1.136	[m^2]
v_a	0.068	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	7.92E+04	[-]
Linear interpolation		
H_a	0.570	[m]
S_f	0.0033	[m/m]
H_0	0.518	[m]
ΔH_a	0.053	[m]
k_e	**0.829**	[-]
u_{be}	**0.070**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.454	1.116		0.063		0.518	
1.00	445.00	0.45			1.116	2.67E+05			0.516	0.001
2.00	1049.00	1.05			1.116	2.67E+05			0.514	0.003
3.00	1799.00	1.80			1.116	2.67E+05			0.512	0.006
4.00	3216.00	3.22	-0.025	0.471	1.116	2.67E+05	0.063	0.509	0.507	0.520
5.00	3972.00	3.97	-0.027	0.464	1.116	2.67E+05	0.063	0.501	0.504	0.514
6.00	4726.00	4.73	-0.029	0.472	1.116	2.67E+05	0.063	0.507	0.502	0.523
7.00	5482.00	5.48	-0.031	0.468	1.116	2.67E+05	0.063	0.500	0.499	0.518
8.00	6240.00	6.24	-0.028	0.457	1.116	2.67E+05	0.063	0.493	0.497	0.514
9.00	6991.00	6.99	-0.034	0.000	1.116	2.67E+05	0.063	0.029	0.494	0.053
10.00	7747.00	7.75	-0.034	0.000	1.116	2.67E+05	0.063	0.029	0.492	0.055
Area ratio	0.061									



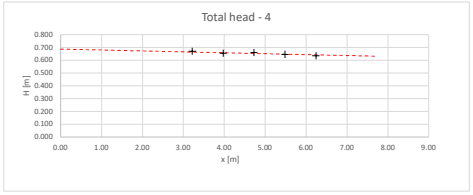
3		
Q	0.100	[m^3/s]
Approach		
y_a	0.685	[m]
w_a	2.000	[m]
A_a	1.370	[m^2]
v_a	0.073	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	9.58E+04	[-]
Linear interpolation		
H_a	0.687	[m]
S_f	0.0052	[m/m]
H_0	0.605	[m]
ΔH_a	0.082	[m]
k_e	**0.769**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.497	1.450		0.107		0.605	
1.00	445.00	0.45			1.450	3.47E+05			0.602	0.002
2.00	1049.00	1.05			1.450	3.47E+05			0.599	0.005
3.00	1799.00	1.80			1.450	3.47E+05			0.595	0.009
4.00	3216.00	3.22	-0.025	0.509	1.450	3.47E+05	0.107	0.591	0.588	0.608
5.00	3972.00	3.97	-0.027	0.498	1.450	3.47E+05	0.107	0.579	0.584	0.599
6.00	4726.00	4.73	-0.029	0.506	1.450	3.47E+05	0.107	0.584	0.580	0.609
7.00	5482.00	5.48	-0.031	0.499	1.450	3.47E+05	0.107	0.575	0.576	0.604
8.00	6240.00	6.24	-0.028	0.492	1.450	3.47E+05	0.107	0.571	0.572	0.604
9.00	6991.00	6.99	-0.034	0.000	1.450	3.47E+05	0.107	0.073	0.568	0.110
10.00	7747.00	7.75	-0.034	0.000	1.450	3.47E+05	0.107	0.073	0.564	0.114
Area ratio	0.050									



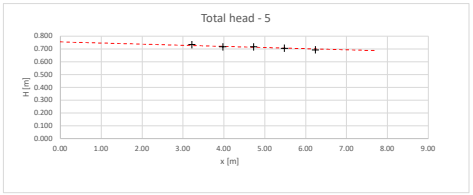
4		
Q	0.120	[m^3/s]
Approach		
y_a	0.799	[m]
w_a	2.000	[m]
A_a	1.598	[m^2]
v_a	0.075	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	1.08E+05	[-]
Linear interpolation		
H_a	0.801	[m]
S_f	0.0072	[m/m]
H_0	0.687	[m]
ΔH_a	0.114	[m]
k_e	**0.742**	[-]
u_{be}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.801		
Face	0	0	0.000	0.532	1.740		0.154		0.687	
1.00	445.00	0.45			1.740	4.16E+05		0.000	0.684	0.003
2.00	1049.00	1.05			1.740	4.16E+05		0.000	0.679	0.008
3.00	1799.00	1.80			1.740	4.16E+05		0.000	0.674	0.013
4.00	3216.00	3.22	-0.025	0.540	1.740	4.16E+05	0.154	0.669	0.664	0.692
5.00	3972.00	3.97	-0.027	0.528	1.740	4.16E+05	0.154	0.655	0.658	0.684
6.00	4726.00	4.73	-0.029	0.535	1.740	4.16E+05	0.154	0.660	0.653	0.694
7.00	5482.00	5.48	-0.031	0.523	1.740	4.16E+05	0.154	0.646	0.647	0.685
8.00	6240.00	6.24	-0.028	0.508	1.740	4.16E+05	0.154	0.634	0.642	0.679
9.00	6991.00	6.99	-0.034	0.000	1.740	4.16E+05	0.154	0.120	0.637	0.171
10.00	7747.00	7.75	-0.034	0.000	1.740	4.16E+05	0.154	0.120	0.631	0.176
Area ratio	0.043									



5		
Q	0.135	[m^3/s]
Approach		
y_a	0.894	[m]
w_a	2.000	[m]
A_a	1.788	[m^2]
v_a	0.075	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.025	[m]
Re	1.15E+05	[-]
Linear interpolation		
H_a	0.896	[m]
S_f	0.0088	[m/m]
H_0	0.755	[m]
ΔH_a	0.141	[m]
k_e	**0.725**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.896		
Face	0	0	0.000	0.561	1.954		0.195		0.755	
1.00	445.00	0.45	0.000	-1.017	1.954	4.67E+05	0.195	-0.822	0.751	-0.818
2.00	1049.00	1.05	0.000	-1.022	1.954	4.67E+05	0.195	-0.827	0.746	-0.818
3.00	1799.00	1.80	0.000	-1.008	1.954	4.67E+05	0.195	-0.813	0.739	-0.797
4.00	3216.00	3.22	-0.025	0.565	1.954	4.67E+05	0.195	0.734	0.727	0.763
5.00	3972.00	3.97	-0.027	0.549	1.954	4.67E+05	0.195	0.717	0.720	0.752
6.00	4726.00	4.73	-0.029	0.551	1.954	4.67E+05	0.195	0.717	0.714	0.758
7.00	5482.00	5.48	-0.031	0.542	1.954	4.67E+05	0.195	0.706	0.707	0.754
8.00	6240.00	6.24	-0.028	0.527	1.954	4.67E+05	0.195	0.694	0.700	0.749
9.00	6991.00	6.99	-0.034	0.000	1.954	4.67E+05	0.195	0.161	0.694	0.222
10.00	7747.00	7.75	-0.034	0.000	1.954	4.67E+05	0.195	0.161	0.687	0.229
Area ratio	0.039									



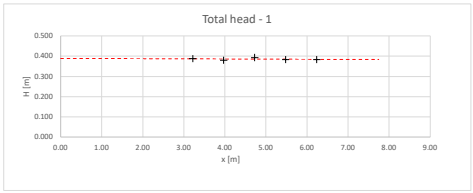
10 Deg Non Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

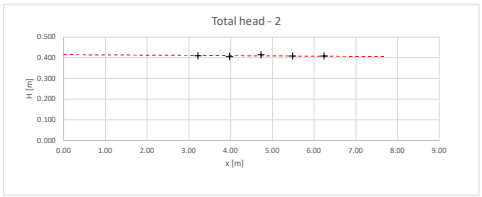
1		
Q	0.030	[m^3/s]
Approach		
y_a	0.470	[m]
w_a	2.000	[m]
A_a	0.940	[m^2]
v_a	0.032	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.015	[m]
Re	3.30E+04	[-]
Linear interpolation		
H_a	0.472	[m]
S_f	0.001	[m/m]
H_0	0.390	[m]
ΔH_a	0.082	[m]
k_e	**8.485**	[-]
u_{ke}	**0.229**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.380	0.436		0.010		0.390	
1.00	445.00	0.45			0.436	1.04E+05			0.389	0.000
2.00	1049.00	1.05			0.436	1.04E+05			0.389	0.001
3.00	1799.00	1.80			0.436	1.04E+05			0.388	0.001
4.00	3216.00	3.22	-0.025	0.404	0.436	1.04E+05	0.010	0.389	0.387	0.392
5.00	3972.00	3.97	-0.027	0.398	0.436	1.04E+05	0.010	0.381	0.387	0.384
6.00	4726.00	4.73	-0.029	0.413	0.436	1.04E+05	0.010	0.393	0.386	0.397
7.00	5482.00	5.48	-0.031	0.405	0.436	1.04E+05	0.010	0.384	0.386	0.388
8.00	6240.00	6.24	-0.028	0.402	0.436	1.04E+05	0.010	0.384	0.385	0.388
9.00	6991.00	6.99	-0.034	0.000	0.436	1.04E+05	0.010	-0.024	0.384	-0.019
10.00	7747.00	7.75	-0.034	0.000	0.436	1.04E+05	0.010	-0.024	0.384	-0.018
Area ratio	0.073									



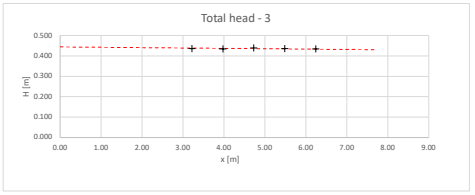
2		
Q	0.041	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.036	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.015	[m]
Re	4.25E+04	[-]
Linear interpolation		
H_a	0.569	[m]
S_f	0.0012	[m/m]
H_0	0.415	[m]
ΔH_a	0.154	[m]
k_e	**8.444**	[-]
u_{ke}	**0.176**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.397	0.598		0.018		0.415	
1.00	445.00	0.45			0.598	1.43E+05			0.414	0.001
2.00	1049.00	1.05			0.598	1.43E+05			0.414	0.001
3.00	1799.00	1.80			0.598	1.43E+05			0.413	0.002
4.00	3216.00	3.22	-0.025	0.417	0.598	1.43E+05	0.018	0.410	0.411	0.414
5.00	3972.00	3.97	-0.027	0.415	0.598	1.43E+05	0.018	0.406	0.410	0.411
6.00	4726.00	4.73	-0.029	0.425	0.598	1.43E+05	0.018	0.414	0.409	0.420
7.00	5482.00	5.48	-0.031	0.421	0.598	1.43E+05	0.018	0.408	0.408	0.415
8.00	6240.00	6.24	-0.028	0.417	0.598	1.43E+05	0.018	0.408	0.407	0.415
9.00	6991.00	6.99	-0.034	0.000	0.598	1.43E+05	0.018	-0.016	0.406	-0.007
10.00	7747.00	7.75	-0.034	0.000	0.598	1.43E+05	0.018	-0.016	0.405	-0.006
Area ratio	0.061									



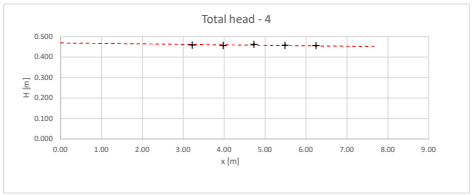
3		
Q	0.052	[m^3/s]
Approach		
y_a	0.686	[m]
w_a	2.000	[m]
A_a	1.372	[m^2]
v_a	0.038	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.015	[m]
Re	4.99E+04	[-]
Linear interpolation		
H_a	0.688	[m]
S_f	0.0018	[m/m]
H_0	0.444	[m]
ΔH_a	0.244	[m]
k_e	**8.355**	[-]
u_{ke}	**0.162**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.415	0.757		0.029		0.444	
1.00	445.00	0.45			0.757	1.81E+05			0.444	0.001
2.00	1049.00	1.05			0.757	1.81E+05			0.443	0.002
3.00	1799.00	1.80			0.757	1.81E+05			0.441	0.003
4.00	3216.00	3.22	-0.025	0.432	0.757	1.81E+05	0.029	0.436	0.439	0.441
5.00	3972.00	3.97	-0.027	0.432	0.757	1.81E+05	0.029	0.434	0.437	0.441
6.00	4726.00	4.73	-0.029	0.439	0.757	1.81E+05	0.029	0.439	0.436	0.448
7.00	5482.00	5.48	-0.031	0.438	0.757	1.81E+05	0.029	0.436	0.435	0.446
8.00	6240.00	6.24	-0.028	0.434	0.757	1.81E+05	0.029	0.435	0.433	0.446
9.00	6991.00	6.99	-0.034	0.000	0.757	1.81E+05	0.029	-0.005	0.432	0.008
10.00	7747.00	7.75	-0.034	0.000	0.757	1.81E+05	0.029	-0.005	0.431	0.009
Area ratio	0.050									



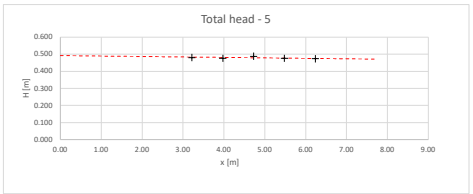
4		
Q	0.061	[m^3/s]
Approach		
y_a	0.801	[m]
w_a	2.000	[m]
A_a	1.602	[m^2]
v_a	0.038	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.014	[m]
Re	5.48E+04	[-]
Linear interpolation		
H_a	0.803	[m]
S_f	0.0023	[m/m]
H_0	0.469	[m]
ΔH_a	0.334	[m]
k_e	**8.336**	[-]
u_{ke}	**0.157**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.803		
Face	0	0	0.000	0.429	0.887		0.040		0.469	
1.00	445.00	0.45			0.887	2.12E+05		0.000	0.468	0.001
2.00	1049.00	1.05			0.887	2.12E+05		0.000	0.467	0.002
3.00	1799.00	1.80			0.887	2.12E+05		0.000	0.465	0.004
4.00	3216.00	3.22	-0.025	0.444	0.887	2.12E+05	0.040	0.459	0.462	0.466
5.00	3972.00	3.97	-0.027	0.444	0.887	2.12E+05	0.040	0.457	0.460	0.466
6.00	4726.00	4.73	-0.029	0.451	0.887	2.12E+05	0.040	0.462	0.458	0.473
7.00	5482.00	5.48	-0.031	0.448	0.887	2.12E+05	0.040	0.457	0.456	0.470
8.00	6240.00	6.24	-0.028	0.444	0.887	2.12E+05	0.040	0.456	0.455	0.470
9.00	6991.00	6.99	-0.034	0.000	0.887	2.12E+05	0.040	0.006	0.453	0.022
10.00	7747.00	7.75	-0.034	0.000	0.887	2.12E+05	0.040	0.006	0.451	0.024
Area ratio	0.043									



5		
Q	0.067	[m^3/s]
Approach		
y_a	0.890	[m]
w_a	2.000	[m]
A_a	1.780	[m^2]
v_a	0.038	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.013	[m]
Re	5.75E+04	[-]
Linear interpolation		
H_a	0.892	[m]
S_f	0.0027	[m/m]
H_0	0.492	[m]
ΔH_a	0.400	[m]
k_e	**8.218**	[-]
u_{ke}	**0.154**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.892		
Face	0	0	0.000	0.443	0.977		0.049		0.492	
1.00	445.00	0.45	0.000	-1.017	0.977	2.34E+05	0.049	-0.968	0.491	-0.967
2.00	1049.00	1.05	0.000	-1.022	0.977	2.34E+05	0.049	-0.973	0.489	-0.971
3.00	1799.00	1.80	0.000	-1.008	0.977	2.34E+05	0.049	-0.959	0.487	-0.954
4.00	3216.00	3.22	-0.025	0.457	0.977	2.34E+05	0.049	0.481	0.483	0.489
5.00	3972.00	3.97	-0.027	0.455	0.977	2.34E+05	0.049	0.477	0.481	0.487
6.00	4726.00	4.73	-0.029	0.469	0.977	2.34E+05	0.049	0.489	0.479	0.501
7.00	5482.00	5.48	-0.031	0.459	0.977	2.34E+05	0.049	0.477	0.477	0.492
8.00	6240.00	6.24	-0.028	0.453	0.977	2.34E+05	0.049	0.474	0.475	0.491
9.00	6991.00	6.99	-0.034	0.000	0.977	2.34E+05	0.049	0.015	0.473	0.033
10.00	7747.00	7.75	-0.034	0.000	0.977	2.34E+05	0.049	0.015	0.471	0.035
Area ratio	0.039									



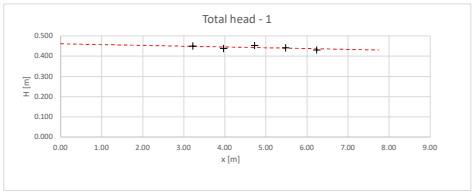
10 Deg Non Linear - Res 6 - NoBlock - 75 mm off Weir Plate

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

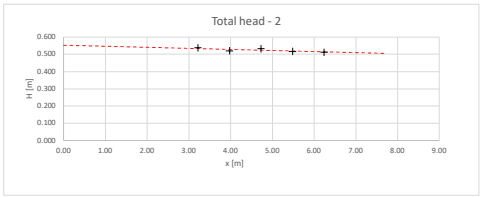
1		
Q	0.085	[m^3/s]
Approach		
y_a	0.470	[m]
w_a	2.000	[m]
A_a	0.940	[m^2]
v_a	0.090	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.042	[m]
Re	9.33E+04	[-]
Linear interpolation		
H_a	0.472	[m]
S_f	0.004	[m/m]
H_0	0.462	[m]
ΔH_a	0.011	[m]
k_e	**0.139**	[-]
u_{ke}	**0.091**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.384	1.232		0.077		0.462	
1.00	445.00	0.45			1.232	2.95E+05			0.460	0.002
2.00	1049.00	1.05			1.232	2.95E+05			0.458	0.004
3.00	1799.00	1.80			1.232	2.95E+05			0.455	0.007
4.00	3216.00	3.22	-0.025	0.398	1.232	2.95E+05	0.077	0.451	0.449	0.463
5.00	3972.00	3.97	-0.027	0.388	1.232	2.95E+05	0.077	0.438	0.446	0.454
6.00	4726.00	4.73	-0.029	0.405	1.232	2.95E+05	0.077	0.453	0.443	0.472
7.00	5482.00	5.48	-0.031	0.396	1.232	2.95E+05	0.077	0.442	0.440	0.463
8.00	6240.00	6.24	-0.028	0.382	1.232	2.95E+05	0.077	0.431	0.437	0.456
9.00	6991.00	6.99	-0.034	0.000	1.232	2.95E+05	0.077	0.043	0.434	0.071
10.00	7747.00	7.75	-0.034	0.000	1.232	2.95E+05	0.077	0.043	0.431	0.074
Area ratio	0.073									



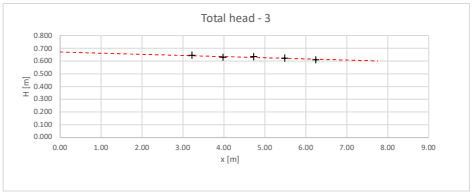
2		
Q	0.110	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.097	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.041	[m]
Re	1.13E+05	[-]
Linear interpolation		
H_a	0.569	[m]
S_f	0.0061	[m/m]
H_0	0.553	[m]
ΔH_a	0.017	[m]
k_e	**0.131**	[-]
u_{ke}	**0.068**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.423	1.592		0.129		0.553	
1.00	445.00	0.45			1.592	3.81E+05			0.550	0.003
2.00	1049.00	1.05			1.592	3.81E+05			0.546	0.006
3.00	1799.00	1.80			1.592	3.81E+05			0.542	0.011
4.00	3216.00	3.22	-0.025	0.433	1.592	3.81E+05	0.129	0.538	0.533	0.557
5.00	3972.00	3.97	-0.027	0.418	1.592	3.81E+05	0.129	0.521	0.528	0.545
6.00	4726.00	4.73	-0.029	0.432	1.592	3.81E+05	0.129	0.532	0.524	0.561
7.00	5482.00	5.48	-0.031	0.419	1.592	3.81E+05	0.129	0.517	0.519	0.550
8.00	6240.00	6.24	-0.028	0.410	1.592	3.81E+05	0.129	0.512	0.514	0.550
9.00	6991.00	6.99	-0.034	0.000	1.592	3.81E+05	0.129	0.095	0.510	0.138
10.00	7747.00	7.75	-0.034	0.000	1.592	3.81E+05	0.129	0.095	0.505	0.143
Area ratio	0.061									



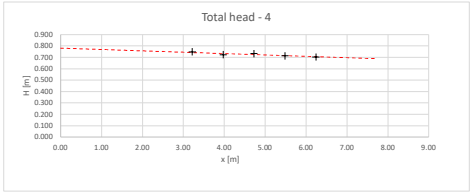
3		
Q	0.136	[m^3/s]
Approach		
y_a	0.687	[m]
w_a	2.000	[m]
A_a	1.375	[m^2]
v_a	0.099	[m/s]
$H(v_a)$	0.001	[m]
Fr	0.038	[m]
Re	1.30E+05	[-]
Linear interpolation		
H_a	0.690	[m]
S_f	0.0090	[m/m]
H_0	0.671	[m]
ΔH_a	0.019	[m]
k_e	**0.096**	[-]
u_{ke}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.472	1.975		0.199		0.671	
1.00	445.00	0.45			1.975	4.72E+05			0.667	0.004
2.00	1049.00	1.05			1.975	4.72E+05			0.661	0.009
3.00	1799.00	1.80			1.975	4.72E+05			0.655	0.016
4.00	3216.00	3.22	-0.025	0.472	1.975	4.72E+05	0.199	0.646	0.642	0.674
5.00	3972.00	3.97	-0.027	0.458	1.975	4.72E+05	0.199	0.630	0.635	0.665
6.00	4726.00	4.73	-0.029	0.464	1.975	4.72E+05	0.199	0.634	0.628	0.677
7.00	5482.00	5.48	-0.031	0.455	1.975	4.72E+05	0.199	0.622	0.621	0.672
8.00	6240.00	6.24	-0.028	0.438	1.975	4.72E+05	0.199	0.609	0.615	0.665
9.00	6991.00	6.99	-0.034	0.000	1.975	4.72E+05	0.199	0.165	0.608	0.228
10.00	7747.00	7.75	-0.034	0.000	1.975	4.72E+05	0.199	0.165	0.601	0.235
Area ratio	0.050									



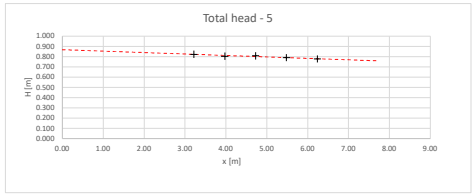
4		
Q	0.160	[m^3/s]
Approach		
y_a	0.802	[m]
w_a	2.000	[m]
A_a	1.604	[m^2]
v_a	0.100	[m/s]
$H(v_a)$	0.001	[m]
Fr	0.036	[m]
Re	1.43E+05	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0120	[m/m]
H_0	0.781	[m]
ΔH_a	0.023	[m]
k_e	**0.086**	[-]
u_{ke}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.805		
Face	0	0	0.000	0.508	2.316		0.273		0.781	
1.00	445.00	0.45			2.316	5.54E+05		0.000	0.776	0.005
2.00	1049.00	1.05			2.316	5.54E+05		0.000	0.769	0.013
3.00	1799.00	1.80			2.316	5.54E+05		0.000	0.760	0.022
4.00	3216.00	3.22	-0.025	0.501	2.316	5.54E+05	0.273	0.749	0.743	0.788
5.00	3972.00	3.97	-0.027	0.477	2.316	5.54E+05	0.273	0.724	0.734	0.772
6.00	4726.00	4.73	-0.029	0.489	2.316	5.54E+05	0.273	0.733	0.725	0.790
7.00	5482.00	5.48	-0.031	0.471	2.316	5.54E+05	0.273	0.713	0.715	0.779
8.00	6240.00	6.24	-0.028	0.458	2.316	5.54E+05	0.273	0.703	0.706	0.778
9.00	6991.00	6.99	-0.034	0.000	2.316	5.54E+05	0.273	0.239	0.697	0.323
10.00	7747.00	7.75	-0.034	0.000	2.316	5.54E+05	0.273	0.239	0.688	0.332
Area ratio	0.043									



5		
Q	0.175	[m^3/s]
Approach		
y_a	0.892	[m]
w_a	2.000	[m]
A_a	1.784	[m^2]
v_a	0.098	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.49E+05	[-]
Linear interpolation		
H_a	0.894	[m]
S_f	0.0141	[m/m]
H_0	0.868	[m]
ΔH_a	0.026	[m]
k_e	**0.080**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.894		
Face	0	0	0.000	0.540	2.537		0.328		0.868	
1.00	445.00	0.45	0.000	-1.017	2.537	6.07E+05	0.328	-0.689	0.862	-0.683
2.00	1049.00	1.05	0.000	-1.022	2.537	6.07E+05	0.328	-0.694	0.853	-0.679
3.00	1799.00	1.80	0.000	-1.008	2.537	6.07E+05	0.328	-0.680	0.843	-0.654
4.00	3216.00	3.22	-0.025	0.521	2.537	6.07E+05	0.328	0.824	0.823	0.869
5.00	3972.00	3.97	-0.027	0.504	2.537	6.07E+05	0.328	0.805	0.812	0.861
6.00	4726.00	4.73	-0.029	0.510	2.537	6.07E+05	0.328	0.809	0.801	0.876
7.00	5482.00	5.48	-0.031	0.494	2.537	6.07E+05	0.328	0.791	0.791	0.868
8.00	6240.00	6.24	-0.028	0.479	2.537	6.07E+05	0.328	0.779	0.780	0.867
9.00	6991.00	6.99	-0.034	0.000	2.537	6.07E+05	0.328	0.294	0.769	0.393
10.00	7747.00	7.75	-0.034	0.000	2.537	6.07E+05	0.328	0.294	0.759	0.403
Area ratio	0.039									



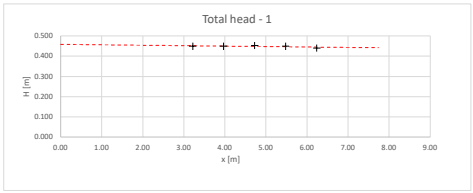
10 Deg Non Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

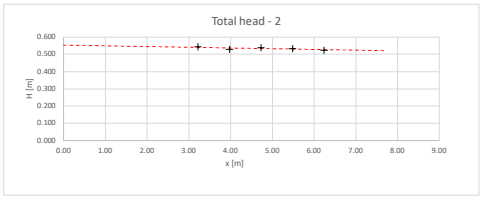
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.467	[m]
w_a	2.000	[m]
A_a	0.934	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.49E+04	[-]
Linear interpolation		
H_a	0.469	[m]
S_f	0.002	[m/m]
H_0	0.459	[m]
ΔH_a	0.010	[m]
k_e	**0.277**	[-]
u_{be}	**0.098**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.421	0.856		0.037		0.459	
1.00	445.00	0.45			0.856	2.05E+05			0.458	0.001
2.00	1049.00	1.05			0.856	2.05E+05			0.457	0.002
3.00	1799.00	1.80			0.856	2.05E+05			0.455	0.004
4.00	3216.00	3.22	-0.025	0.437	0.856	2.05E+05	0.037	0.450	0.452	0.457
5.00	3972.00	3.97	-0.027	0.439	0.856	2.05E+05	0.037	0.450	0.450	0.458
6.00	4726.00	4.73	-0.029	0.445	0.856	2.05E+05	0.037	0.454	0.449	0.464
7.00	5482.00	5.48	-0.031	0.443	0.856	2.05E+05	0.037	0.450	0.447	0.461
8.00	6240.00	6.24	-0.028	0.431	0.856	2.05E+05	0.037	0.441	0.445	0.454
9.00	6991.00	6.99	-0.034	0.000	0.856	2.05E+05	0.037	0.003	0.444	0.018
10.00	7747.00	7.75	-0.034	0.000	0.856	2.05E+05	0.037	0.003	0.442	0.020
Area ratio	0.074									



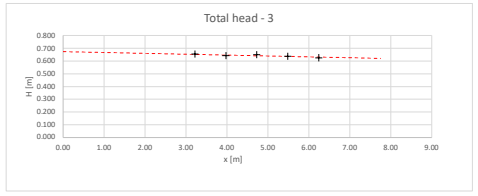
2		
Q	0.088	[m^3/s]
Approach		
y_a	0.566	[m]
w_a	2.000	[m]
A_a	1.132	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.06E+04	[-]
Linear interpolation		
H_a	0.568	[m]
S_f	0.0042	[m/m]
H_0	0.553	[m]
ΔH_a	0.015	[m]
k_e	**0.182**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.470	1.275		0.083		0.553	
1.00	445.00	0.45			1.275	3.05E+05			0.551	0.002
2.00	1049.00	1.05			1.275	3.05E+05			0.549	0.004
3.00	1799.00	1.80			1.275	3.05E+05			0.546	0.008
4.00	3216.00	3.22	-0.025	0.486	1.275	3.05E+05	0.083	0.544	0.540	0.557
5.00	3972.00	3.97	-0.027	0.473	1.275	3.05E+05	0.083	0.529	0.537	0.546
6.00	4726.00	4.73	-0.029	0.485	1.275	3.05E+05	0.083	0.539	0.533	0.558
7.00	5482.00	5.48	-0.031	0.481	1.275	3.05E+05	0.083	0.533	0.530	0.556
8.00	6240.00	6.24	-0.028	0.468	1.275	3.05E+05	0.083	0.523	0.527	0.549
9.00	6991.00	6.99	-0.034	0.000	1.275	3.05E+05	0.083	0.049	0.524	0.078
10.00	7747.00	7.75	-0.034	0.000	1.275	3.05E+05	0.083	0.049	0.521	0.081
Area ratio	0.061									



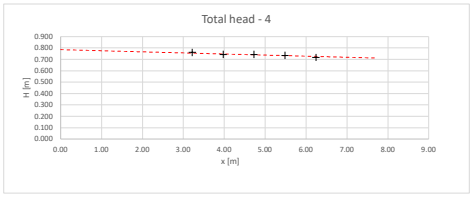
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.690	[m]
S_f	0.0068	[m/m]
H_0	0.674	[m]
ΔH_a	0.016	[m]
k_e	**0.111**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.528	1.694		0.146		0.674	
1.00	445.00	0.45			1.694	4.05E+05			0.671	0.003
2.00	1049.00	1.05			1.694	4.05E+05			0.667	0.007
3.00	1799.00	1.80			1.694	4.05E+05			0.662	0.012
4.00	3216.00	3.22	-0.025	0.534	1.694	4.05E+05	0.146	0.656	0.652	0.678
5.00	3972.00	3.97	-0.027	0.522	1.694	4.05E+05	0.146	0.642	0.647	0.669
6.00	4726.00	4.73	-0.029	0.532	1.694	4.05E+05	0.146	0.649	0.642	0.681
7.00	5482.00	5.48	-0.031	0.522	1.694	4.05E+05	0.146	0.637	0.637	0.675
8.00	6240.00	6.24	-0.028	0.507	1.694	4.05E+05	0.146	0.625	0.631	0.668
9.00	6991.00	6.99	-0.034	0.000	1.694	4.05E+05	0.146	0.112	0.626	0.160
10.00	7747.00	7.75	-0.034	0.000	1.694	4.05E+05	0.146	0.112	0.621	0.165
Area ratio	0.050									



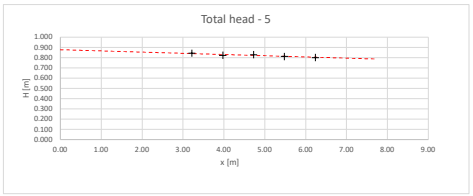
4		
Q	0.141	[m^3/s]
Approach		
y_a	0.803	[m]
w_a	2.000	[m]
A_a	1.606	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0096	[m/m]
H_0	0.785	[m]
ΔH_a	0.020	[m]
k_e	**0.095**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.805		
Face	0	0	0.000	0.572	2.044		0.213		0.785	
1.00	445.00	0.45			2.044	4.89E+05		0.000	0.781	0.004
2.00	1049.00	1.05			2.044	4.89E+05		0.000	0.775	0.010
3.00	1799.00	1.80			2.044	4.89E+05		0.000	0.768	0.017
4.00	3216.00	3.22	-0.025	0.573	2.044	4.89E+05	0.213	0.761	0.755	0.792
5.00	3972.00	3.97	-0.027	0.557	2.044	4.89E+05	0.213	0.743	0.747	0.781
6.00	4726.00	4.73	-0.029	0.559	2.044	4.89E+05	0.213	0.743	0.740	0.788
7.00	5482.00	5.48	-0.031	0.553	2.044	4.89E+05	0.213	0.735	0.733	0.787
8.00	6240.00	6.24	-0.028	0.533	2.044	4.89E+05	0.213	0.718	0.726	0.777
9.00	6991.00	6.99	-0.034	0.000	2.044	4.89E+05	0.213	0.179	0.719	0.246
10.00	7747.00	7.75	-0.034	0.000	2.044	4.89E+05	0.213	0.179	0.711	0.253
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.897	[m]
w_a	2.000	[m]
A_a	1.793	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.899	[m]
S_f	0.0117	[m/m]
H_0	0.878	[m]
ΔH_a	0.021	[m]
k_e	**0.080**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.899		
Face	0	0	0.000	0.610	2.291		0.267		0.878	
1.00	445.00	0.45	0.000	-1.017	2.291	5.48E+05	0.267	-0.750	0.872	-0.744
2.00	1049.00	1.05	0.000	-1.022	2.291	5.48E+05	0.267	-0.755	0.865	-0.742
3.00	1799.00	1.80	0.000	-1.008	2.291	5.48E+05	0.267	-0.740	0.856	-0.719
4.00	3216.00	3.22	-0.025	0.601	2.291	5.48E+05	0.267	0.844	0.840	0.881
5.00	3972.00	3.97	-0.027	0.583	2.291	5.48E+05	0.267	0.824	0.831	0.870
6.00	4726.00	4.73	-0.029	0.592	2.291	5.48E+05	0.267	0.830	0.822	0.886
7.00	5482.00	5.48	-0.031	0.575	2.291	5.48E+05	0.267	0.812	0.813	0.876
8.00	6240.00	6.24	-0.028	0.561	2.291	5.48E+05	0.267	0.801	0.804	0.874
9.00	6991.00	6.99	-0.034	0.000	2.291	5.48E+05	0.267	0.233	0.796	0.316
10.00	7747.00	7.75	-0.034	0.000	2.291	5.48E+05	0.267	0.233	0.787	0.324
Area ratio	0.038									



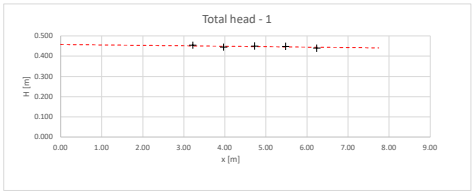
10 Deg Non Linear - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

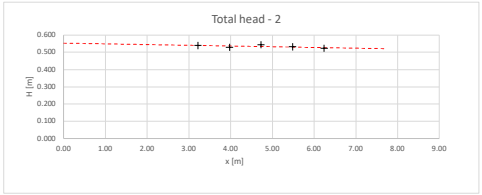
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.467	[m]
w_a	2.000	[m]
A_a	0.934	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.52E+04	[-]
Linear interpolation		
H_a	0.469	[m]
S_f	0.002	[m/m]
H_0	0.458	[m]
ΔH_a	0.011	[m]
k_e	**0.292**	[-]
u_{be}	**0.098**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.421	0.859		0.038		0.458	
1.00	445.00	0.45			0.859	2.05E+05			0.457	0.001
2.00	1049.00	1.05			0.859	2.05E+05			0.456	0.002
3.00	1799.00	1.80			0.859	2.05E+05			0.454	0.004
4.00	3216.00	3.22	-0.025	0.442	0.859	2.05E+05	0.038	0.454	0.451	0.461
5.00	3972.00	3.97	-0.027	0.435	0.859	2.05E+05	0.038	0.446	0.450	0.454
6.00	4726.00	4.73	-0.029	0.442	0.859	2.05E+05	0.038	0.451	0.448	0.461
7.00	5482.00	5.48	-0.031	0.443	0.859	2.05E+05	0.038	0.449	0.446	0.461
8.00	6240.00	6.24	-0.028	0.430	0.859	2.05E+05	0.038	0.440	0.445	0.453
9.00	6991.00	6.99	-0.034	0.000	0.859	2.05E+05	0.038	0.004	0.443	0.019
10.00	7747.00	7.75	-0.034	0.000	0.859	2.05E+05	0.038	0.004	0.441	0.020
Area ratio	0.074									



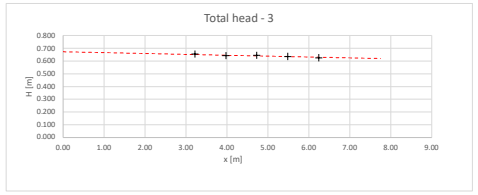
2		
Q	0.088	[m^3/s]
Approach		
y_a	0.564	[m]
w_a	2.000	[m]
A_a	1.128	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.07E+04	[-]
Linear interpolation		
H_a	0.566	[m]
S_f	0.0042	[m/m]
H_0	0.553	[m]
ΔH_a	0.013	[m]
k_e	**0.160**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.470	1.274		0.083		0.553	
1.00	445.00	0.45			1.274	3.05E+05			0.551	0.002
2.00	1049.00	1.05			1.274	3.05E+05			0.549	0.004
3.00	1799.00	1.80			1.274	3.05E+05			0.546	0.008
4.00	3216.00	3.22	-0.025	0.482	1.274	3.05E+05	0.083	0.539	0.540	0.553
5.00	3972.00	3.97	-0.027	0.473	1.274	3.05E+05	0.083	0.529	0.536	0.546
6.00	4726.00	4.73	-0.029	0.490	1.274	3.05E+05	0.083	0.543	0.533	0.563
7.00	5482.00	5.48	-0.031	0.480	1.274	3.05E+05	0.083	0.532	0.530	0.555
8.00	6240.00	6.24	-0.028	0.468	1.274	3.05E+05	0.083	0.523	0.527	0.549
9.00	6991.00	6.99	-0.034	0.000	1.274	3.05E+05	0.083	0.049	0.524	0.078
10.00	7747.00	7.75	-0.034	0.000	1.274	3.05E+05	0.083	0.049	0.521	0.081
Area ratio	0.061									



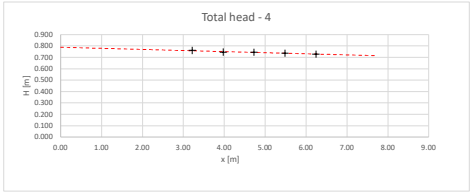
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.690	[m]
S_f	0.0069	[m/m]
H_0	0.673	[m]
ΔH_a	0.017	[m]
k_e	**0.118**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.526	1.697		0.147		0.673	
1.00	445.00	0.45			1.697	4.06E+05			0.670	0.003
2.00	1049.00	1.05			1.697	4.06E+05			0.666	0.007
3.00	1799.00	1.80			1.697	4.06E+05			0.661	0.012
4.00	3216.00	3.22	-0.025	0.533	1.697	4.06E+05	0.147	0.654	0.651	0.676
5.00	3972.00	3.97	-0.027	0.523	1.697	4.06E+05	0.147	0.642	0.646	0.670
6.00	4726.00	4.73	-0.029	0.527	1.697	4.06E+05	0.147	0.645	0.641	0.677
7.00	5482.00	5.48	-0.031	0.520	1.697	4.06E+05	0.147	0.636	0.635	0.673
8.00	6240.00	6.24	-0.028	0.507	1.697	4.06E+05	0.147	0.626	0.630	0.668
9.00	6991.00	6.99	-0.034	0.000	1.697	4.06E+05	0.147	0.113	0.625	0.161
10.00	7747.00	7.75	-0.034	0.000	1.697	4.06E+05	0.147	0.113	0.620	0.166
Area ratio	0.050									



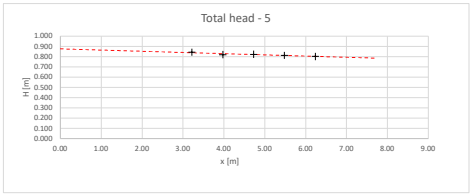
4		
Q	0.141	[m^3/s]
Approach		
y_a	0.805	[m]
w_a	2.000	[m]
A_a	1.610	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.807	[m]
S_f	0.0096	[m/m]
H_0	0.789	[m]
ΔH_a	0.019	[m]
k_e	**0.087**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.807		
Face	0	0	0.000	0.576	2.045		0.213		0.789	
1.00	445.00	0.45			2.045	4.89E+05		0.000	0.785	0.004
2.00	1049.00	1.05			2.045	4.89E+05		0.000	0.779	0.010
3.00	1799.00	1.80			2.045	4.89E+05		0.000	0.772	0.017
4.00	3216.00	3.22	-0.025	0.573	2.045	4.89E+05	0.213	0.761	0.758	0.792
5.00	3972.00	3.97	-0.027	0.560	2.045	4.89E+05	0.213	0.746	0.751	0.784
6.00	4726.00	4.73	-0.029	0.561	2.045	4.89E+05	0.213	0.746	0.744	0.791
7.00	5482.00	5.48	-0.031	0.555	2.045	4.89E+05	0.213	0.737	0.736	0.789
8.00	6240.00	6.24	-0.028	0.543	2.045	4.89E+05	0.213	0.728	0.729	0.788
9.00	6991.00	6.99	-0.034	0.000	2.045	4.89E+05	0.213	0.179	0.722	0.246
10.00	7747.00	7.75	-0.034	0.000	2.045	4.89E+05	0.213	0.179	0.715	0.253
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.897	[m]
w_a	2.000	[m]
A_a	1.794	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.899	[m]
S_f	0.0117	[m/m]
H_0	0.876	[m]
ΔH_a	0.024	[m]
k_e	**0.088**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.899		
Face	0	0	0.000	0.609	2.287		0.267		0.876	
1.00	445.00	0.45	0.000	-1.017	2.287	5.47E+05	0.267	-0.750	0.871	-0.745
2.00	1049.00	1.05	0.000	-1.022	2.287	5.47E+05	0.267	-0.756	0.864	-0.743
3.00	1799.00	1.80	0.000	-1.008	2.287	5.47E+05	0.267	-0.741	0.855	-0.720
4.00	3216.00	3.22	-0.025	0.602	2.287	5.47E+05	0.267	0.844	0.838	0.881
5.00	3972.00	3.97	-0.027	0.581	2.287	5.47E+05	0.267	0.820	0.829	0.867
6.00	4726.00	4.73	-0.029	0.586	2.287	5.47E+05	0.267	0.824	0.821	0.879
7.00	5482.00	5.48	-0.031	0.578	2.287	5.47E+05	0.267	0.813	0.812	0.877
8.00	6240.00	6.24	-0.028	0.564	2.287	5.47E+05	0.267	0.802	0.803	0.875
9.00	6991.00	6.99	-0.034	0.000	2.287	5.47E+05	0.267	0.233	0.794	0.314
10.00	7747.00	7.75	-0.034	0.000	2.287	5.47E+05	0.267	0.233	0.785	0.323
Area ratio	0.038									



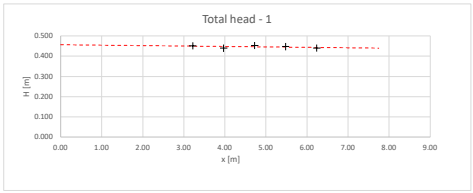
10 Deg Non Linear - Res 3 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

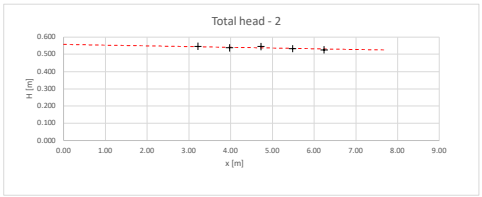
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.468	[m]
w_a	2.000	[m]
A_a	0.936	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.48E+04	[-]
Linear interpolation		
H_a	0.470	[m]
S_f	0.002	[m/m]
H_0	0.457	[m]
ΔH_a	0.013	[m]
k_e	**0.354**	[-]
u_{be}	**0.098**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.420	0.855		0.037		0.457	
1.00	445.00	0.45			0.855	2.04E+05			0.456	0.001
2.00	1049.00	1.05			0.855	2.04E+05			0.455	0.002
3.00	1799.00	1.80			0.855	2.04E+05			0.453	0.004
4.00	3216.00	3.22	-0.025	0.440	0.855	2.04E+05	0.037	0.452	0.450	0.459
5.00	3972.00	3.97	-0.027	0.430	0.855	2.04E+05	0.037	0.440	0.448	0.448
6.00	4726.00	4.73	-0.029	0.445	0.855	2.04E+05	0.037	0.454	0.447	0.464
7.00	5482.00	5.48	-0.031	0.442	0.855	2.04E+05	0.037	0.448	0.445	0.460
8.00	6240.00	6.24	-0.028	0.432	0.855	2.04E+05	0.037	0.441	0.444	0.454
9.00	6991.00	6.99	-0.034	0.000	0.855	2.04E+05	0.037	0.003	0.442	0.018
10.00	7747.00	7.75	-0.034	0.000	0.855	2.04E+05	0.037	0.003	0.440	0.020
Area ratio	0.074									



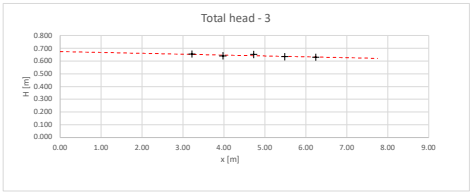
2		
Q	0.088	[m^3/s]
Approach		
y_a	0.568	[m]
w_a	2.000	[m]
A_a	1.136	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.06E+04	[-]
Linear interpolation		
H_a	0.570	[m]
S_f	0.0042	[m/m]
H_0	0.557	[m]
ΔH_a	0.013	[m]
k_e	**0.157**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.474	1.277		0.083		0.557	
1.00	445.00	0.45			1.277	3.05E+05			0.555	0.002
2.00	1049.00	1.05			1.277	3.05E+05			0.553	0.004
3.00	1799.00	1.80			1.277	3.05E+05			0.550	0.008
4.00	3216.00	3.22	-0.025	0.488	1.277	3.05E+05	0.083	0.546	0.544	0.560
5.00	3972.00	3.97	-0.027	0.481	1.277	3.05E+05	0.083	0.537	0.541	0.554
6.00	4726.00	4.73	-0.029	0.491	1.277	3.05E+05	0.083	0.545	0.537	0.565
7.00	5482.00	5.48	-0.031	0.481	1.277	3.05E+05	0.083	0.533	0.534	0.556
8.00	6240.00	6.24	-0.028	0.471	1.277	3.05E+05	0.083	0.526	0.531	0.552
9.00	6991.00	6.99	-0.034	0.000	1.277	3.05E+05	0.083	0.049	0.528	0.078
10.00	7747.00	7.75	-0.034	0.000	1.277	3.05E+05	0.083	0.049	0.525	0.082
Area ratio	0.061									



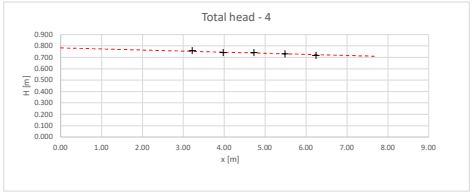
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.689	[m]
w_a	2.000	[m]
A_a	1.378	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.691	[m]
S_f	0.0069	[m/m]
H_0	0.674	[m]
ΔH_a	0.017	[m]
k_e	**0.115**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002							
Face	0	0	0.000	0.527	1.698		0.147		0.674	
1.00	445.00	0.45			1.698	4.06E+05			0.671	0.003
2.00	1049.00	1.05			1.698	4.06E+05			0.667	0.007
3.00	1799.00	1.80			1.698	4.06E+05			0.662	0.012
4.00	3216.00	3.22	-0.025	0.533	1.698	4.06E+05	0.147	0.654	0.652	0.677
5.00	3972.00	3.97	-0.027	0.521	1.698	4.06E+05	0.147	0.641	0.647	0.668
6.00	4726.00	4.73	-0.029	0.533	1.698	4.06E+05	0.147	0.651	0.642	0.683
7.00	5482.00	5.48	-0.031	0.518	1.698	4.06E+05	0.147	0.634	0.637	0.671
8.00	6240.00	6.24	-0.028	0.511	1.698	4.06E+05	0.147	0.630	0.632	0.673
9.00	6991.00	6.99	-0.034	0.000	1.698	4.06E+05	0.147	0.113	0.626	0.161
10.00	7747.00	7.75	-0.034	0.000	1.698	4.06E+05	0.147	0.113	0.621	0.166
Area ratio	0.050									



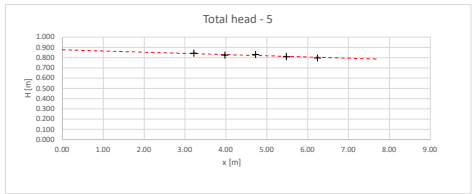
4		
Q	0.141	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.612	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.808	[m]
S_f	0.0095	[m/m]
H_0	0.783	[m]
ΔH_a	0.025	[m]
k_e	**0.117**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.808		
Face	0	0	0.000	0.571	2.041		0.212		0.783	
1.00	445.00	0.45			2.041	4.88E+05		0.000	0.779	0.004
2.00	1049.00	1.05			2.041	4.88E+05		0.000	0.773	0.010
3.00	1799.00	1.80			2.041	4.88E+05		0.000	0.766	0.017
4.00	3216.00	3.22	-0.025	0.571	2.041	4.88E+05	0.212	0.759	0.753	0.789
5.00	3972.00	3.97	-0.027	0.556	2.041	4.88E+05	0.212	0.742	0.746	0.780
6.00	4726.00	4.73	-0.029	0.559	2.041	4.88E+05	0.212	0.743	0.738	0.788
7.00	5482.00	5.48	-0.031	0.550	2.041	4.88E+05	0.212	0.731	0.731	0.783
8.00	6240.00	6.24	-0.028	0.533	2.041	4.88E+05	0.212	0.717	0.724	0.777
9.00	6991.00	6.99	-0.034	0.000	2.041	4.88E+05	0.212	0.178	0.717	0.245
10.00	7747.00	7.75	-0.034	0.000	2.041	4.88E+05	0.212	0.178	0.710	0.252
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.899	[m]
w_a	2.000	[m]
A_a	1.798	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.901	[m]
S_f	0.0117	[m/m]
H_0	0.877	[m]
ΔH_a	0.025	[m]
k_e	**0.092**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	0.002					0.901		
Face	0	0	0.000	0.610	2.289		0.267		0.877	
1.00	445.00	0.45	0.000	-1.017	2.289	5.47E+05	0.267	-0.750	0.872	-0.745
2.00	1049.00	1.05	0.000	-1.022	2.289	5.47E+05	0.267	-0.755	0.865	-0.743
3.00	1799.00	1.80	0.000	-1.008	2.289	5.47E+05	0.267	-0.741	0.856	-0.720
4.00	3216.00	3.22	-0.025	0.601	2.289	5.47E+05	0.267	0.843	0.839	0.881
5.00	3972.00	3.97	-0.027	0.585	2.289	5.47E+05	0.267	0.825	0.830	0.871
6.00	4726.00	4.73	-0.029	0.593	2.289	5.47E+05	0.267	0.831	0.821	0.887
7.00	5482.00	5.48	-0.031	0.575	2.289	5.47E+05	0.267	0.811	0.813	0.875
8.00	6240.00	6.24	-0.028	0.558	2.289	5.47E+05	0.267	0.797	0.804	0.870
9.00	6991.00	6.99	-0.034	0.000	2.289	5.47E+05	0.267	0.233	0.795	0.315
10.00	7747.00	7.75	-0.034	0.000	2.289	5.47E+05	0.267	0.233	0.786	0.324
Area ratio	0.038									



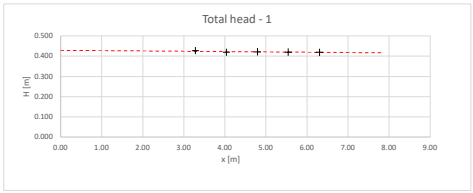
20 Deg Linear - Res 4 - 37.5%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

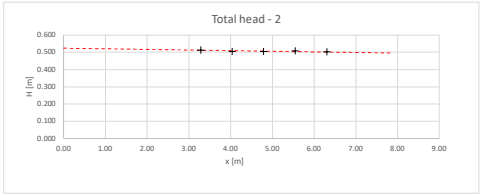
1		
Q	0.048	[m^3/s]
Approach		
y_a	0.446	[m]
w_a	2.000	[m]
A_a	0.891	[m^2]
v_a	0.054	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.026	[m]
Re	5.37E+04	[-]
Linear interpolation		
H_a	0.443	[m]
S_f	0.002	[m/m]
H_0	0.429	[m]
ΔH_a	0.013	[m]
k_e	**0.535**	[-]
u_{be}	**0.112**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.405	0.697		0.025		0.429	
1.00	445.00	0.45			0.697	1.67E+05			0.429	0.001
2.00	1049.00	1.05			0.697	1.67E+05			0.428	0.002
3.00	1799.00	1.80			0.697	1.67E+05			0.427	0.003
4.00	3282.00	3.28	-0.029	0.432	0.697	1.67E+05	0.025	0.428	0.424	0.433
5.00	4037.00	4.04	-0.032	0.427	0.697	1.67E+05	0.025	0.420	0.423	0.426
6.00	4791.00	4.79	-0.034	0.431	0.697	1.67E+05	0.025	0.422	0.422	0.430
7.00	5547.00	5.55	-0.035	0.431	0.697	1.67E+05	0.025	0.420	0.421	0.429
8.00	6305.00	6.31	-0.034	0.429	0.697	1.67E+05	0.025	0.419	0.420	0.429
9.00	7056.00	7.06	-0.034	0.000	0.697	1.67E+05	0.025	-0.009	0.419	0.002
10.00	7813.00	7.81	-0.034	0.000	0.697	1.67E+05	0.025	-0.009	0.417	0.003
Area ratio	0.077									



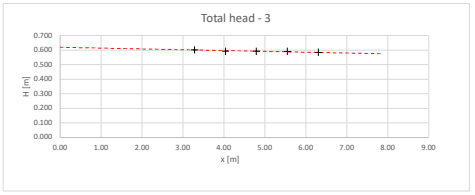
2		
Q	0.080	[m^3/s]
Approach		
y_a	0.566	[m]
w_a	2.000	[m]
A_a	1.132	[m^2]
v_a	0.071	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	8.24E+04	[-]
Linear interpolation		
H_a	0.563	[m]
S_f	0.0036	[m/m]
H_0	0.524	[m]
ΔH_a	0.039	[m]
k_e	**0.575**	[-]
u_{be}	**0.068**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.455	1.160		0.069		0.524	
1.00	445.00	0.45			1.160	2.77E+05			0.522	0.002
2.00	1049.00	1.05			1.160	2.77E+05			0.520	0.004
3.00	1799.00	1.80			1.160	2.77E+05			0.517	0.006
4.00	3282.00	3.28	-0.029	0.473	1.160	2.77E+05	0.069	0.513	0.512	0.525
5.00	4037.00	4.04	-0.032	0.469	1.160	2.77E+05	0.069	0.505	0.509	0.520
6.00	4791.00	4.79	-0.034	0.470	1.160	2.77E+05	0.069	0.505	0.507	0.522
7.00	5547.00	5.55	-0.035	0.474	1.160	2.77E+05	0.069	0.508	0.504	0.528
8.00	6305.00	6.31	-0.034	0.468	1.160	2.77E+05	0.069	0.503	0.501	0.525
9.00	7056.00	7.06	-0.034	0.000	1.160	2.77E+05	0.069	0.035	0.499	0.060
10.00	7813.00	7.81	-0.034	0.000	1.160	2.77E+05	0.069	0.035	0.496	0.062
Area ratio	0.061									



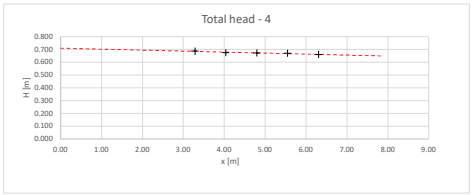
3		
Q	0.105	[m^3/s]
Approach		
y_a	0.687	[m]
w_a	2.000	[m]
A_a	1.374	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.01E+05	[-]
Linear interpolation		
H_a	0.684	[m]
S_f	0.0057	[m/m]
H_0	0.620	[m]
ΔH_a	0.065	[m]
k_e	**0.545**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.501	1.524		0.118		0.620	
1.00	445.00	0.45			1.524	3.64E+05			0.617	0.003
2.00	1049.00	1.05			1.524	3.64E+05			0.614	0.006
3.00	1799.00	1.80			1.524	3.64E+05			0.610	0.010
4.00	3282.00	3.28	-0.029	0.513	1.524	3.64E+05	0.118	0.602	0.601	0.621
5.00	4037.00	4.04	-0.032	0.506	1.524	3.64E+05	0.118	0.592	0.597	0.615
6.00	4791.00	4.79	-0.034	0.508	1.524	3.64E+05	0.118	0.592	0.593	0.620
7.00	5547.00	5.55	-0.035	0.508	1.524	3.64E+05	0.118	0.592	0.588	0.623
8.00	6305.00	6.31	-0.034	0.501	1.524	3.64E+05	0.118	0.585	0.584	0.621
9.00	7056.00	7.06	-0.034	0.000	1.524	3.64E+05	0.118	0.084	0.580	0.124
10.00	7813.00	7.81	-0.034	0.000	1.524	3.64E+05	0.118	0.084	0.575	0.129
Area ratio	0.050									



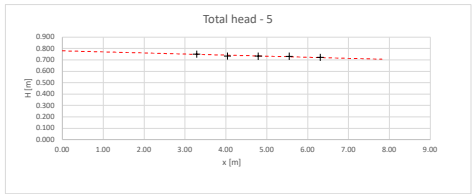
4		
Q	0.125	[m^3/s]
Approach		
y_a	0.801	[m]
w_a	2.000	[m]
A_a	1.602	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.798	[m]
S_f	0.0077	[m/m]
H_0	0.710	[m]
ΔH_a	0.089	[m]
k_e	**0.530**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.798		
Face	0	0	0.000	0.542	1.812		0.167		0.710	
1.00	445.00	0.45			1.812	4.33E+05		0.000	0.706	0.003
2.00	1049.00	1.05			1.812	4.33E+05		0.000	0.702	0.008
3.00	1799.00	1.80			1.812	4.33E+05		0.000	0.696	0.014
4.00	3282.00	3.28	-0.029	0.548	1.812	4.33E+05	0.167	0.686	0.684	0.711
5.00	4037.00	4.04	-0.032	0.539	1.812	4.33E+05	0.167	0.674	0.679	0.705
6.00	4791.00	4.79	-0.034	0.539	1.812	4.33E+05	0.167	0.672	0.673	0.709
7.00	5547.00	5.55	-0.035	0.538	1.812	4.33E+05	0.167	0.670	0.667	0.713
8.00	6305.00	6.31	-0.034	0.528	1.812	4.33E+05	0.167	0.661	0.661	0.710
9.00	7056.00	7.06	-0.034	0.000	1.812	4.33E+05	0.167	0.133	0.655	0.188
10.00	7813.00	7.81	-0.034	0.000	1.812	4.33E+05	0.167	0.133	0.649	0.194
Area ratio	0.043									



5		
Q	0.140	[m^3/s]
Approach		
y_a	0.892	[m]
w_a	2.000	[m]
A_a	1.784	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.026	[m]
Re	1.19E+05	[-]
Linear interpolation		
H_a	0.889	[m]
S_f	0.0094	[m/m]
H_0	0.780	[m]
ΔH_a	0.109	[m]
k_e	**0.522**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.889		
Face	0	0	0.000	0.571	2.026		0.209		0.780	
1.00	445.00	0.45	0.000	-1.017	2.026	4.85E+05	0.209	-0.808	0.776	-0.804
2.00	1049.00	1.05	0.000	-1.022	2.026	4.85E+05	0.209	-0.813	0.770	-0.803
3.00	1799.00	1.80	0.000	-1.008	2.026	4.85E+05	0.209	-0.798	0.763	-0.781
4.00	3282.00	3.28	-0.029	0.572	2.026	4.85E+05	0.209	0.752	0.749	0.783
5.00	4037.00	4.04	-0.032	0.557	2.026	4.85E+05	0.209	0.735	0.742	0.773
6.00	4791.00	4.79	-0.034	0.558	2.026	4.85E+05	0.209	0.733	0.735	0.778
7.00	5547.00	5.55	-0.035	0.558	2.026	4.85E+05	0.209	0.733	0.728	0.785
8.00	6305.00	6.31	-0.034	0.547	2.026	4.85E+05	0.209	0.723	0.721	0.782
9.00	7056.00	7.06	-0.034	0.000	2.026	4.85E+05	0.209	0.175	0.714	0.242
10.00	7813.00	7.81	-0.034	0.000	2.026	4.85E+05	0.209	0.175	0.707	0.249
Area ratio	0.039									



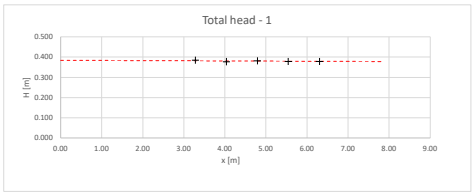
20 Deg Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

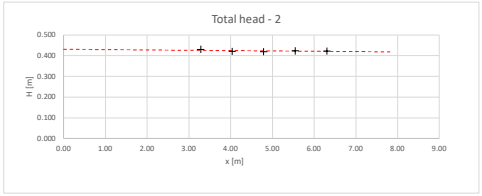
1		
Q	0.030	[m^3/s]
Approach		
y_a	0.441	[m]
w_a	2.000	[m]
A_a	0.883	[m^2]
v_a	0.035	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.017	[m]
Re	3.41E+04	[-]
Linear interpolation		
H_a	0.438	[m]
S_f	0.001	[m/m]
H_0	0.385	[m]
ΔH_a	0.054	[m]
k_e	**5.417**	[-]
u_{ke}	**0.200**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.375	0.442		0.010		0.385	
1.00	445.00	0.45			0.442	1.06E+05			0.384	0.000
2.00	1049.00	1.05			0.442	1.06E+05			0.384	0.001
3.00	1799.00	1.80			0.442	1.06E+05			0.383	0.001
4.00	3282.00	3.28	-0.029	0.405	0.442	1.06E+05	0.010	0.385	0.382	0.388
5.00	4037.00	4.04	-0.032	0.400	0.442	1.06E+05	0.010	0.378	0.381	0.381
6.00	4791.00	4.79	-0.034	0.406	0.442	1.06E+05	0.010	0.382	0.381	0.386
7.00	5547.00	5.55	-0.035	0.404	0.442	1.06E+05	0.010	0.379	0.380	0.384
8.00	6305.00	6.31	-0.034	0.403	0.442	1.06E+05	0.010	0.379	0.380	0.384
9.00	7056.00	7.06	-0.034	0.000	0.442	1.06E+05	0.010	-0.024	0.379	-0.019
10.00	7813.00	7.81	-0.034	0.000	0.442	1.06E+05	0.010	-0.024	0.379	-0.018
Area ratio	0.078									



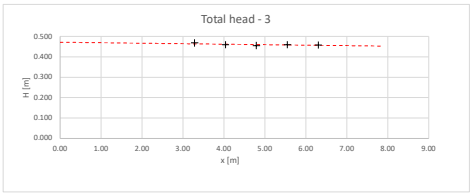
2		
Q	0.049	[m^3/s]
Approach		
y_a	0.563	[m]
w_a	2.000	[m]
A_a	1.126	[m^2]
v_a	0.043	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.018	[m]
Re	5.04E+04	[-]
Linear interpolation		
H_a	0.560	[m]
S_f	0.0016	[m/m]
H_0	0.431	[m]
ΔH_a	0.129	[m]
k_e	**5.061**	[-]
u_{ke}	**0.122**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.405	0.708		0.026		0.431	
1.00	445.00	0.45			0.708	1.69E+05			0.430	0.001
2.00	1049.00	1.05			0.708	1.69E+05			0.429	0.002
3.00	1799.00	1.80			0.708	1.69E+05			0.428	0.003
4.00	3282.00	3.28	-0.029	0.434	0.708	1.69E+05	0.026	0.430	0.426	0.436
5.00	4037.00	4.04	-0.032	0.427	0.708	1.69E+05	0.026	0.421	0.424	0.427
6.00	4791.00	4.79	-0.034	0.428	0.708	1.69E+05	0.026	0.419	0.423	0.427
7.00	5547.00	5.55	-0.035	0.432	0.708	1.69E+05	0.026	0.423	0.422	0.432
8.00	6305.00	6.31	-0.034	0.431	0.708	1.69E+05	0.026	0.422	0.421	0.432
9.00	7056.00	7.06	-0.034	0.000	0.708	1.69E+05	0.026	-0.008	0.420	0.003
10.00	7813.00	7.81	-0.034	0.000	0.708	1.69E+05	0.026	-0.008	0.418	0.004
Area ratio	0.061									



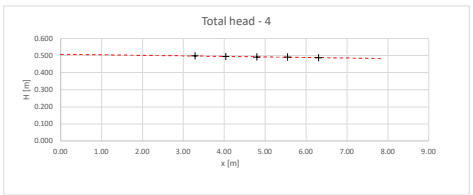
3		
Q	0.063	[m^3/s]
Approach		
y_a	0.682	[m]
w_a	2.000	[m]
A_a	1.364	[m^2]
v_a	0.046	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.018	[m]
Re	6.03E+04	[-]
Linear interpolation		
H_a	0.679	[m]
S_f	0.0024	[m/m]
H_0	0.472	[m]
ΔH_a	0.207	[m]
k_e	**4.895**	[-]
u_{ke}	**0.109**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.430	0.911		0.042		0.472	
1.00	445.00	0.45			0.911	2.18E+05			0.471	0.001
2.00	1049.00	1.05			0.911	2.18E+05			0.469	0.003
3.00	1799.00	1.80			0.911	2.18E+05			0.468	0.004
4.00	3282.00	3.28	-0.029	0.455	0.911	2.18E+05	0.042	0.468	0.464	0.476
5.00	4037.00	4.04	-0.032	0.450	0.911	2.18E+05	0.042	0.460	0.462	0.470
6.00	4791.00	4.79	-0.034	0.447	0.911	2.18E+05	0.042	0.455	0.460	0.467
7.00	5547.00	5.55	-0.035	0.453	0.911	2.18E+05	0.042	0.460	0.459	0.473
8.00	6305.00	6.31	-0.034	0.450	0.911	2.18E+05	0.042	0.458	0.457	0.473
9.00	7056.00	7.06	-0.034	0.000	0.911	2.18E+05	0.042	0.008	0.455	0.025
10.00	7813.00	7.81	-0.034	0.000	0.911	2.18E+05	0.042	0.008	0.453	0.027
Area ratio	0.051									



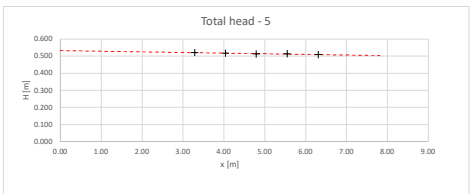
4		
Q	0.074	[m^3/s]
Approach		
y_a	0.800	[m]
w_a	2.000	[m]
A_a	1.599	[m^2]
v_a	0.046	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.017	[m]
Re	6.65E+04	[-]
Linear interpolation		
H_a	0.797	[m]
S_f	0.0031	[m/m]
H_0	0.508	[m]
ΔH_a	0.289	[m]
k_e	**4.905**	[-]
u_{ke}	**0.106**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.797		
Face	0	0	0.000	0.449	1.075		0.059		0.508	
1.00	445.00	0.45			1.075	2.57E+05		0.000	0.506	0.001
2.00	1049.00	1.05			1.075	2.57E+05		0.000	0.505	0.003
3.00	1799.00	1.80			1.075	2.57E+05		0.000	0.502	0.006
4.00	3282.00	3.28	-0.029	0.468	1.075	2.57E+05	0.059	0.498	0.498	0.508
5.00	4037.00	4.04	-0.032	0.467	1.075	2.57E+05	0.059	0.494	0.495	0.507
6.00	4791.00	4.79	-0.034	0.467	1.075	2.57E+05	0.059	0.492	0.493	0.507
7.00	5547.00	5.55	-0.035	0.468	1.075	2.57E+05	0.059	0.492	0.490	0.509
8.00	6305.00	6.31	-0.034	0.463	1.075	2.57E+05	0.059	0.487	0.488	0.507
9.00	7056.00	7.06	-0.034	0.000	1.075	2.57E+05	0.059	0.025	0.486	0.047
10.00	7813.00	7.81	-0.034	0.000	1.075	2.57E+05	0.059	0.025	0.483	0.049
Area ratio	0.043									



5		
Q	0.082	[m^3/s]
Approach		
y_a	0.887	[m]
w_a	2.000	[m]
A_a	1.774	[m^2]
v_a	0.046	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.016	[m]
Re	6.99E+04	[-]
Linear interpolation		
H_a	0.884	[m]
S_f	0.0037	[m/m]
H_0	0.532	[m]
ΔH_a	0.352	[m]
k_e	**4.904**	[-]
u_{ke}	**0.105**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.884		
Face	0	0	0.000	0.461	1.186		0.072		0.532	
1.00	445.00	0.45	0.000	-1.017	1.186	2.84E+05	0.072	-0.945	0.531	-0.944
2.00	1049.00	1.05	0.000	-1.022	1.186	2.84E+05	0.072	-0.950	0.529	-0.947
3.00	1799.00	1.80	0.000	-1.008	1.186	2.84E+05	0.072	-0.936	0.526	-0.929
4.00	3282.00	3.28	-0.029	0.478	1.186	2.84E+05	0.072	0.521	0.520	0.533
5.00	4037.00	4.04	-0.032	0.478	1.186	2.84E+05	0.072	0.517	0.518	0.532
6.00	4791.00	4.79	-0.034	0.475	1.186	2.84E+05	0.072	0.513	0.515	0.530
7.00	5547.00	5.55	-0.035	0.477	1.186	2.84E+05	0.072	0.514	0.512	0.534
8.00	6305.00	6.31	-0.034	0.471	1.186	2.84E+05	0.072	0.509	0.509	0.532
9.00	7056.00	7.06	-0.034	0.000	1.186	2.84E+05	0.072	0.038	0.506	0.064
10.00	7813.00	7.81	-0.034	0.000	1.186	2.84E+05	0.072	0.038	0.504	0.067
Area ratio	0.039									



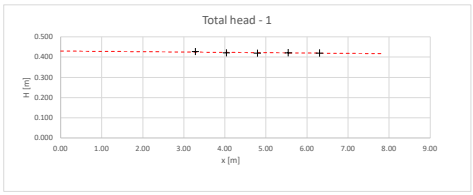
20 Deg Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

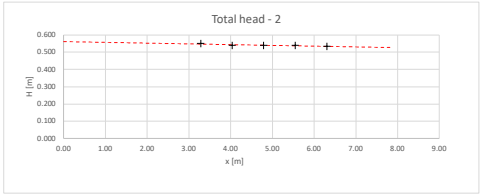
1		
Q	0.050	[m^3/s]
Approach		
y_a	0.442	[m]
w_a	2.000	[m]
A_a	0.884	[m^2]
v_a	0.057	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	5.61E+04	[-]
Linear interpolation		
H_s	0.439	[m]
S_f	0.002	[m/m]
H_0	0.431	[m]
ΔH_s	0.008	[m]
k_e	**0.314**	[-]
u_{ke}	**0.110**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.404	0.726		0.027		0.431	
1.00	445.00	0.45			0.726	1.74E+05			0.430	0.001
2.00	1049.00	1.05			0.726	1.74E+05			0.429	0.002
3.00	1799.00	1.80			0.726	1.74E+05			0.428	0.003
4.00	3282.00	3.28	-0.029	0.430	0.726	1.74E+05	0.027	0.428	0.425	0.433
5.00	4037.00	4.04	-0.032	0.427	0.726	1.74E+05	0.027	0.422	0.424	0.428
6.00	4791.00	4.79	-0.034	0.428	0.726	1.74E+05	0.027	0.420	0.423	0.428
7.00	5547.00	5.55	-0.035	0.431	0.726	1.74E+05	0.027	0.422	0.421	0.432
8.00	6305.00	6.31	-0.034	0.428	0.726	1.74E+05	0.027	0.421	0.420	0.431
9.00	7056.00	7.06	-0.034	0.000	0.726	1.74E+05	0.027	-0.007	0.419	0.005
10.00	7813.00	7.81	-0.034	0.000	0.726	1.74E+05	0.027	-0.007	0.418	0.006
Area ratio	0.078									



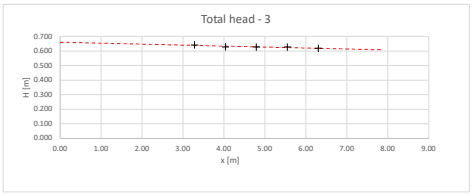
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.577	[m]
w_a	2.000	[m]
A_a	1.154	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.22E+04	[-]
Linear interpolation		
H_s	0.574	[m]
S_f	0.0044	[m/m]
H_0	0.561	[m]
ΔH_s	0.013	[m]
k_e	**0.149**	[-]
u_{ke}	**0.065**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.474	1.307		0.087		0.561	
1.00	445.00	0.45			1.307	3.13E+05			0.559	0.002
2.00	1049.00	1.05			1.307	3.13E+05			0.557	0.005
3.00	1799.00	1.80			1.307	3.13E+05			0.553	0.008
4.00	3282.00	3.28	-0.029	0.492	1.307	3.13E+05	0.087	0.551	0.547	0.565
5.00	4037.00	4.04	-0.032	0.484	1.307	3.13E+05	0.087	0.539	0.544	0.557
6.00	4791.00	4.79	-0.034	0.486	1.307	3.13E+05	0.087	0.539	0.540	0.560
7.00	5547.00	5.55	-0.035	0.487	1.307	3.13E+05	0.087	0.539	0.537	0.563
8.00	6305.00	6.31	-0.034	0.481	1.307	3.13E+05	0.087	0.534	0.534	0.561
9.00	7056.00	7.06	-0.034	0.000	1.307	3.13E+05	0.087	0.053	0.531	0.084
10.00	7813.00	7.81	-0.034	0.000	1.307	3.13E+05	0.087	0.053	0.527	0.087
Area ratio	0.060									



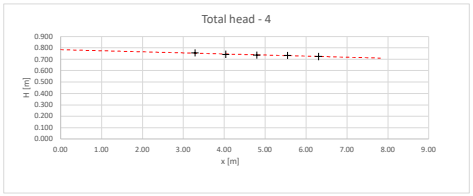
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.681	[m]
w_a	2.000	[m]
A_a	1.362	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_s	0.678	[m]
S_f	0.0066	[m/m]
H_0	0.661	[m]
ΔH_s	0.018	[m]
k_e	**0.125**	[-]
u_{ke}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.520	1.664		0.141		0.661	
1.00	445.00	0.45			1.664	3.98E+05			0.658	0.003
2.00	1049.00	1.05			1.664	3.98E+05			0.654	0.007
3.00	1799.00	1.80			1.664	3.98E+05			0.649	0.012
4.00	3282.00	3.28	-0.029	0.531	1.664	3.98E+05	0.141	0.643	0.639	0.664
5.00	4037.00	4.04	-0.032	0.520	1.664	3.98E+05	0.141	0.629	0.634	0.656
6.00	4791.00	4.79	-0.034	0.521	1.664	3.98E+05	0.141	0.628	0.629	0.659
7.00	5547.00	5.55	-0.035	0.521	1.664	3.98E+05	0.141	0.627	0.624	0.664
8.00	6305.00	6.31	-0.034	0.511	1.664	3.98E+05	0.141	0.618	0.619	0.660
9.00	7056.00	7.06	-0.034	0.000	1.664	3.98E+05	0.141	0.107	0.614	0.154
10.00	7813.00	7.81	-0.034	0.000	1.664	3.98E+05	0.141	0.107	0.609	0.159
Area ratio	0.051									



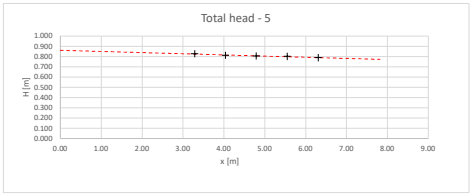
4		
Q	0.140	[m^3/s]
Approach		
y_a	0.808	[m]
w_a	2.000	[m]
A_a	1.616	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.25E+05	[-]
Linear interpolation		
H_s	0.805	[m]
S_f	0.0094	[m/m]
H_0	0.784	[m]
ΔH_s	0.021	[m]
k_e	**0.100**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.805		
Face	0	0	0.000	0.575	2.029		0.210		0.784	
1.00	445.00	0.45			2.029	4.85E+05		0.000	0.780	0.004
2.00	1049.00	1.05			2.029	4.85E+05		0.000	0.775	0.010
3.00	1799.00	1.80			2.029	4.85E+05		0.000	0.767	0.017
4.00	3282.00	3.28	-0.029	0.576	2.029	4.85E+05	0.210	0.756	0.753	0.787
5.00	4037.00	4.04	-0.032	0.566	2.029	4.85E+05	0.210	0.744	0.746	0.782
6.00	4791.00	4.79	-0.034	0.562	2.029	4.85E+05	0.210	0.737	0.739	0.783
7.00	5547.00	5.55	-0.035	0.560	2.029	4.85E+05	0.210	0.734	0.732	0.787
8.00	6305.00	6.31	-0.034	0.548	2.029	4.85E+05	0.210	0.724	0.725	0.784
9.00	7056.00	7.06	-0.034	0.000	2.029	4.85E+05	0.210	0.176	0.718	0.242
10.00	7813.00	7.81	-0.034	0.000	2.029	4.85E+05	0.210	0.176	0.711	0.250
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.888	[m]
w_a	2.000	[m]
A_a	1.776	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.32E+05	[-]
Linear interpolation		
H_s	0.885	[m]
S_f	0.0113	[m/m]
H_0	0.861	[m]
ΔH_s	0.024	[m]
k_e	**0.094**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.885		
Face	0	0	0.000	0.604	2.247		0.257		0.861	
1.00	445.00	0.45	0.000	-1.017	2.247	5.37E+05	0.257	-0.760	0.856	-0.755
2.00	1049.00	1.05	0.000	-1.022	2.247	5.37E+05	0.257	-0.765	0.849	-0.753
3.00	1799.00	1.80	0.000	-1.008	2.247	5.37E+05	0.257	-0.750	0.841	-0.730
4.00	3282.00	3.28	-0.029	0.599	2.247	5.37E+05	0.257	0.827	0.824	0.864
5.00	4037.00	4.04	-0.032	0.587	2.247	5.37E+05	0.257	0.812	0.816	0.858
6.00	4791.00	4.79	-0.034	0.583	2.247	5.37E+05	0.257	0.806	0.807	0.860
7.00	5547.00	5.55	-0.035	0.579	2.247	5.37E+05	0.257	0.802	0.798	0.864
8.00	6305.00	6.31	-0.034	0.566	2.247	5.37E+05	0.257	0.789	0.790	0.860
9.00	7056.00	7.06	-0.034	0.000	2.247	5.37E+05	0.257	0.223	0.781	0.303
10.00	7813.00	7.81	-0.034	0.000	2.247	5.37E+05	0.257	0.223	0.773	0.312
Area ratio	0.039									



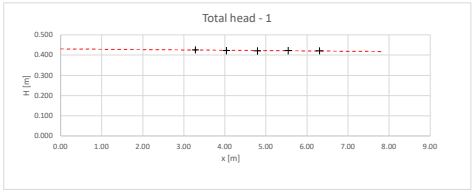
20 Deg Linear - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

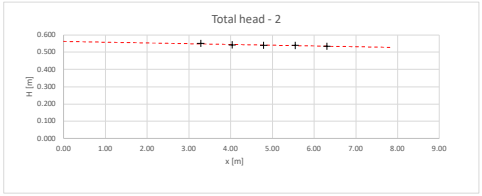
1		
Q	0.050	[m^3/s]
Approach		
y_a	0.441	[m]
w_a	2.000	[m]
A_a	0.883	[m^2]
v_a	0.057	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	5.62E+04	[-]
Linear interpolation		
H_s	0.439	[m]
S_f	0.002	[m/m]
H_0	0.431	[m]
ΔH_e	0.007	[m]
k_e	**0.277**	[-]
u_{ke}	**0.110**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.404	0.727		0.027		0.431	
1.00	445.00	0.45			0.727	1.74E+05			0.430	0.001
2.00	1049.00	1.05			0.727	1.74E+05			0.429	0.002
3.00	1799.00	1.80			0.727	1.74E+05			0.428	0.003
4.00	3282.00	3.28	-0.029	0.429	0.727	1.74E+05	0.027	0.427	0.426	0.432
5.00	4037.00	4.04	-0.032	0.428	0.727	1.74E+05	0.027	0.423	0.424	0.430
6.00	4791.00	4.79	-0.034	0.428	0.727	1.74E+05	0.027	0.421	0.423	0.429
7.00	5547.00	5.55	-0.035	0.431	0.727	1.74E+05	0.027	0.423	0.422	0.432
8.00	6305.00	6.31	-0.034	0.429	0.727	1.74E+05	0.027	0.422	0.421	0.432
9.00	7056.00	7.06	-0.034	0.000	0.727	1.74E+05	0.027	-0.007	0.419	0.005
10.00	7813.00	7.81	-0.034	0.000	0.727	1.74E+05	0.027	-0.007	0.418	0.006
Area ratio	0.078									



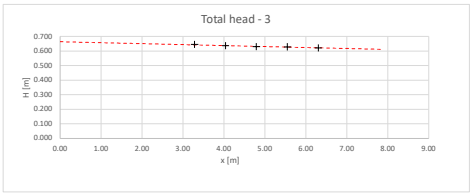
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.576	[m]
w_a	2.000	[m]
A_a	1.151	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.23E+04	[-]
Linear interpolation		
H_s	0.573	[m]
S_f	0.0044	[m/m]
H_0	0.562	[m]
ΔH_e	0.011	[m]
k_e	**0.121**	[-]
u_{ke}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.475	1.307		0.087		0.562	
1.00	445.00	0.45			1.307	3.12E+05			0.560	0.002
2.00	1049.00	1.05			1.307	3.12E+05			0.558	0.005
3.00	1799.00	1.80			1.307	3.12E+05			0.555	0.008
4.00	3282.00	3.28	-0.029	0.493	1.307	3.12E+05	0.087	0.551	0.548	0.566
5.00	4037.00	4.04	-0.032	0.487	1.307	3.12E+05	0.087	0.542	0.545	0.560
6.00	4791.00	4.79	-0.034	0.487	1.307	3.12E+05	0.087	0.540	0.541	0.561
7.00	5547.00	5.55	-0.035	0.487	1.307	3.12E+05	0.087	0.539	0.538	0.564
8.00	6305.00	6.31	-0.034	0.481	1.307	3.12E+05	0.087	0.534	0.535	0.562
9.00	7056.00	7.06	-0.034	0.000	1.307	3.12E+05	0.087	0.053	0.532	0.084
10.00	7813.00	7.81	-0.034	0.000	1.307	3.12E+05	0.087	0.053	0.528	0.087
Area ratio	0.060									



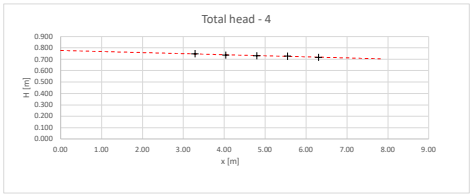
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.681	[m]
w_a	2.000	[m]
A_a	1.363	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_s	0.679	[m]
S_f	0.0066	[m/m]
H_0	0.664	[m]
ΔH_e	0.015	[m]
k_e	**0.103**	[-]
u_{ke}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.523	1.666		0.141		0.664	
1.00	445.00	0.45			1.666	3.98E+05			0.661	0.003
2.00	1049.00	1.05			1.666	3.98E+05			0.657	0.007
3.00	1799.00	1.80			1.666	3.98E+05			0.652	0.012
4.00	3282.00	3.28	-0.029	0.533	1.666	3.98E+05	0.141	0.646	0.642	0.667
5.00	4037.00	4.04	-0.032	0.527	1.666	3.98E+05	0.141	0.636	0.637	0.663
6.00	4791.00	4.79	-0.034	0.523	1.666	3.98E+05	0.141	0.630	0.632	0.662
7.00	5547.00	5.55	-0.035	0.522	1.666	3.98E+05	0.141	0.629	0.627	0.666
8.00	6305.00	6.31	-0.034	0.514	1.666	3.98E+05	0.141	0.621	0.622	0.663
9.00	7056.00	7.06	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.617	0.154
10.00	7813.00	7.81	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.612	0.159
Area ratio	0.051									



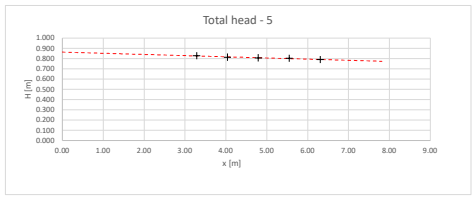
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.802	[m]
w_a	2.000	[m]
A_a	1.604	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.25E+05	[-]
Linear interpolation		
H_s	0.799	[m]
S_f	0.0093	[m/m]
H_0	0.777	[m]
ΔH_e	0.022	[m]
k_e	**0.105**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.799		
Face	0	0	0.000	0.570	2.018		0.207		0.777	
1.00	445.00	0.45			2.018	4.82E+05		0.000	0.773	0.004
2.00	1049.00	1.05			2.018	4.82E+05		0.000	0.768	0.010
3.00	1799.00	1.80			2.018	4.82E+05		0.000	0.761	0.017
4.00	3282.00	3.28	-0.029	0.571	2.018	4.82E+05	0.207	0.749	0.747	0.780
5.00	4037.00	4.04	-0.032	0.562	2.018	4.82E+05	0.207	0.737	0.740	0.775
6.00	4791.00	4.79	-0.034	0.557	2.018	4.82E+05	0.207	0.731	0.733	0.776
7.00	5547.00	5.55	-0.035	0.555	2.018	4.82E+05	0.207	0.728	0.726	0.780
8.00	6305.00	6.31	-0.034	0.545	2.018	4.82E+05	0.207	0.718	0.719	0.777
9.00	7056.00	7.06	-0.034	0.000	2.018	4.82E+05	0.207	0.173	0.712	0.239
10.00	7813.00	7.81	-0.034	0.000	2.018	4.82E+05	0.207	0.173	0.705	0.246
Area ratio	0.043									



5		
Q	0.156	[m^3/s]
Approach		
y_a	0.889	[m]
w_a	2.000	[m]
A_a	1.778	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.33E+05	[-]
Linear interpolation		
H_s	0.886	[m]
S_f	0.0114	[m/m]
H_0	0.863	[m]
ΔH_e	0.023	[m]
k_e	**0.090**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.886		
Face	0	0	0.000	0.604	2.255		0.259		0.863	
1.00	445.00	0.45	0.000	-1.017	2.255	5.39E+05	0.259	-0.758	0.858	-0.753
2.00	1049.00	1.05	0.000	-1.022	2.255	5.39E+05	0.259	-0.763	0.851	-0.751
3.00	1799.00	1.80	0.000	-1.008	2.255	5.39E+05	0.259	-0.748	0.842	-0.728
4.00	3282.00	3.28	-0.029	0.598	2.255	5.39E+05	0.259	0.828	0.826	0.866
5.00	4037.00	4.04	-0.032	0.586	2.255	5.39E+05	0.259	0.813	0.817	0.859
6.00	4791.00	4.79	-0.034	0.582	2.255	5.39E+05	0.259	0.807	0.808	0.862
7.00	5547.00	5.55	-0.035	0.578	2.255	5.39E+05	0.259	0.802	0.800	0.866
8.00	6305.00	6.31	-0.034	0.565	2.255	5.39E+05	0.259	0.791	0.791	0.862
9.00	7056.00	7.06	-0.034	0.000	2.255	5.39E+05	0.259	0.225	0.783	0.306
10.00	7813.00	7.81	-0.034	0.000	2.255	5.39E+05	0.259	0.225	0.774	0.314
Area ratio	0.039									



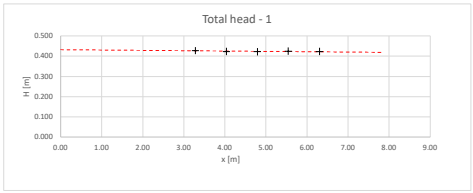
20 Deg Linear - Res 3 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

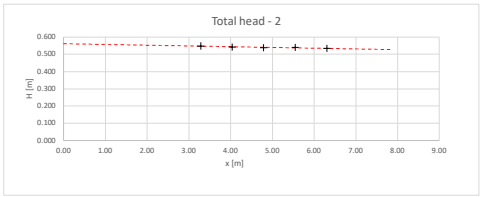
1		
Q	0.050	[m^3/s]
Approach		
y_a	0.442	[m]
w_a	2.000	[m]
A_a	0.884	[m^2]
v_a	0.057	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	5.63E+04	[-]
Linear interpolation		
H_a	0.439	[m]
S_f	0.002	[m/m]
H_0	0.433	[m]
ΔH_a	0.007	[m]
k_e	**0.241**	[-]
u_{be}	**0.109**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.405	0.730		0.027		0.433	
1.00	445.00	0.45			0.730	1.74E+05			0.432	0.001
2.00	1049.00	1.05			0.730	1.74E+05			0.431	0.002
3.00	1799.00	1.80			0.730	1.74E+05			0.430	0.003
4.00	3282.00	3.28	-0.029	0.429	0.730	1.74E+05	0.027	0.427	0.427	0.433
5.00	4037.00	4.04	-0.032	0.429	0.730	1.74E+05	0.027	0.424	0.426	0.431
6.00	4791.00	4.79	-0.034	0.429	0.730	1.74E+05	0.027	0.423	0.425	0.431
7.00	5547.00	5.55	-0.035	0.433	0.730	1.74E+05	0.027	0.425	0.423	0.435
8.00	6305.00	6.31	-0.034	0.430	0.730	1.74E+05	0.027	0.424	0.422	0.434
9.00	7056.00	7.06	-0.034	0.000	0.730	1.74E+05	0.027	-0.007	0.421	0.005
10.00	7813.00	7.81	-0.034	0.000	0.730	1.74E+05	0.027	-0.007	0.420	0.006
Area ratio	0.078									



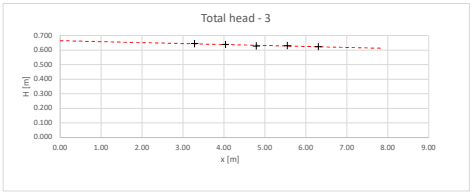
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.575	[m]
w_a	2.000	[m]
A_a	1.150	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.20E+04	[-]
Linear interpolation		
H_a	0.572	[m]
S_f	0.0043	[m/m]
H_0	0.561	[m]
ΔH_a	0.011	[m]
k_e	**0.128**	[-]
u_{be}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.475	1.302		0.086		0.561	
1.00	445.00	0.45			1.302	3.11E+05			0.559	0.002
2.00	1049.00	1.05			1.302	3.11E+05			0.557	0.005
3.00	1799.00	1.80			1.302	3.11E+05			0.553	0.008
4.00	3282.00	3.28	-0.029	0.491	1.302	3.11E+05	0.086	0.548	0.547	0.562
5.00	4037.00	4.04	-0.032	0.488	1.302	3.11E+05	0.086	0.542	0.544	0.559
6.00	4791.00	4.79	-0.034	0.486	1.302	3.11E+05	0.086	0.538	0.541	0.559
7.00	5547.00	5.55	-0.035	0.488	1.302	3.11E+05	0.086	0.540	0.537	0.564
8.00	6305.00	6.31	-0.034	0.482	1.302	3.11E+05	0.086	0.535	0.534	0.562
9.00	7056.00	7.06	-0.034	0.000	1.302	3.11E+05	0.086	0.052	0.531	0.083
10.00	7813.00	7.81	-0.034	0.000	1.302	3.11E+05	0.086	0.052	0.527	0.086
Area ratio	0.060									



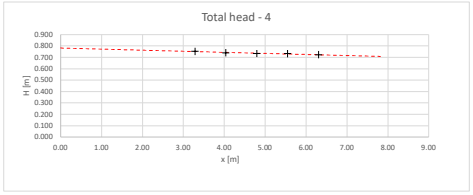
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.684	[m]
w_a	2.000	[m]
A_a	1.368	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.681	[m]
S_f	0.0066	[m/m]
H_0	0.665	[m]
ΔH_a	0.016	[m]
k_e	**0.115**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.524	1.667		0.142		0.665	
1.00	445.00	0.45			1.667	3.99E+05			0.662	0.003
2.00	1049.00	1.05			1.667	3.99E+05			0.658	0.007
3.00	1799.00	1.80			1.667	3.99E+05			0.653	0.012
4.00	3282.00	3.28	-0.029	0.532	1.667	3.99E+05	0.142	0.645	0.643	0.667
5.00	4037.00	4.04	-0.032	0.529	1.667	3.99E+05	0.142	0.638	0.638	0.665
6.00	4791.00	4.79	-0.034	0.521	1.667	3.99E+05	0.142	0.629	0.633	0.660
7.00	5547.00	5.55	-0.035	0.525	1.667	3.99E+05	0.142	0.631	0.628	0.668
8.00	6305.00	6.31	-0.034	0.516	1.667	3.99E+05	0.142	0.624	0.623	0.666
9.00	7056.00	7.06	-0.034	0.000	1.667	3.99E+05	0.142	0.108	0.618	0.155
10.00	7813.00	7.81	-0.034	0.000	1.667	3.99E+05	0.142	0.108	0.613	0.160
Area ratio	0.050									



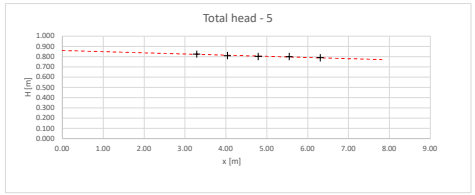
4		
Q	0.140	[m^3/s]
Approach		
y_a	0.805	[m]
w_a	2.000	[m]
A_a	1.610	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.25E+05	[-]
Linear interpolation		
H_a	0.802	[m]
S_f	0.0094	[m/m]
H_0	0.782	[m]
ΔH_a	0.020	[m]
k_e	**0.097**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.802		
Face	0	0	0.000	0.573	2.027		0.209		0.782	
1.00	445.00	0.45			2.027	4.85E+05		0.000	0.778	0.004
2.00	1049.00	1.05			2.027	4.85E+05		0.000	0.772	0.010
3.00	1799.00	1.80			2.027	4.85E+05		0.000	0.765	0.017
4.00	3282.00	3.28	-0.029	0.571	2.027	4.85E+05	0.209	0.752	0.751	0.783
5.00	4037.00	4.04	-0.032	0.564	2.027	4.85E+05	0.209	0.741	0.744	0.779
6.00	4791.00	4.79	-0.034	0.559	2.027	4.85E+05	0.209	0.734	0.737	0.779
7.00	5547.00	5.55	-0.035	0.559	2.027	4.85E+05	0.209	0.733	0.730	0.785
8.00	6305.00	6.31	-0.034	0.548	2.027	4.85E+05	0.209	0.724	0.723	0.783
9.00	7056.00	7.06	-0.034	0.000	2.027	4.85E+05	0.209	0.175	0.716	0.242
10.00	7813.00	7.81	-0.034	0.000	2.027	4.85E+05	0.209	0.175	0.708	0.249
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.888	[m]
w_a	2.000	[m]
A_a	1.777	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.32E+05	[-]
Linear interpolation		
H_a	0.886	[m]
S_f	0.0113	[m/m]
H_0	0.860	[m]
ΔH_a	0.026	[m]
k_e	**0.100**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.886		
Face	0	0	0.000	0.602	2.248		0.258		0.860	
1.00	445.00	0.45	0.000	-1.017	2.248	5.38E+05	0.258	-0.759	0.855	-0.754
2.00	1049.00	1.05	0.000	-1.022	2.248	5.38E+05	0.258	-0.764	0.848	-0.753
3.00	1799.00	1.80	0.000	-1.008	2.248	5.38E+05	0.258	-0.750	0.840	-0.730
4.00	3282.00	3.28	-0.029	0.596	2.248	5.38E+05	0.258	0.824	0.823	0.861
5.00	4037.00	4.04	-0.032	0.585	2.248	5.38E+05	0.258	0.811	0.814	0.857
6.00	4791.00	4.79	-0.034	0.579	2.248	5.38E+05	0.258	0.802	0.806	0.857
7.00	5547.00	5.55	-0.035	0.579	2.248	5.38E+05	0.258	0.801	0.797	0.864
8.00	6305.00	6.31	-0.034	0.566	2.248	5.38E+05	0.258	0.790	0.788	0.861
9.00	7056.00	7.06	-0.034	0.000	2.248	5.38E+05	0.258	0.224	0.780	0.304
10.00	7813.00	7.81	-0.034	0.000	2.248	5.38E+05	0.258	0.224	0.771	0.312
Area ratio	0.039									



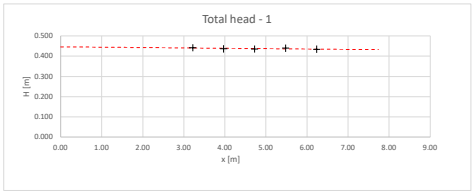
20 Deg Non Linear - Res 4 - 37.5 Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

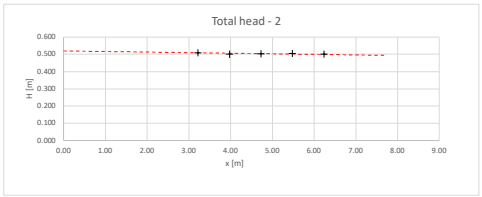
1		
Q	0.053	[m^3/s]
Approach		
y_a	0.471	[m]
w_a	2.000	[m]
A_a	0.942	[m^2]
v_a	0.056	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.026	[m]
Re	5.81E+04	[-]
Linear interpolation		
H_a	0.470	[m]
S_f	0.002	[m/m]
H_0	0.447	[m]
ΔH_a	0.023	[m]
k_e	**0.781**	[-]
u_{be}	**0.103**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.417	0.768		0.030		0.447	
1.00	445.00	0.45			0.768	1.84E+05			0.446	0.001
2.00	1049.00	1.05			0.768	1.84E+05			0.445	0.002
3.00	1799.00	1.80			0.768	1.84E+05			0.443	0.003
4.00	3216.00	3.22	-0.025	0.438	0.768	1.84E+05	0.030	0.443	0.441	0.449
5.00	3971.00	3.97	-0.027	0.434	0.768	1.84E+05	0.030	0.437	0.439	0.444
6.00	4724.00	4.72	-0.028	0.434	0.768	1.84E+05	0.030	0.436	0.438	0.444
7.00	5479.00	5.48	-0.030	0.440	0.768	1.84E+05	0.030	0.440	0.437	0.450
8.00	6236.00	6.24	-0.027	0.432	0.768	1.84E+05	0.030	0.435	0.435	0.447
9.00	6986.00	6.99	-0.034	0.000	0.768	1.84E+05	0.030	-0.004	0.434	0.009
10.00	7742.00	7.74	-0.034	0.000	0.768	1.84E+05	0.030	-0.004	0.433	0.010
Area ratio	0.073									



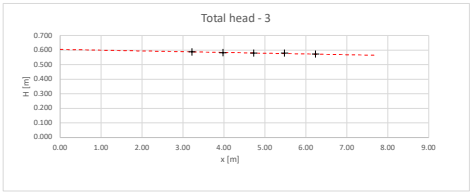
2		
Q	0.077	[m^3/s]
Approach		
y_a	0.571	[m]
w_a	2.000	[m]
A_a	1.142	[m^2]
v_a	0.067	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	7.90E+04	[-]
Linear interpolation		
H_a	0.570	[m]
S_f	0.0033	[m/m]
H_0	0.520	[m]
ΔH_a	0.051	[m]
k_e	**0.800**	[-]
u_{be}	**0.070**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.456	1.115		0.063		0.520	
1.00	445.00	0.45			1.115	2.67E+05			0.518	0.001
2.00	1049.00	1.05			1.115	2.67E+05			0.516	0.003
3.00	1799.00	1.80			1.115	2.67E+05			0.514	0.006
4.00	3216.00	3.22	-0.025	0.471	1.115	2.67E+05	0.063	0.509	0.509	0.520
5.00	3971.00	3.97	-0.027	0.464	1.115	2.67E+05	0.063	0.500	0.506	0.514
6.00	4724.00	4.72	-0.028	0.468	1.115	2.67E+05	0.063	0.504	0.504	0.519
7.00	5479.00	5.48	-0.030	0.472	1.115	2.67E+05	0.063	0.505	0.501	0.523
8.00	6236.00	6.24	-0.027	0.465	1.115	2.67E+05	0.063	0.501	0.499	0.522
9.00	6986.00	6.99	-0.034	0.000	1.115	2.67E+05	0.063	0.029	0.496	0.053
10.00	7742.00	7.74	-0.034	0.000	1.115	2.67E+05	0.063	0.029	0.494	0.055
Area ratio	0.060									



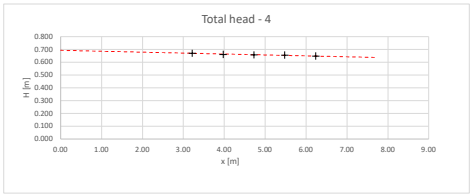
3		
Q	0.100	[m^3/s]
Approach		
y_a	0.686	[m]
w_a	2.000	[m]
A_a	1.372	[m^2]
v_a	0.073	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	9.56E+04	[-]
Linear interpolation		
H_a	0.685	[m]
S_f	0.0052	[m/m]
H_0	0.605	[m]
ΔH_a	0.080	[m]
k_e	**0.752**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.498	1.448		0.107		0.605	
1.00	445.00	0.45			1.448	3.46E+05			0.603	0.002
2.00	1049.00	1.05			1.448	3.46E+05			0.599	0.005
3.00	1799.00	1.80			1.448	3.46E+05			0.596	0.009
4.00	3216.00	3.22	-0.025	0.506	1.448	3.46E+05	0.107	0.588	0.588	0.605
5.00	3971.00	3.97	-0.027	0.502	1.448	3.46E+05	0.107	0.582	0.584	0.603
6.00	4724.00	4.72	-0.028	0.500	1.448	3.46E+05	0.107	0.579	0.580	0.604
7.00	5479.00	5.48	-0.030	0.502	1.448	3.46E+05	0.107	0.579	0.576	0.608
8.00	6236.00	6.24	-0.027	0.494	1.448	3.46E+05	0.107	0.573	0.573	0.606
9.00	6986.00	6.99	-0.034	0.000	1.448	3.46E+05	0.107	0.073	0.569	0.109
10.00	7742.00	7.74	-0.034	0.000	1.448	3.46E+05	0.107	0.073	0.565	0.113
Area ratio	0.050									



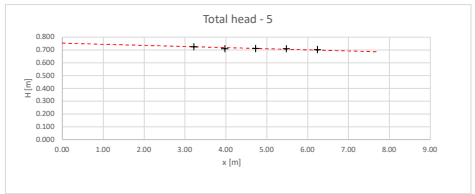
4		
Q	0.120	[m^3/s]
Approach		
y_a	0.809	[m]
w_a	2.000	[m]
A_a	1.618	[m^2]
v_a	0.074	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.026	[m]
Re	1.07E+05	[-]
Linear interpolation		
H_a	0.808	[m]
S_f	0.0072	[m/m]
H_0	0.693	[m]
ΔH_a	0.115	[m]
k_e	**0.744**	[-]
u_{be}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.808		
Face	0	0	0.000	0.538	1.745		0.155		0.693	
1.00	445.00	0.45			1.745	4.17E+05		0.000	0.690	0.003
2.00	1049.00	1.05			1.745	4.17E+05		0.000	0.685	0.008
3.00	1799.00	1.80			1.745	4.17E+05		0.000	0.680	0.013
4.00	3216.00	3.22	-0.025	0.540	1.745	4.17E+05	0.155	0.670	0.670	0.693
5.00	3971.00	3.97	-0.027	0.533	1.745	4.17E+05	0.155	0.661	0.664	0.690
6.00	4724.00	4.72	-0.028	0.531	1.745	4.17E+05	0.155	0.658	0.659	0.692
7.00	5479.00	5.48	-0.030	0.531	1.745	4.17E+05	0.155	0.656	0.653	0.696
8.00	6236.00	6.24	-0.027	0.520	1.745	4.17E+05	0.155	0.649	0.648	0.693
9.00	6986.00	6.99	-0.034	0.000	1.745	4.17E+05	0.155	0.121	0.642	0.172
10.00	7742.00	7.74	-0.034	0.000	1.745	4.17E+05	0.155	0.121	0.637	0.177
Area ratio	0.043									



5		
Q	0.134	[m^3/s]
Approach		
y_a	0.899	[m]
w_a	2.000	[m]
A_a	1.798	[m^2]
v_a	0.074	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.025	[m]
Re	1.14E+05	[-]
Linear interpolation		
H_a	0.898	[m]
S_f	0.0087	[m/m]
H_0	0.753	[m]
ΔH_a	0.145	[m]
k_e	**0.758**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.898		
Face	0	0	0.000	0.562	1.938		0.192		0.753	
1.00	445.00	0.45	0.000	-1.017	1.938	4.64E+05	0.192	-0.825	0.749	-0.822
2.00	1049.00	1.05	0.000	-1.022	1.938	4.64E+05	0.192	-0.831	0.744	-0.821
3.00	1799.00	1.80	0.000	-1.008	1.938	4.64E+05	0.192	-0.816	0.737	-0.801
4.00	3216.00	3.22	-0.025	0.558	1.938	4.64E+05	0.192	0.725	0.725	0.753
5.00	3971.00	3.97	-0.027	0.546	1.938	4.64E+05	0.192	0.711	0.719	0.745
6.00	4724.00	4.72	-0.028	0.548	1.938	4.64E+05	0.192	0.711	0.712	0.752
7.00	5479.00	5.48	-0.030	0.548	1.938	4.64E+05	0.192	0.710	0.705	0.757
8.00	6236.00	6.24	-0.027	0.539	1.938	4.64E+05	0.192	0.704	0.699	0.758
9.00	6986.00	6.99	-0.034	0.000	1.938	4.64E+05	0.192	0.158	0.692	0.218
10.00	7742.00	7.74	-0.034	0.000	1.938	4.64E+05	0.192	0.158	0.686	0.225
Area ratio	0.038									



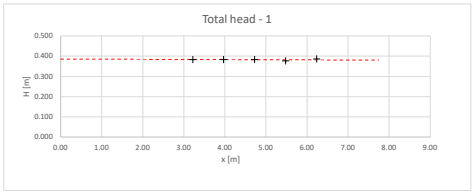
20 Deg Non Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

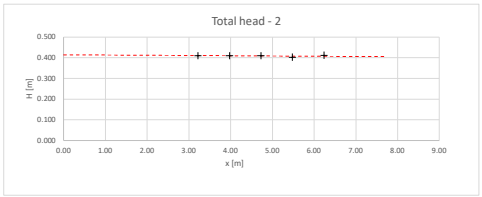
1		
Q	0.029	[m^3/s]
Approach		
y_a	0.471	[m]
w_a	2.000	[m]
A_a	0.942	[m^2]
v_a	0.031	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.014	[m]
Re	3.19E+04	[-]
Linear interpolation		
H_a	0.470	[m]
S_f	0.001	[m/m]
H_0	0.387	[m]
ΔH_a	0.083	[m]
k_e	**9.225**	[-]
u_{be}	**0.244**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.378	0.421		0.009		0.387	
1.00	445.00	0.45			0.421	1.01E+05			0.386	0.000
2.00	1049.00	1.05			0.421	1.01E+05			0.386	0.001
3.00	1799.00	1.80			0.421	1.01E+05			0.385	0.001
4.00	3216.00	3.22	-0.025	0.399	0.421	1.01E+05	0.009	0.383	0.384	0.386
5.00	3971.00	3.97	-0.027	0.402	0.421	1.01E+05	0.009	0.384	0.384	0.387
6.00	4724.00	4.72	-0.028	0.402	0.421	1.01E+05	0.009	0.383	0.383	0.387
7.00	5479.00	5.48	-0.030	0.399	0.421	1.01E+05	0.009	0.378	0.383	0.382
8.00	6236.00	6.24	-0.027	0.405	0.421	1.01E+05	0.009	0.387	0.382	0.392
9.00	6986.00	6.99	-0.034	0.000	0.421	1.01E+05	0.009	-0.025	0.382	-0.020
10.00	7742.00	7.74	-0.034	0.000	0.421	1.01E+05	0.009	-0.025	0.381	-0.019
Area ratio	0.073									



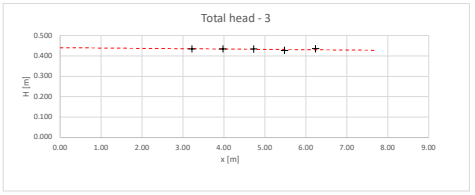
2		
Q	0.040	[m^3/s]
Approach		
y_a	0.571	[m]
w_a	2.000	[m]
A_a	1.141	[m^2]
v_a	0.035	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.015	[m]
Re	4.11E+04	[-]
Linear interpolation		
H_a	0.570	[m]
S_f	0.0012	[m/m]
H_0	0.414	[m]
ΔH_a	0.155	[m]
k_e	**9.054**	[-]
u_{be}	**0.187**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.397	0.580		0.017		0.414	
1.00	445.00	0.45			0.580	1.39E+05			0.414	0.001
2.00	1049.00	1.05			0.580	1.39E+05			0.413	0.001
3.00	1799.00	1.80			0.580	1.39E+05			0.412	0.002
4.00	3216.00	3.22	-0.025	0.418	0.580	1.39E+05	0.017	0.410	0.411	0.414
5.00	3971.00	3.97	-0.027	0.420	0.580	1.39E+05	0.017	0.410	0.410	0.415
6.00	4724.00	4.72	-0.028	0.420	0.580	1.39E+05	0.017	0.409	0.409	0.415
7.00	5479.00	5.48	-0.030	0.416	0.580	1.39E+05	0.017	0.403	0.408	0.409
8.00	6236.00	6.24	-0.027	0.422	0.580	1.39E+05	0.017	0.412	0.407	0.419
9.00	6986.00	6.99	-0.034	0.000	0.580	1.39E+05	0.017	-0.017	0.406	-0.009
10.00	7742.00	7.74	-0.034	0.000	0.580	1.39E+05	0.017	-0.017	0.405	-0.008
Area ratio	0.060									



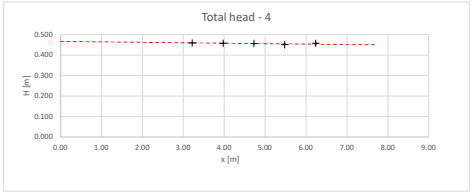
3		
Q	0.050	[m^3/s]
Approach		
y_a	0.685	[m]
w_a	2.000	[m]
A_a	1.370	[m^2]
v_a	0.036	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.014	[m]
Re	4.78E+04	[-]
Linear interpolation		
H_a	0.684	[m]
S_f	0.0017	[m/m]
H_0	0.441	[m]
ΔH_a	0.243	[m]
k_e	**9.110**	[-]
u_{be}	**0.175**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.414	0.724		0.027		0.441	
1.00	445.00	0.45			0.724	1.73E+05			0.440	0.001
2.00	1049.00	1.05			0.724	1.73E+05			0.439	0.002
3.00	1799.00	1.80			0.724	1.73E+05			0.438	0.003
4.00	3216.00	3.22	-0.025	0.433	0.724	1.73E+05	0.027	0.435	0.435	0.440
5.00	3971.00	3.97	-0.027	0.434	0.724	1.73E+05	0.027	0.434	0.434	0.441
6.00	4724.00	4.72	-0.028	0.435	0.724	1.73E+05	0.027	0.433	0.433	0.441
7.00	5479.00	5.48	-0.030	0.430	0.724	1.73E+05	0.027	0.427	0.432	0.436
8.00	6236.00	6.24	-0.027	0.436	0.724	1.73E+05	0.027	0.435	0.430	0.446
9.00	6986.00	6.99	-0.034	0.000	0.724	1.73E+05	0.027	-0.007	0.429	0.004
10.00	7742.00	7.74	-0.034	0.000	0.724	1.73E+05	0.027	-0.007	0.428	0.005
Area ratio	0.050									



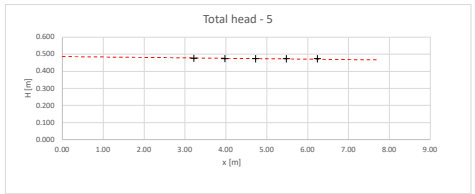
4		
Q	0.059	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.613	[m^2]
v_a	0.037	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.013	[m]
Re	5.28E+04	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0022	[m/m]
H_0	0.467	[m]
ΔH_a	0.339	[m]
k_e	**9.066**	[-]
u_{be}	**0.169**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.805		
Face	0	0	0.000	0.429	0.856		0.037		0.467	
1.00	445.00	0.45			0.856	2.05E+05		0.000	0.466	0.001
2.00	1049.00	1.05			0.856	2.05E+05		0.000	0.464	0.002
3.00	1799.00	1.80			0.856	2.05E+05		0.000	0.463	0.004
4.00	3216.00	3.22	-0.025	0.447	0.856	2.05E+05	0.037	0.460	0.460	0.466
5.00	3971.00	3.97	-0.027	0.447	0.856	2.05E+05	0.037	0.458	0.458	0.466
6.00	4724.00	4.72	-0.028	0.447	0.856	2.05E+05	0.037	0.457	0.456	0.467
7.00	5479.00	5.48	-0.030	0.443	0.856	2.05E+05	0.037	0.451	0.455	0.463
8.00	6236.00	6.24	-0.027	0.447	0.856	2.05E+05	0.037	0.458	0.453	0.471
9.00	6986.00	6.99	-0.034	0.000	0.856	2.05E+05	0.037	0.003	0.452	0.018
10.00	7742.00	7.74	-0.034	0.000	0.856	2.05E+05	0.037	0.003	0.450	0.020
Area ratio	0.043									



5		
Q	0.065	[m^3/s]
Approach		
y_a	0.896	[m]
w_a	2.000	[m]
A_a	1.792	[m^2]
v_a	0.036	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.012	[m]
Re	5.52E+04	[-]
Linear interpolation		
H_a	0.895	[m]
S_f	0.0025	[m/m]
H_0	0.486	[m]
ΔH_a	0.409	[m]
k_e	**9.060**	[-]
u_{be}	**0.167**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.895		
Face	0	0	0.000	0.441	0.941		0.045		0.486	
1.00	445.00	0.45	0.000	-1.017	0.941	2.25E+05	0.045	-0.972	0.485	-0.971
2.00	1049.00	1.05	0.000	-1.022	0.941	2.25E+05	0.045	-0.977	0.484	-0.974
3.00	1799.00	1.80	0.000	-1.008	0.941	2.25E+05	0.045	-0.963	0.482	-0.958
4.00	3216.00	3.22	-0.025	0.457	0.941	2.25E+05	0.045	0.477	0.478	0.485
5.00	3971.00	3.97	-0.027	0.456	0.941	2.25E+05	0.045	0.474	0.476	0.484
6.00	4724.00	4.72	-0.028	0.457	0.941	2.25E+05	0.045	0.474	0.475	0.486
7.00	5479.00	5.48	-0.030	0.459	0.941	2.25E+05	0.045	0.474	0.473	0.488
8.00	6236.00	6.24	-0.027	0.456	0.941	2.25E+05	0.045	0.474	0.471	0.489
9.00	6986.00	6.99	-0.034	0.000	0.941	2.25E+05	0.045	0.011	0.469	0.029
10.00	7742.00	7.74	-0.034	0.000	0.941	2.25E+05	0.045	0.011	0.467	0.031
Area ratio	0.039									



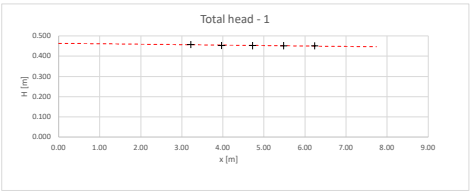
20 Deg Non Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

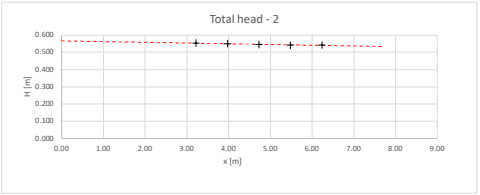
1		
Q	0.060	[m^3/s]
Approach		
y_a	0.468	[m]
w_a	2.000	[m]
A_a	0.936	[m^2]
v_a	0.064	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.60E+04	[-]
Linear interpolation		
H_a	0.467	[m]
S_f	0.002	[m/m]
H_0	0.464	[m]
ΔH_a	0.003	[m]
k_e	**0.080**	[-]
u_{be}	**0.098**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.425	0.871		0.039		0.464	
1.00	445.00	0.45			0.871	2.08E+05			0.463	0.001
2.00	1049.00	1.05			0.871	2.08E+05			0.462	0.002
3.00	1799.00	1.80			0.871	2.08E+05			0.460	0.004
4.00	3216.00	3.22	-0.025	0.444	0.871	2.08E+05	0.039	0.458	0.457	0.465
5.00	3971.00	3.97	-0.027	0.442	0.871	2.08E+05	0.039	0.454	0.455	0.462
6.00	4724.00	4.72	-0.028	0.442	0.871	2.08E+05	0.039	0.453	0.454	0.463
7.00	5479.00	5.48	-0.030	0.444	0.871	2.08E+05	0.039	0.452	0.452	0.464
8.00	6236.00	6.24	-0.027	0.440	0.871	2.08E+05	0.039	0.452	0.450	0.466
9.00	6986.00	6.99	-0.034	0.000	0.871	2.08E+05	0.039	0.005	0.449	0.020
10.00	7742.00	7.74	-0.034	0.000	0.871	2.08E+05	0.039	0.005	0.447	0.022
Area ratio	0.074									



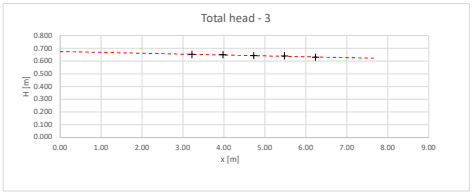
2		
Q	0.089	[m^3/s]
Approach		
y_a	0.569	[m]
w_a	2.000	[m]
A_a	1.138	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.14E+04	[-]
Linear interpolation		
H_a	0.568	[m]
S_f	0.0043	[m/m]
H_0	0.566	[m]
ΔH_a	0.002	[m]
k_e	**0.024**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.482	1.288		0.085		0.566	
1.00	445.00	0.45			1.288	3.08E+05			0.564	0.002
2.00	1049.00	1.05			1.288	3.08E+05			0.562	0.004
3.00	1799.00	1.80			1.288	3.08E+05			0.559	0.008
4.00	3216.00	3.22	-0.025	0.494	1.288	3.08E+05	0.085	0.553	0.553	0.567
5.00	3971.00	3.97	-0.027	0.492	1.288	3.08E+05	0.085	0.550	0.549	0.567
6.00	4724.00	4.72	-0.028	0.488	1.288	3.08E+05	0.085	0.545	0.546	0.565
7.00	5479.00	5.48	-0.030	0.487	1.288	3.08E+05	0.085	0.541	0.543	0.565
8.00	6236.00	6.24	-0.027	0.484	1.288	3.08E+05	0.085	0.542	0.540	0.568
9.00	6986.00	6.99	-0.034	0.000	1.288	3.08E+05	0.085	0.051	0.537	0.080
10.00	7742.00	7.74	-0.034	0.000	1.288	3.08E+05	0.085	0.051	0.533	0.083
Area ratio	0.061									



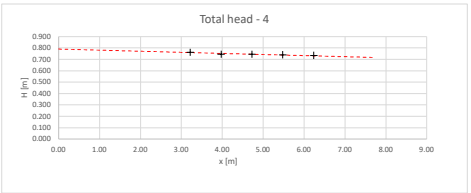
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.687	[m]
S_f	0.0068	[m/m]
H_0	0.675	[m]
ΔH_a	0.012	[m]
k_e	**0.085**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.529	1.695		0.146		0.675	
1.00	445.00	0.45			1.695	4.05E+05			0.672	0.003
2.00	1049.00	1.05			1.695	4.05E+05			0.668	0.007
3.00	1799.00	1.80			1.695	4.05E+05			0.663	0.012
4.00	3216.00	3.22	-0.025	0.529	1.695	4.05E+05	0.146	0.651	0.653	0.673
5.00	3971.00	3.97	-0.027	0.530	1.695	4.05E+05	0.146	0.649	0.648	0.676
6.00	4724.00	4.72	-0.028	0.524	1.695	4.05E+05	0.146	0.643	0.643	0.675
7.00	5479.00	5.48	-0.030	0.525	1.695	4.05E+05	0.146	0.641	0.637	0.679
8.00	6236.00	6.24	-0.027	0.510	1.695	4.05E+05	0.146	0.629	0.632	0.672
9.00	6986.00	6.99	-0.034	0.000	1.695	4.05E+05	0.146	0.112	0.627	0.160
10.00	7742.00	7.74	-0.034	0.000	1.695	4.05E+05	0.146	0.112	0.622	0.165
Area ratio	0.050									



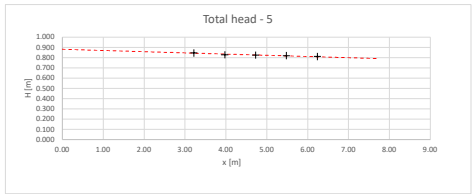
4		
Q	0.141	[m^3/s]
Approach		
y_a	0.804	[m]
w_a	2.000	[m]
A_a	1.609	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.804	[m]
S_f	0.0095	[m/m]
H_0	0.790	[m]
ΔH_a	0.013	[m]
k_e	**0.063**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.804		
Face	0	0	0.000	0.578	2.043		0.213		0.790	
1.00	445.00	0.45			2.043	4.89E+05		0.000	0.786	0.004
2.00	1049.00	1.05			2.043	4.89E+05		0.000	0.780	0.010
3.00	1799.00	1.80			2.043	4.89E+05		0.000	0.773	0.017
4.00	3216.00	3.22	-0.025	0.574	2.043	4.89E+05	0.213	0.762	0.760	0.792
5.00	3971.00	3.97	-0.027	0.559	2.043	4.89E+05	0.213	0.744	0.753	0.782
6.00	4724.00	4.72	-0.028	0.560	2.043	4.89E+05	0.213	0.745	0.745	0.790
7.00	5479.00	5.48	-0.030	0.558	2.043	4.89E+05	0.213	0.741	0.738	0.793
8.00	6236.00	6.24	-0.027	0.549	2.043	4.89E+05	0.213	0.735	0.731	0.794
9.00	6986.00	6.99	-0.034	0.000	2.043	4.89E+05	0.213	0.179	0.724	0.245
10.00	7742.00	7.74	-0.034	0.000	2.043	4.89E+05	0.213	0.179	0.717	0.253
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.895	[m]
w_a	2.000	[m]
A_a	1.791	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.35E+05	[-]
Linear interpolation		
H_a	0.895	[m]
S_f	0.0117	[m/m]
H_0	0.882	[m]
ΔH_a	0.013	[m]
k_e	**0.049**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.895		
Face	0	0	0.000	0.614	2.291		0.268		0.882	
1.00	445.00	0.45	0.000	-1.017	2.291	5.48E+05	0.268	-0.749	0.877	-0.744
2.00	1049.00	1.05	0.000	-1.022	2.291	5.48E+05	0.268	-0.754	0.869	-0.742
3.00	1799.00	1.80	0.000	-1.008	2.291	5.48E+05	0.268	-0.740	0.861	-0.719
4.00	3216.00	3.22	-0.025	0.603	2.291	5.48E+05	0.268	0.846	0.844	0.883
5.00	3971.00	3.97	-0.027	0.588	2.291	5.48E+05	0.268	0.829	0.835	0.875
6.00	4724.00	4.72	-0.028	0.586	2.291	5.48E+05	0.268	0.826	0.826	0.881
7.00	5479.00	5.48	-0.030	0.583	2.291	5.48E+05	0.268	0.820	0.817	0.884
8.00	6236.00	6.24	-0.027	0.571	2.291	5.48E+05	0.268	0.811	0.809	0.885
9.00	6986.00	6.99	-0.034	0.000	2.291	5.48E+05	0.268	0.234	0.800	0.316
10.00	7742.00	7.74	-0.034	0.000	2.291	5.48E+05	0.268	0.234	0.791	0.324
Area ratio	0.039									



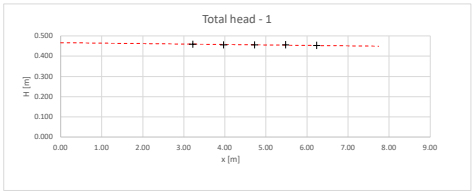
20 Deg Non Linear - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

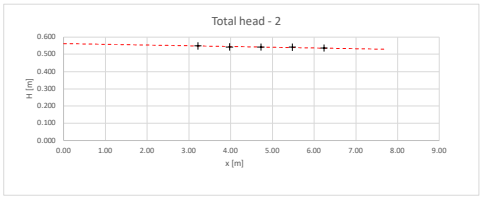
1		
Q	0.060	[m^3/s]
Approach		
y_a	0.471	[m]
w_a	2.000	[m]
A_a	0.942	[m^2]
v_a	0.064	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.61E+04	[-]
Linear interpolation		
H_a	0.470	[m]
S_f	0.002	[m/m]
H_0	0.467	[m]
ΔH_a	0.003	[m]
k_e	**0.077**	[-]
u_{be}	**0.097**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.428	0.874		0.039		0.467	
1.00	445.00	0.45			0.874	2.09E+05			0.466	0.001
2.00	1049.00	1.05			0.874	2.09E+05			0.465	0.002
3.00	1799.00	1.80			0.874	2.09E+05			0.463	0.004
4.00	3216.00	3.22	-0.025	0.445	0.874	2.09E+05	0.039	0.459	0.460	0.467
5.00	3971.00	3.97	-0.027	0.445	0.874	2.09E+05	0.039	0.457	0.458	0.465
6.00	4724.00	4.72	-0.028	0.445	0.874	2.09E+05	0.039	0.456	0.457	0.467
7.00	5479.00	5.48	-0.030	0.448	0.874	2.09E+05	0.039	0.457	0.455	0.469
8.00	6236.00	6.24	-0.027	0.442	0.874	2.09E+05	0.039	0.454	0.453	0.468
9.00	6986.00	6.99	-0.034	0.000	0.874	2.09E+05	0.039	0.005	0.452	0.021
10.00	7742.00	7.74	-0.034	0.000	0.874	2.09E+05	0.039	0.005	0.450	0.022
Area ratio	0.073									



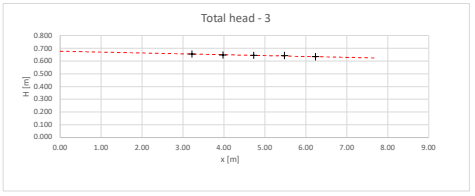
2		
Q	0.089	[m^3/s]
Approach		
y_a	0.570	[m]
w_a	2.000	[m]
A_a	1.139	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.13E+04	[-]
Linear interpolation		
H_a	0.569	[m]
S_f	0.0043	[m/m]
H_0	0.562	[m]
ΔH_a	0.007	[m]
k_e	**0.082**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.477	1.288		0.085		0.562	
1.00	445.00	0.45			1.288	3.08E+05			0.560	0.002
2.00	1049.00	1.05			1.288	3.08E+05			0.558	0.004
3.00	1799.00	1.80			1.288	3.08E+05			0.554	0.008
4.00	3216.00	3.22	-0.025	0.489	1.288	3.08E+05	0.085	0.548	0.548	0.562
5.00	3971.00	3.97	-0.027	0.485	1.288	3.08E+05	0.085	0.542	0.545	0.559
6.00	4724.00	4.72	-0.028	0.485	1.288	3.08E+05	0.085	0.542	0.542	0.562
7.00	5479.00	5.48	-0.030	0.487	1.288	3.08E+05	0.085	0.541	0.539	0.564
8.00	6236.00	6.24	-0.027	0.478	1.288	3.08E+05	0.085	0.536	0.535	0.562
9.00	6986.00	6.99	-0.034	0.000	1.288	3.08E+05	0.085	0.051	0.532	0.080
10.00	7742.00	7.74	-0.034	0.000	1.288	3.08E+05	0.085	0.051	0.529	0.083
Area ratio	0.061									



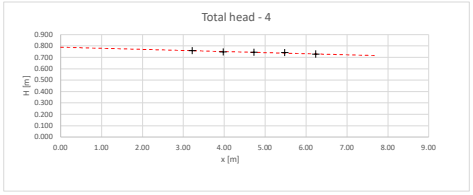
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.687	[m]
S_f	0.0068	[m/m]
H_0	0.677	[m]
ΔH_a	0.010	[m]
k_e	**0.071**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001							
Face	0	0	0.000	0.531	1.693		0.146		0.677	
1.00	445.00	0.45			1.693	4.05E+05			0.674	0.003
2.00	1049.00	1.05			1.693	4.05E+05			0.670	0.007
3.00	1799.00	1.80			1.693	4.05E+05			0.665	0.012
4.00	3216.00	3.22	-0.025	0.534	1.693	4.05E+05	0.146	0.655	0.655	0.677
5.00	3971.00	3.97	-0.027	0.527	1.693	4.05E+05	0.146	0.646	0.650	0.674
6.00	4724.00	4.72	-0.028	0.526	1.693	4.05E+05	0.146	0.645	0.645	0.677
7.00	5479.00	5.48	-0.030	0.527	1.693	4.05E+05	0.146	0.643	0.640	0.681
8.00	6236.00	6.24	-0.027	0.515	1.693	4.05E+05	0.146	0.634	0.634	0.677
9.00	6986.00	6.99	-0.034	0.000	1.693	4.05E+05	0.146	0.112	0.629	0.160
10.00	7742.00	7.74	-0.034	0.000	1.693	4.05E+05	0.146	0.112	0.624	0.165
Area ratio	0.050									



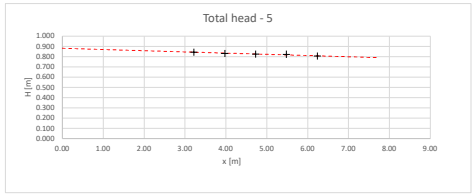
4		
Q	0.141	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.611	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.805	[m]
S_f	0.0095	[m/m]
H_0	0.789	[m]
ΔH_a	0.016	[m]
k_e	**0.074**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.805		
Face	0	0	0.000	0.577	2.041		0.212		0.789	
1.00	445.00	0.45			2.041	4.88E+05		0.000	0.785	0.004
2.00	1049.00	1.05			2.041	4.88E+05		0.000	0.779	0.010
3.00	1799.00	1.80			2.041	4.88E+05		0.000	0.772	0.017
4.00	3216.00	3.22	-0.025	0.571	2.041	4.88E+05	0.212	0.759	0.759	0.789
5.00	3971.00	3.97	-0.027	0.562	2.041	4.88E+05	0.212	0.747	0.751	0.785
6.00	4724.00	4.72	-0.028	0.560	2.041	4.88E+05	0.212	0.744	0.744	0.789
7.00	5479.00	5.48	-0.030	0.559	2.041	4.88E+05	0.212	0.741	0.737	0.794
8.00	6236.00	6.24	-0.027	0.544	2.041	4.88E+05	0.212	0.729	0.730	0.789
9.00	6986.00	6.99	-0.034	0.000	2.041	4.88E+05	0.212	0.178	0.723	0.245
10.00	7742.00	7.74	-0.034	0.000	2.041	4.88E+05	0.212	0.178	0.715	0.252
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.898	[m]
w_a	2.000	[m]
A_a	1.796	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.897	[m]
S_f	0.0118	[m/m]
H_0	0.881	[m]
ΔH_a	0.016	[m]
k_e	**0.059**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.001					0.897		
Face	0	0	0.000	0.613	2.293		0.268		0.881	
1.00	445.00	0.45	0.000	-1.017	2.293	5.48E+05	0.268	-0.749	0.876	-0.744
2.00	1049.00	1.05	0.000	-1.022	2.293	5.48E+05	0.268	-0.754	0.869	-0.742
3.00	1799.00	1.80	0.000	-1.008	2.293	5.48E+05	0.268	-0.740	0.860	-0.719
4.00	3216.00	3.22	-0.025	0.601	2.293	5.48E+05	0.268	0.844	0.844	0.882
5.00	3971.00	3.97	-0.027	0.590	2.293	5.48E+05	0.268	0.831	0.835	0.878
6.00	4724.00	4.72	-0.028	0.585	2.293	5.48E+05	0.268	0.825	0.826	0.881
7.00	5479.00	5.48	-0.030	0.585	2.293	5.48E+05	0.268	0.823	0.817	0.887
8.00	6236.00	6.24	-0.027	0.565	2.293	5.48E+05	0.268	0.806	0.808	0.880
9.00	6986.00	6.99	-0.034	0.000	2.293	5.48E+05	0.268	0.234	0.799	0.316
10.00	7742.00	7.74	-0.034	0.000	2.293	5.48E+05	0.268	0.234	0.790	0.325
Area ratio	0.038									



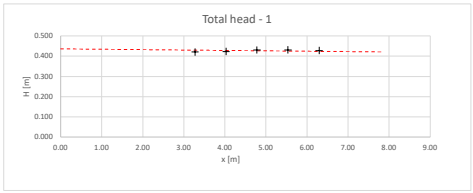
33.7 Deg Linear - Res 4 - 37.5%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

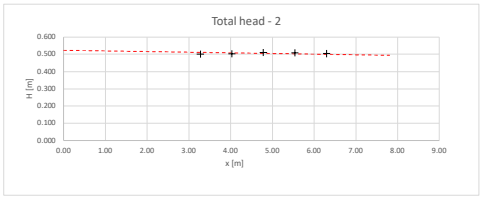
1		
Q	0.055	[m^3/s]
Approach		
y_a	0.468	[m]
w_a	2.000	[m]
A_a	0.936	[m^2]
v_a	0.059	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	6.07E+04	[-]
Linear interpolation		
H_a	0.466	[m]
S_f	0.002	[m/m]
H_0	0.437	[m]
ΔH_a	0.030	[m]
k_e	**0.903**	[-]
u_{be}	**0.102**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.404	0.801		0.033		0.437	
1.00	445.00	0.45			0.801	1.92E+05			0.436	0.001
2.00	1049.00	1.05			0.801	1.92E+05			0.435	0.002
3.00	1799.00	1.80			0.801	1.92E+05			0.433	0.003
4.00	3274.00	3.27	-0.048	0.436	0.801	1.92E+05	0.033	0.421	0.430	0.427
5.00	4029.00	4.03	-0.047	0.438	0.801	1.92E+05	0.033	0.424	0.429	0.431
6.00	4783.00	4.78	-0.044	0.443	0.801	1.92E+05	0.033	0.431	0.427	0.441
7.00	5539.00	5.54	-0.043	0.442	0.801	1.92E+05	0.033	0.432	0.426	0.443
8.00	6297.00	6.30	-0.038	0.434	0.801	1.92E+05	0.033	0.429	0.424	0.441
9.00	7048.00	7.05	-0.034	0.000	0.801	1.92E+05	0.033	-0.001	0.423	0.012
10.00	7805.00	7.81	-0.034	0.000	0.801	1.92E+05	0.033	-0.001	0.422	0.014
Area ratio	0.074									



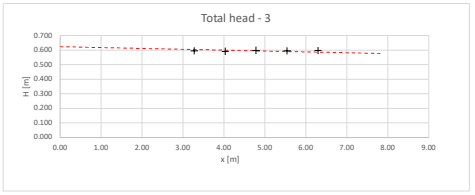
2		
Q	0.082	[m^3/s]
Approach		
y_a	0.570	[m]
w_a	2.000	[m]
A_a	1.140	[m^2]
v_a	0.072	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	8.45E+04	[-]
Linear interpolation		
H_a	0.568	[m]
S_f	0.0037	[m/m]
H_0	0.523	[m]
ΔH_a	0.045	[m]
k_e	**0.621**	[-]
u_{be}	**0.069**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.451	1.192		0.072		0.523	
1.00	445.00	0.45			1.192	2.85E+05			0.522	0.002
2.00	1049.00	1.05			1.192	2.85E+05			0.519	0.004
3.00	1799.00	1.80			1.192	2.85E+05			0.517	0.007
4.00	3274.00	3.27	-0.048	0.477	1.192	2.85E+05	0.072	0.501	0.511	0.513
5.00	4029.00	4.03	-0.047	0.477	1.192	2.85E+05	0.072	0.503	0.508	0.518
6.00	4783.00	4.78	-0.044	0.481	1.192	2.85E+05	0.072	0.510	0.505	0.528
7.00	5539.00	5.54	-0.043	0.479	1.192	2.85E+05	0.072	0.509	0.503	0.529
8.00	6297.00	6.30	-0.038	0.470	1.192	2.85E+05	0.072	0.504	0.500	0.528
9.00	7048.00	7.05	-0.034	0.000	1.192	2.85E+05	0.072	0.038	0.497	0.065
10.00	7805.00	7.81	-0.034	0.000	1.192	2.85E+05	0.072	0.038	0.494	0.068
Area ratio	0.061									



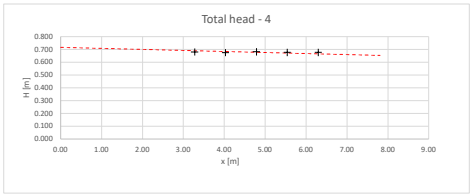
3		
Q	0.108	[m^3/s]
Approach		
y_a	0.690	[m]
w_a	2.000	[m]
A_a	1.380	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.03E+05	[-]
Linear interpolation		
H_a	0.688	[m]
S_f	0.0060	[m/m]
H_0	0.624	[m]
ΔH_a	0.065	[m]
k_e	**0.515**	[-]
u_{be}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.499	1.567		0.125		0.624	
1.00	445.00	0.45			1.567	3.75E+05			0.621	0.003
2.00	1049.00	1.05			1.567	3.75E+05			0.618	0.006
3.00	1799.00	1.80			1.567	3.75E+05			0.613	0.011
4.00	3274.00	3.27	-0.048	0.517	1.567	3.75E+05	0.125	0.594	0.604	0.614
5.00	4029.00	4.03	-0.047	0.513	1.567	3.75E+05	0.125	0.592	0.600	0.616
6.00	4783.00	4.78	-0.044	0.517	1.567	3.75E+05	0.125	0.598	0.595	0.627
7.00	5539.00	5.54	-0.043	0.513	1.567	3.75E+05	0.125	0.595	0.591	0.628
8.00	6297.00	6.30	-0.038	0.510	1.567	3.75E+05	0.125	0.597	0.586	0.634
9.00	7048.00	7.05	-0.034	0.000	1.567	3.75E+05	0.125	0.091	0.582	0.133
10.00	7805.00	7.81	-0.034	0.000	1.567	3.75E+05	0.125	0.091	0.577	0.138
Area ratio	0.050									



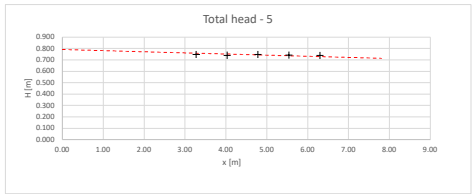
4		
Q	0.128	[m^3/s]
Approach		
y_a	0.805	[m]
w_a	2.000	[m]
A_a	1.609	[m^2]
v_a	0.080	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.028	[m]
Re	1.15E+05	[-]
Linear interpolation		
H_a	0.803	[m]
S_f	0.0081	[m/m]
H_0	0.716	[m]
ΔH_a	0.087	[m]
k_e	**0.492**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.803		
Face	0	0	0.000	0.540	1.860		0.176		0.716	
1.00	445.00	0.45			1.860	4.45E+05		0.000	0.713	0.004
2.00	1049.00	1.05			1.860	4.45E+05		0.000	0.708	0.008
3.00	1799.00	1.80			1.860	4.45E+05		0.000	0.702	0.015
4.00	3274.00	3.27	-0.048	0.552	1.860	4.45E+05	0.176	0.680	0.690	0.707
5.00	4029.00	4.03	-0.047	0.545	1.860	4.45E+05	0.176	0.675	0.684	0.707
6.00	4783.00	4.78	-0.044	0.549	1.860	4.45E+05	0.176	0.681	0.678	0.720
7.00	5539.00	5.54	-0.043	0.543	1.860	4.45E+05	0.176	0.676	0.671	0.721
8.00	6297.00	6.30	-0.038	0.538	1.860	4.45E+05	0.176	0.676	0.665	0.727
9.00	7048.00	7.05	-0.034	0.000	1.860	4.45E+05	0.176	0.142	0.659	0.199
10.00	7805.00	7.81	-0.034	0.000	1.860	4.45E+05	0.176	0.142	0.653	0.205
Area ratio	0.043									



5		
Q	0.144	[m^3/s]
Approach		
y_a	0.900	[m]
w_a	2.000	[m]
A_a	1.800	[m^2]
v_a	0.080	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	1.22E+05	[-]
Linear interpolation		
H_a	0.898	[m]
S_f	0.0099	[m/m]
H_0	0.792	[m]
ΔH_a	0.107	[m]
k_e	**0.481**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.898		
Face	0	0	0.000	0.570	2.086		0.222		0.792	
1.00	445.00	0.45	0.000	-1.017	2.086	4.99E+05	0.222	-0.795	0.787	-0.791
2.00	1049.00	1.05	0.000	-1.022	2.086	4.99E+05	0.222	-0.800	0.781	-0.790
3.00	1799.00	1.80	0.000	-1.008	2.086	4.99E+05	0.222	-0.786	0.774	-0.768
4.00	3274.00	3.27	-0.048	0.575	2.086	4.99E+05	0.222	0.749	0.759	0.782
5.00	4029.00	4.03	-0.047	0.566	2.086	4.99E+05	0.222	0.741	0.752	0.781
6.00	4783.00	4.78	-0.044	0.571	2.086	4.99E+05	0.222	0.749	0.744	0.797
7.00	5539.00	5.54	-0.043	0.563	2.086	4.99E+05	0.222	0.742	0.737	0.797
8.00	6297.00	6.30	-0.038	0.556	2.086	4.99E+05	0.222	0.740	0.729	0.802
9.00	7048.00	7.05	-0.034	0.000	2.086	4.99E+05	0.222	0.188	0.722	0.258
10.00	7805.00	7.81	-0.034	0.000	2.086	4.99E+05	0.222	0.188	0.714	0.265
Area ratio	0.038									



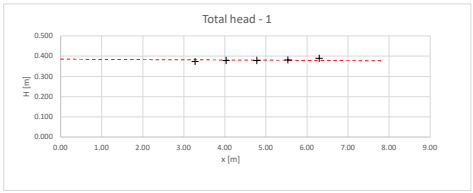
33.7 Deg Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

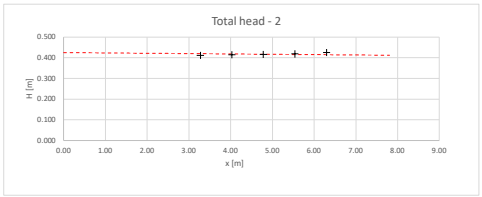
1		
Q	0.035	[m^3/s]
Approach		
y_a	0.466	[m]
w_a	2.000	[m]
A_a	0.932	[m^2]
v_a	0.038	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.018	[m]
Re	3.88E+04	[-]
Linear interpolation		
H_a	0.464	[m]
S_f	0.001	[m/m]
H_0	0.386	[m]
ΔH_a	0.078	[m]
k_e	**5.903**	[-]
u_{be}	**0.176**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.372	0.511		0.013		0.386	
1.00	445.00	0.45			0.511	1.22E+05			0.385	0.000
2.00	1049.00	1.05			0.511	1.22E+05			0.385	0.001
3.00	1799.00	1.80			0.511	1.22E+05			0.384	0.002
4.00	3274.00	3.27	-0.048	0.409	0.511	1.22E+05	0.013	0.374	0.382	0.377
5.00	4029.00	4.03	-0.047	0.413	0.511	1.22E+05	0.013	0.380	0.382	0.383
6.00	4783.00	4.78	-0.044	0.410	0.511	1.22E+05	0.013	0.380	0.381	0.384
7.00	5539.00	5.54	-0.043	0.412	0.511	1.22E+05	0.013	0.382	0.380	0.388
8.00	6297.00	6.30	-0.038	0.414	0.511	1.22E+05	0.013	0.390	0.380	0.396
9.00	7048.00	7.05	-0.034	0.000	0.511	1.22E+05	0.013	-0.021	0.379	-0.014
10.00	7805.00	7.81	-0.034	0.000	0.511	1.22E+05	0.013	-0.021	0.378	-0.013
Area ratio	0.074									



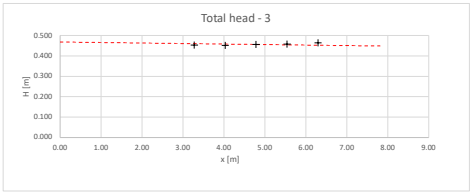
2		
Q	0.050	[m^3/s]
Approach		
y_a	0.564	[m]
w_a	2.000	[m]
A_a	1.128	[m^2]
v_a	0.044	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.019	[m]
Re	5.15E+04	[-]
Linear interpolation		
H_a	0.562	[m]
S_f	0.0016	[m/m]
H_0	0.425	[m]
ΔH_a	0.137	[m]
k_e	**5.145**	[-]
u_{be}	**0.122**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.398	0.723		0.027		0.425	
1.00	445.00	0.45			0.723	1.73E+05			0.424	0.001
2.00	1049.00	1.05			0.723	1.73E+05			0.423	0.002
3.00	1799.00	1.80			0.723	1.73E+05			0.422	0.003
4.00	3274.00	3.27	-0.048	0.433	0.723	1.73E+05	0.027	0.411	0.420	0.417
5.00	4029.00	4.03	-0.047	0.435	0.723	1.73E+05	0.027	0.414	0.418	0.421
6.00	4783.00	4.78	-0.044	0.434	0.723	1.73E+05	0.027	0.416	0.417	0.424
7.00	5539.00	5.54	-0.043	0.435	0.723	1.73E+05	0.027	0.418	0.416	0.427
8.00	6297.00	6.30	-0.038	0.436	0.723	1.73E+05	0.027	0.425	0.415	0.436
9.00	7048.00	7.05	-0.034	0.000	0.723	1.73E+05	0.027	-0.007	0.413	0.004
10.00	7805.00	7.81	-0.034	0.000	0.723	1.73E+05	0.027	-0.007	0.412	0.006
Area ratio	0.061									



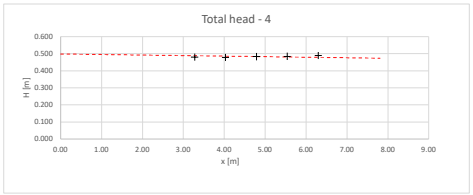
3		
Q	0.065	[m^3/s]
Approach		
y_a	0.694	[m]
w_a	2.000	[m]
A_a	1.388	[m^2]
v_a	0.047	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.018	[m]
Re	6.19E+04	[-]
Linear interpolation		
H_a	0.692	[m]
S_f	0.0025	[m/m]
H_0	0.469	[m]
ΔH_a	0.224	[m]
k_e	**4.946**	[-]
u_{be}	**0.109**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.423	0.942		0.045		0.469	
1.00	445.00	0.45			0.942	2.25E+05			0.467	0.001
2.00	1049.00	1.05			0.942	2.25E+05			0.466	0.003
3.00	1799.00	1.80			0.942	2.25E+05			0.464	0.005
4.00	3274.00	3.27	-0.048	0.456	0.942	2.25E+05	0.045	0.453	0.460	0.461
5.00	4029.00	4.03	-0.047	0.453	0.942	2.25E+05	0.045	0.451	0.458	0.462
6.00	4783.00	4.78	-0.044	0.456	0.942	2.25E+05	0.045	0.457	0.457	0.469
7.00	5539.00	5.54	-0.043	0.456	0.942	2.25E+05	0.045	0.458	0.455	0.472
8.00	6297.00	6.30	-0.038	0.457	0.942	2.25E+05	0.045	0.464	0.453	0.480
9.00	7048.00	7.05	-0.034	0.000	0.942	2.25E+05	0.045	0.011	0.451	0.029
10.00	7805.00	7.81	-0.034	0.000	0.942	2.25E+05	0.045	0.011	0.449	0.031
Area ratio	0.050									



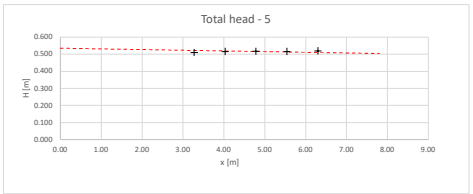
4		
Q	0.075	[m^3/s]
Approach		
y_a	0.802	[m]
w_a	2.000	[m]
A_a	1.603	[m^2]
v_a	0.047	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.017	[m]
Re	6.71E+04	[-]
Linear interpolation		
H_a	0.800	[m]
S_f	0.0032	[m/m]
H_0	0.498	[m]
ΔH_a	0.301	[m]
k_e	**5.018**	[-]
u_{be}	**0.107**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.800		
Face	0	0	0.000	0.438	1.085		0.060		0.498	
1.00	445.00	0.45			1.085	2.60E+05		0.000	0.497	0.001
2.00	1049.00	1.05			1.085	2.60E+05		0.000	0.495	0.003
3.00	1799.00	1.80			1.085	2.60E+05		0.000	0.493	0.006
4.00	3274.00	3.27	-0.048	0.468	1.085	2.60E+05	0.060	0.480	0.488	0.490
5.00	4029.00	4.03	-0.047	0.466	1.085	2.60E+05	0.060	0.479	0.486	0.492
6.00	4783.00	4.78	-0.044	0.467	1.085	2.60E+05	0.060	0.483	0.483	0.498
7.00	5539.00	5.54	-0.043	0.467	1.085	2.60E+05	0.060	0.485	0.481	0.502
8.00	6297.00	6.30	-0.038	0.468	1.085	2.60E+05	0.060	0.490	0.478	0.510
9.00	7048.00	7.05	-0.034	0.000	1.085	2.60E+05	0.060	0.026	0.476	0.049
10.00	7805.00	7.81	-0.034	0.000	1.085	2.60E+05	0.060	0.026	0.474	0.051
Area ratio	0.043									



5		
Q	0.085	[m^3/s]
Approach		
y_a	0.905	[m]
w_a	2.000	[m]
A_a	1.809	[m^2]
v_a	0.047	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.016	[m]
Re	7.20E+04	[-]
Linear interpolation		
H_a	0.903	[m]
S_f	0.0039	[m/m]
H_0	0.535	[m]
ΔH_a	0.368	[m]
k_e	**4.744**	[-]
u_{be}	**0.102**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.903		
Face	0	0	0.000	0.458	1.233		0.077		0.535	
1.00	445.00	0.45	0.000	-1.017	1.233	2.95E+05	0.077	-0.940	0.533	-0.938
2.00	1049.00	1.05	0.000	-1.022	1.233	2.95E+05	0.077	-0.945	0.531	-0.940
3.00	1799.00	1.80	0.000	-1.008	1.233	2.95E+05	0.077	-0.930	0.528	-0.923
4.00	3274.00	3.27	-0.048	0.481	1.233	2.95E+05	0.077	0.511	0.522	0.524
5.00	4029.00	4.03	-0.047	0.486	1.233	2.95E+05	0.077	0.517	0.519	0.532
6.00	4783.00	4.78	-0.044	0.484	1.233	2.95E+05	0.077	0.518	0.516	0.536
7.00	5539.00	5.54	-0.043	0.482	1.233	2.95E+05	0.077	0.516	0.513	0.538
8.00	6297.00	6.30	-0.038	0.481	1.233	2.95E+05	0.077	0.520	0.510	0.545
9.00	7048.00	7.05	-0.034	0.000	1.233	2.95E+05	0.077	0.043	0.507	0.071
10.00	7805.00	7.81	-0.034	0.000	1.233	2.95E+05	0.077	0.043	0.504	0.074
Area ratio	0.038									



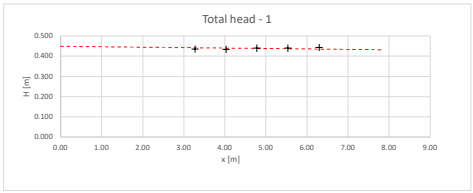
33.7 Deg Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

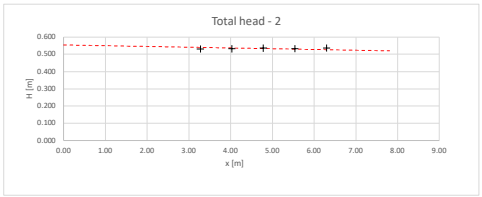
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.466	[m]
w_a	2.000	[m]
A_a	0.932	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.49E+04	[-]
Linear interpolation		
H_a	0.464	[m]
S_f	0.002	[m/m]
H_0	0.449	[m]
ΔH_a	0.015	[m]
k_e	**0.405**	[-]
u_{ke}	**0.099**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.412	0.855		0.037		0.449	
1.00	445.00	0.45			0.855	2.04E+05			0.448	0.001
2.00	1049.00	1.05			0.855	2.04E+05			0.447	0.002
3.00	1799.00	1.80			0.855	2.04E+05			0.445	0.004
4.00	3274.00	3.27	-0.048	0.447	0.855	2.04E+05	0.037	0.436	0.442	0.443
5.00	4029.00	4.03	-0.047	0.444	0.855	2.04E+05	0.037	0.434	0.440	0.443
6.00	4783.00	4.78	-0.044	0.447	0.855	2.04E+05	0.037	0.440	0.439	0.451
7.00	5539.00	5.54	-0.043	0.446	0.855	2.04E+05	0.037	0.440	0.437	0.452
8.00	6297.00	6.30	-0.038	0.445	0.855	2.04E+05	0.037	0.444	0.436	0.458
9.00	7048.00	7.05	-0.034	0.000	0.855	2.04E+05	0.037	0.003	0.434	0.018
10.00	7805.00	7.81	-0.034	0.000	0.855	2.04E+05	0.037	0.003	0.432	0.020
Area ratio	0.074									



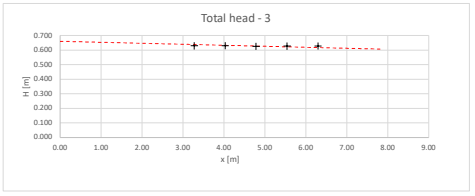
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.574	[m]
w_a	2.000	[m]
A_a	1.148	[m^2]
v_a	0.079	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.24E+04	[-]
Linear interpolation		
H_a	0.572	[m]
S_f	0.0044	[m/m]
H_0	0.554	[m]
ΔH_a	0.018	[m]
k_e	**0.210**	[-]
u_{ke}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.467	1.307		0.087		0.554	
1.00	445.00	0.45			1.307	3.12E+05			0.552	0.002
2.00	1049.00	1.05			1.307	3.12E+05			0.549	0.005
3.00	1799.00	1.80			1.307	3.12E+05			0.546	0.008
4.00	3274.00	3.27	-0.048	0.492	1.307	3.12E+05	0.087	0.531	0.540	0.545
5.00	4029.00	4.03	-0.047	0.492	1.307	3.12E+05	0.087	0.532	0.537	0.549
6.00	4783.00	4.78	-0.044	0.492	1.307	3.12E+05	0.087	0.535	0.533	0.556
7.00	5539.00	5.54	-0.043	0.489	1.307	3.12E+05	0.087	0.533	0.530	0.557
8.00	6297.00	6.30	-0.038	0.487	1.307	3.12E+05	0.087	0.536	0.527	0.563
9.00	7048.00	7.05	-0.034	0.000	1.307	3.12E+05	0.087	0.053	0.523	0.084
10.00	7805.00	7.81	-0.034	0.000	1.307	3.12E+05	0.087	0.053	0.520	0.087
Area ratio	0.060									



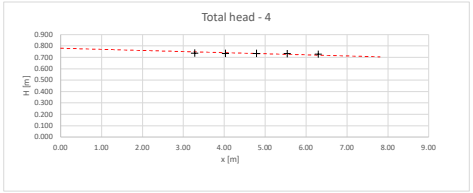
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.686	[m]
w_a	2.000	[m]
A_a	1.373	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.685	[m]
S_f	0.0069	[m/m]
H_0	0.661	[m]
ΔH_a	0.024	[m]
k_e	**0.163**	[-]
u_{ke}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.514	1.696		0.147		0.661	
1.00	445.00	0.45			1.696	4.06E+05			0.658	0.003
2.00	1049.00	1.05			1.696	4.06E+05			0.654	0.007
3.00	1799.00	1.80			1.696	4.06E+05			0.649	0.012
4.00	3274.00	3.27	-0.048	0.531	1.696	4.06E+05	0.147	0.629	0.638	0.652
5.00	4029.00	4.03	-0.047	0.530	1.696	4.06E+05	0.147	0.630	0.633	0.658
6.00	4783.00	4.78	-0.044	0.523	1.696	4.06E+05	0.147	0.626	0.628	0.659
7.00	5539.00	5.54	-0.043	0.524	1.696	4.06E+05	0.147	0.628	0.623	0.666
8.00	6297.00	6.30	-0.038	0.519	1.696	4.06E+05	0.147	0.628	0.618	0.671
9.00	7048.00	7.05	-0.034	0.000	1.696	4.06E+05	0.147	0.113	0.613	0.161
10.00	7805.00	7.81	-0.034	0.000	1.696	4.06E+05	0.147	0.113	0.607	0.166
Area ratio	0.050									



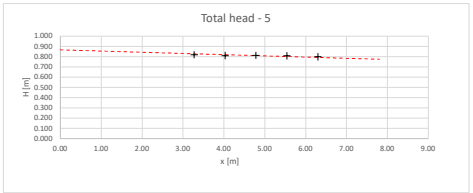
4		
Q	0.142	[m^3/s]
Approach		
y_a	0.810	[m]
w_a	2.000	[m]
A_a	1.620	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.808	[m]
S_f	0.0096	[m/m]
H_0	0.780	[m]
ΔH_a	0.028	[m]
k_e	**0.132**	[-]
u_{ke}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.808		
Face	0	0	0.000	0.565	2.055		0.215		0.780	
1.00	445.00	0.45			2.055	4.91E+05		0.000	0.776	0.004
2.00	1049.00	1.05			2.055	4.91E+05		0.000	0.770	0.010
3.00	1799.00	1.80			2.055	4.91E+05		0.000	0.763	0.017
4.00	3274.00	3.27	-0.048	0.571	2.055	4.91E+05	0.215	0.738	0.748	0.770
5.00	4029.00	4.03	-0.047	0.567	2.055	4.91E+05	0.215	0.735	0.741	0.774
6.00	4783.00	4.78	-0.044	0.563	2.055	4.91E+05	0.215	0.735	0.734	0.781
7.00	5539.00	5.54	-0.043	0.561	2.055	4.91E+05	0.215	0.733	0.727	0.787
8.00	6297.00	6.30	-0.038	0.551	2.055	4.91E+05	0.215	0.728	0.719	0.789
9.00	7048.00	7.05	-0.034	0.000	2.055	4.91E+05	0.215	0.181	0.712	0.249
10.00	7805.00	7.81	-0.034	0.000	2.055	4.91E+05	0.215	0.181	0.705	0.257
Area ratio	0.043									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.897	[m]
w_a	2.000	[m]
A_a	1.794	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.896	[m]
S_f	0.0117	[m/m]
H_0	0.866	[m]
ΔH_a	0.029	[m]
k_e	**0.109**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.896		
Face	0	0	0.000	0.599	2.291		0.267		0.866	
1.00	445.00	0.45	0.000	-1.017	2.291	5.48E+05	0.267	-0.750	0.861	-0.744
2.00	1049.00	1.05	0.000	-1.022	2.291	5.48E+05	0.267	-0.755	0.854	-0.742
3.00	1799.00	1.80	0.000	-1.008	2.291	5.48E+05	0.267	-0.740	0.845	-0.719
4.00	3274.00	3.27	-0.048	0.600	2.291	5.48E+05	0.267	0.820	0.828	0.858
5.00	4029.00	4.03	-0.047	0.590	2.291	5.48E+05	0.267	0.811	0.819	0.858
6.00	4783.00	4.78	-0.044	0.589	2.291	5.48E+05	0.267	0.813	0.810	0.869
7.00	5539.00	5.54	-0.043	0.584	2.291	5.48E+05	0.267	0.809	0.801	0.874
8.00	6297.00	6.30	-0.038	0.569	2.291	5.48E+05	0.267	0.799	0.792	0.873
9.00	7048.00	7.05	-0.034	0.000	2.291	5.48E+05	0.267	0.233	0.784	0.316
10.00	7805.00	7.81	-0.034	0.000	2.291	5.48E+05	0.267	0.233	0.775	0.325
Area ratio	0.038									



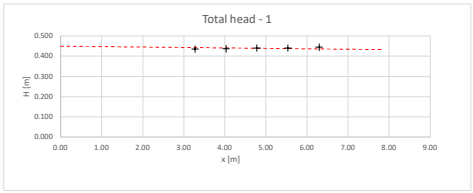
33.7 Deg Liner - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

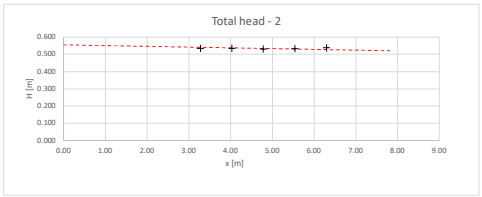
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.465	[m]
w_a	2.000	[m]
A_a	0.931	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.48E+04	[-]
Linear interpolation		
H_a	0.464	[m]
S_f	0.002	[m/m]
H_0	0.450	[m]
ΔH_a	0.014	[m]
k_e	**0.369**	[-]
u_{ke}	**0.099**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.413	0.854		0.037		0.450	
1.00	445.00	0.45			0.854	2.04E+05			0.449	0.001
2.00	1049.00	1.05			0.854	2.04E+05			0.448	0.002
3.00	1799.00	1.80			0.854	2.04E+05			0.446	0.004
4.00	3274.00	3.27	-0.048	0.446	0.854	2.04E+05	0.037	0.436	0.443	0.443
5.00	4029.00	4.03	-0.047	0.447	0.854	2.04E+05	0.037	0.437	0.441	0.446
6.00	4783.00	4.78	-0.044	0.447	0.854	2.04E+05	0.037	0.440	0.440	0.451
7.00	5539.00	5.54	-0.043	0.446	0.854	2.04E+05	0.037	0.440	0.438	0.452
8.00	6297.00	6.30	-0.038	0.446	0.854	2.04E+05	0.037	0.445	0.436	0.458
9.00	7048.00	7.05	-0.034	0.000	0.854	2.04E+05	0.037	0.003	0.435	0.018
10.00	7805.00	7.81	-0.034	0.000	0.854	2.04E+05	0.037	0.003	0.433	0.020
Area ratio	0.074									



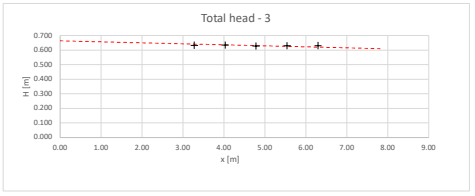
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.574	[m]
w_a	2.000	[m]
A_a	1.148	[m^2]
v_a	0.079	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.25E+04	[-]
Linear interpolation		
H_a	0.573	[m]
S_f	0.0044	[m/m]
H_0	0.555	[m]
ΔH_a	0.018	[m]
k_e	**0.204**	[-]
u_{ke}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.467	1.308		0.087		0.555	
1.00	445.00	0.45			1.308	3.13E+05			0.553	0.002
2.00	1049.00	1.05			1.308	3.13E+05			0.550	0.005
3.00	1799.00	1.80			1.308	3.13E+05			0.547	0.008
4.00	3274.00	3.27	-0.048	0.495	1.308	3.13E+05	0.087	0.534	0.540	0.549
5.00	4029.00	4.03	-0.047	0.494	1.308	3.13E+05	0.087	0.535	0.537	0.552
6.00	4783.00	4.78	-0.044	0.487	1.308	3.13E+05	0.087	0.530	0.534	0.551
7.00	5539.00	5.54	-0.043	0.488	1.308	3.13E+05	0.087	0.532	0.531	0.556
8.00	6297.00	6.30	-0.038	0.488	1.308	3.13E+05	0.087	0.537	0.527	0.565
9.00	7048.00	7.05	-0.034	0.000	1.308	3.13E+05	0.087	0.053	0.524	0.084
10.00	7805.00	7.81	-0.034	0.000	1.308	3.13E+05	0.087	0.053	0.521	0.087
Area ratio	0.060									



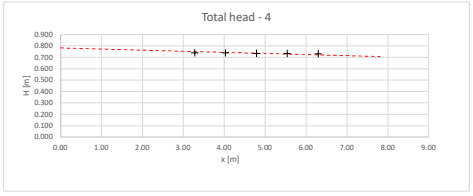
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.688	[m]
w_a	2.000	[m]
A_a	1.376	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.686	[m]
S_f	0.0069	[m/m]
H_0	0.664	[m]
ΔH_a	0.022	[m]
k_e	**0.152**	[-]
u_{ke}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.517	1.698		0.147		0.664	
1.00	445.00	0.45			1.698	4.06E+05			0.661	0.003
2.00	1049.00	1.05			1.698	4.06E+05			0.657	0.007
3.00	1799.00	1.80			1.698	4.06E+05			0.652	0.012
4.00	3274.00	3.27	-0.048	0.534	1.698	4.06E+05	0.147	0.633	0.642	0.655
5.00	4029.00	4.03	-0.047	0.534	1.698	4.06E+05	0.147	0.634	0.636	0.662
6.00	4783.00	4.78	-0.044	0.525	1.698	4.06E+05	0.147	0.628	0.631	0.661
7.00	5539.00	5.54	-0.043	0.526	1.698	4.06E+05	0.147	0.630	0.626	0.668
8.00	6297.00	6.30	-0.038	0.522	1.698	4.06E+05	0.147	0.631	0.621	0.674
9.00	7048.00	7.05	-0.034	0.000	1.698	4.06E+05	0.147	0.113	0.616	0.161
10.00	7805.00	7.81	-0.034	0.000	1.698	4.06E+05	0.147	0.113	0.610	0.167
Area ratio	0.050									



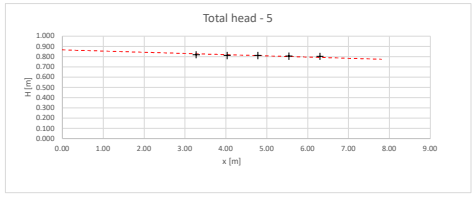
4		
Q	0.142	[m^3/s]
Approach		
y_a	0.812	[m]
w_a	2.000	[m]
A_a	1.624	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.810	[m]
S_f	0.0097	[m/m]
H_0	0.783	[m]
ΔH_a	0.028	[m]
k_e	**0.129**	[-]
u_{ke}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.810		
Face	0	0	0.000	0.567	2.056		0.216		0.783	
1.00	445.00	0.45			2.056	4.92E+05		0.000	0.778	0.004
2.00	1049.00	1.05			2.056	4.92E+05		0.000	0.772	0.010
3.00	1799.00	1.80			2.056	4.92E+05		0.000	0.765	0.017
4.00	3274.00	3.27	-0.048	0.574	2.056	4.92E+05	0.216	0.741	0.751	0.773
5.00	4029.00	4.03	-0.047	0.570	2.056	4.92E+05	0.216	0.739	0.744	0.778
6.00	4783.00	4.78	-0.044	0.564	2.056	4.92E+05	0.216	0.735	0.736	0.781
7.00	5539.00	5.54	-0.043	0.562	2.056	4.92E+05	0.216	0.735	0.729	0.788
8.00	6297.00	6.30	-0.038	0.555	2.056	4.92E+05	0.216	0.732	0.722	0.793
9.00	7048.00	7.05	-0.034	0.000	2.056	4.92E+05	0.216	0.182	0.715	0.250
10.00	7805.00	7.81	-0.034	0.000	2.056	4.92E+05	0.216	0.182	0.707	0.257
Area ratio	0.042									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.901	[m]
w_a	2.000	[m]
A_a	1.802	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.899	[m]
S_f	0.0117	[m/m]
H_0	0.866	[m]
ΔH_a	0.033	[m]
k_e	**0.124**	[-]
u_{ke}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.899		
Face	0	0	0.000	0.599	2.288		0.267		0.866	
1.00	445.00	0.45	0.000	-1.017	2.288	5.47E+05	0.267	-0.750	0.861	-0.745
2.00	1049.00	1.05	0.000	-1.022	2.288	5.47E+05	0.267	-0.755	0.854	-0.743
3.00	1799.00	1.80	0.000	-1.008	2.288	5.47E+05	0.267	-0.741	0.845	-0.720
4.00	3274.00	3.27	-0.048	0.601	2.288	5.47E+05	0.267	0.820	0.828	0.858
5.00	4029.00	4.03	-0.047	0.592	2.288	5.47E+05	0.267	0.811	0.819	0.858
6.00	4783.00	4.78	-0.044	0.589	2.288	5.47E+05	0.267	0.811	0.810	0.867
7.00	5539.00	5.54	-0.043	0.582	2.288	5.47E+05	0.267	0.806	0.801	0.870
8.00	6297.00	6.30	-0.038	0.574	2.288	5.47E+05	0.267	0.803	0.793	0.877
9.00	7048.00	7.05	-0.034	0.000	2.288	5.47E+05	0.267	0.233	0.784	0.315
10.00	7805.00	7.81	-0.034	0.000	2.288	5.47E+05	0.267	0.233	0.775	0.324
Area ratio	0.038									



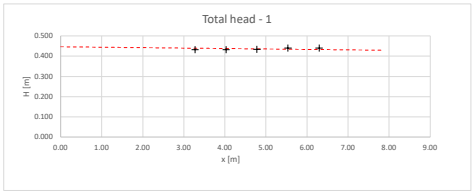
33.7 Deg Linear - Res 3 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

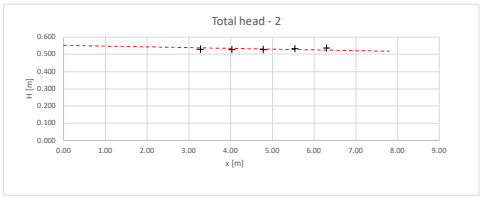
1		
Q	0.059	[m^3/s]
Approach		
y_a	0.468	[m]
w_a	2.000	[m]
A_a	0.936	[m^2]
v_a	0.063	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	6.52E+04	[-]
Linear interpolation		
H_a	0.466	[m]
S_f	0.002	[m/m]
H_0	0.447	[m]
ΔH_a	0.019	[m]
k_e	**0.512**	[-]
u_{be}	**0.099**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.409	0.860		0.038		0.447	
1.00	445.00	0.45			0.860	2.06E+05			0.446	0.001
2.00	1049.00	1.05			0.860	2.06E+05			0.445	0.002
3.00	1799.00	1.80			0.860	2.06E+05			0.443	0.004
4.00	3274.00	3.27	-0.048	0.443	0.860	2.06E+05	0.038	0.433	0.440	0.440
5.00	4029.00	4.03	-0.047	0.442	0.860	2.06E+05	0.038	0.433	0.438	0.442
6.00	4783.00	4.78	-0.044	0.441	0.860	2.06E+05	0.038	0.435	0.437	0.445
7.00	5539.00	5.54	-0.043	0.447	0.860	2.06E+05	0.038	0.441	0.435	0.453
8.00	6297.00	6.30	-0.038	0.441	0.860	2.06E+05	0.038	0.441	0.433	0.455
9.00	7048.00	7.05	-0.034	0.000	0.860	2.06E+05	0.038	0.004	0.432	0.019
10.00	7805.00	7.81	-0.034	0.000	0.860	2.06E+05	0.038	0.004	0.430	0.021
Area ratio	0.074									



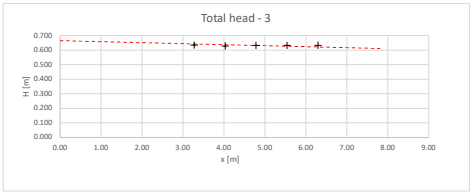
2		
Q	0.090	[m^3/s]
Approach		
y_a	0.574	[m]
w_a	2.000	[m]
A_a	1.148	[m^2]
v_a	0.078	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	9.22E+04	[-]
Linear interpolation		
H_a	0.572	[m]
S_f	0.0043	[m/m]
H_0	0.552	[m]
ΔH_a	0.021	[m]
k_e	**0.238**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.465	1.305		0.087		0.552	
1.00	445.00	0.45			1.305	3.12E+05			0.550	0.002
2.00	1049.00	1.05			1.305	3.12E+05			0.547	0.005
3.00	1799.00	1.80			1.305	3.12E+05			0.544	0.008
4.00	3274.00	3.27	-0.048	0.491	1.305	3.12E+05	0.087	0.530	0.537	0.544
5.00	4029.00	4.03	-0.047	0.487	1.305	3.12E+05	0.087	0.527	0.534	0.545
6.00	4783.00	4.78	-0.044	0.485	1.305	3.12E+05	0.087	0.528	0.531	0.548
7.00	5539.00	5.54	-0.043	0.489	1.305	3.12E+05	0.087	0.533	0.528	0.557
8.00	6297.00	6.30	-0.038	0.488	1.305	3.12E+05	0.087	0.537	0.524	0.564
9.00	7048.00	7.05	-0.034	0.000	1.305	3.12E+05	0.087	0.053	0.521	0.083
10.00	7805.00	7.81	-0.034	0.000	1.305	3.12E+05	0.087	0.053	0.518	0.087
Area ratio	0.060									



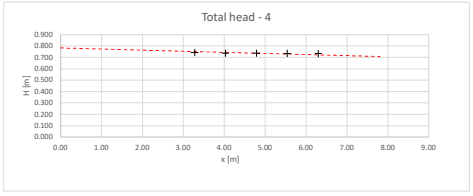
3		
Q	0.117	[m^3/s]
Approach		
y_a	0.690	[m]
w_a	2.000	[m]
A_a	1.380	[m^2]
v_a	0.085	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.12E+05	[-]
Linear interpolation		
H_a	0.688	[m]
S_f	0.0069	[m/m]
H_0	0.665	[m]
ΔH_a	0.023	[m]
k_e	**0.156**	[-]
u_{be}	**0.063**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002							
Face	0	0	0.000	0.518	1.701		0.147		0.665	
1.00	445.00	0.45			1.701	4.07E+05			0.662	0.003
2.00	1049.00	1.05			1.701	4.07E+05			0.658	0.007
3.00	1799.00	1.80			1.701	4.07E+05			0.653	0.012
4.00	3274.00	3.27	-0.048	0.535	1.701	4.07E+05	0.147	0.635	0.643	0.657
5.00	4029.00	4.03	-0.047	0.528	1.701	4.07E+05	0.147	0.629	0.637	0.657
6.00	4783.00	4.78	-0.044	0.529	1.701	4.07E+05	0.147	0.632	0.632	0.665
7.00	5539.00	5.54	-0.043	0.528	1.701	4.07E+05	0.147	0.632	0.627	0.670
8.00	6297.00	6.30	-0.038	0.524	1.701	4.07E+05	0.147	0.633	0.622	0.677
9.00	7048.00	7.05	-0.034	0.000	1.701	4.07E+05	0.147	0.113	0.617	0.162
10.00	7805.00	7.81	-0.034	0.000	1.701	4.07E+05	0.147	0.113	0.611	0.167
Area ratio	0.050									



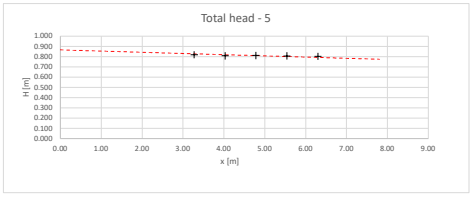
4		
Q	0.142	[m^3/s]
Approach		
y_a	0.812	[m]
w_a	2.000	[m]
A_a	1.624	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.26E+05	[-]
Linear interpolation		
H_a	0.810	[m]
S_f	0.0097	[m/m]
H_0	0.783	[m]
ΔH_a	0.028	[m]
k_e	**0.128**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.810		
Face	0	0	0.000	0.567	2.056		0.216		0.783	
1.00	445.00	0.45			2.056	4.92E+05		0.000	0.778	0.004
2.00	1049.00	1.05			2.056	4.92E+05		0.000	0.773	0.010
3.00	1799.00	1.80			2.056	4.92E+05		0.000	0.765	0.017
4.00	3274.00	3.27	-0.048	0.575	2.056	4.92E+05	0.216	0.743	0.751	0.774
5.00	4029.00	4.03	-0.047	0.568	2.056	4.92E+05	0.216	0.736	0.744	0.775
6.00	4783.00	4.78	-0.044	0.565	2.056	4.92E+05	0.216	0.737	0.737	0.783
7.00	5539.00	5.54	-0.043	0.562	2.056	4.92E+05	0.216	0.735	0.729	0.788
8.00	6297.00	6.30	-0.038	0.555	2.056	4.92E+05	0.216	0.733	0.722	0.793
9.00	7048.00	7.05	-0.034	0.000	2.056	4.92E+05	0.216	0.182	0.715	0.250
10.00	7805.00	7.81	-0.034	0.000	2.056	4.92E+05	0.216	0.182	0.707	0.257
Area ratio	0.042									



5		
Q	0.158	[m^3/s]
Approach		
y_a	0.896	[m]
w_a	2.000	[m]
A_a	1.792	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.34E+05	[-]
Linear interpolation		
H_a	0.894	[m]
S_f	0.0117	[m/m]
H_0	0.866	[m]
ΔH_a	0.028	[m]
k_e	**0.107**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.002					0.894		
Face	0	0	0.000	0.600	2.286		0.266		0.866	
1.00	445.00	0.45	0.000	-1.017	2.286	5.46E+05	0.266	-0.751	0.861	-0.746
2.00	1049.00	1.05	0.000	-1.022	2.286	5.46E+05	0.266	-0.756	0.854	-0.744
3.00	1799.00	1.80	0.000	-1.008	2.286	5.46E+05	0.266	-0.741	0.845	-0.720
4.00	3274.00	3.27	-0.048	0.601	2.286	5.46E+05	0.266	0.819	0.828	0.857
5.00	4029.00	4.03	-0.047	0.589	2.286	5.46E+05	0.266	0.808	0.819	0.856
6.00	4783.00	4.78	-0.044	0.589	2.286	5.46E+05	0.266	0.812	0.810	0.868
7.00	5539.00	5.54	-0.043	0.584	2.286	5.46E+05	0.266	0.808	0.801	0.872
8.00	6297.00	6.30	-0.038	0.575	2.286	5.46E+05	0.266	0.804	0.792	0.877
9.00	7048.00	7.05	-0.034	0.000	2.286	5.46E+05	0.266	0.232	0.784	0.315
10.00	7805.00	7.81	-0.034	0.000	2.286	5.46E+05	0.266	0.232	0.775	0.323
Area ratio	0.039									



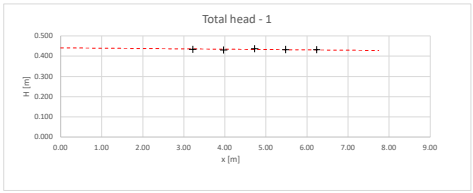
33.7 Deg Non Linear - Res 4 - 37.5Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

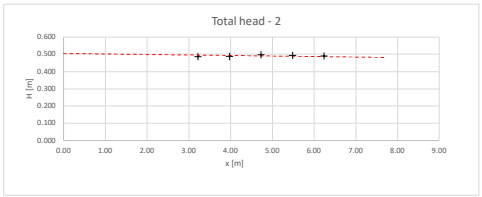
1		
Q	0.050	[m^3/s]
Approach		
y_a	0.467	[m]
w_a	2.000	[m]
A_a	0.934	[m^2]
v_a	0.054	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.025	[m]
Re	5.50E+04	[-]
Linear interpolation		
H_a	0.464	[m]
S_f	0.002	[m/m]
H_0	0.442	[m]
ΔH_a	0.023	[m]
k_e	**0.840**	[-]
u_{ke}	**0.107**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.415	0.725		0.027		0.442	
1.00	445.00	0.45			0.725	1.73E+05			0.441	0.001
2.00	1049.00	1.05			0.725	1.73E+05			0.440	0.002
3.00	1799.00	1.80			0.725	1.73E+05			0.439	0.003
4.00	3217.00	3.22	-0.024	0.431	0.725	1.73E+05	0.027	0.434	0.436	0.439
5.00	3972.00	3.97	-0.026	0.430	0.725	1.73E+05	0.027	0.431	0.435	0.438
6.00	4726.00	4.73	-0.028	0.439	0.725	1.73E+05	0.027	0.438	0.434	0.446
7.00	5481.00	5.48	-0.028	0.435	0.725	1.73E+05	0.027	0.434	0.433	0.443
8.00	6238.00	6.24	-0.027	0.433	0.725	1.73E+05	0.027	0.432	0.431	0.443
9.00	6989.00	6.99	-0.034	0.000	0.725	1.73E+05	0.027	-0.007	0.430	0.004
10.00	7747.00	7.75	-0.034	0.000	0.725	1.73E+05	0.027	-0.007	0.429	0.006
Area ratio	0.074									



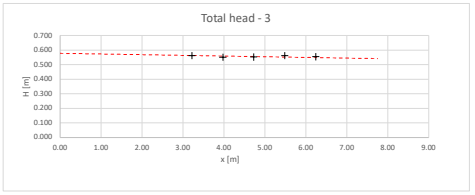
2		
Q	0.072	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.064	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	7.42E+04	[-]
Linear interpolation		
H_a	0.564	[m]
S_f	0.0030	[m/m]
H_0	0.505	[m]
ΔH_a	0.059	[m]
k_e	**1.068**	[-]
u_{ke}	**0.072**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.449	1.044		0.056		0.505	
1.00	445.00	0.45			1.044	2.50E+05			0.504	0.001
2.00	1049.00	1.05			1.044	2.50E+05			0.502	0.003
3.00	1799.00	1.80			1.044	2.50E+05			0.500	0.005
4.00	3217.00	3.22	-0.024	0.455	1.044	2.50E+05	0.056	0.486	0.495	0.496
5.00	3972.00	3.97	-0.026	0.458	1.044	2.50E+05	0.056	0.487	0.493	0.499
6.00	4726.00	4.73	-0.028	0.469	1.044	2.50E+05	0.056	0.497	0.491	0.511
7.00	5481.00	5.48	-0.028	0.466	1.044	2.50E+05	0.056	0.493	0.489	0.510
8.00	6238.00	6.24	-0.027	0.462	1.044	2.50E+05	0.056	0.490	0.486	0.509
9.00	6989.00	6.99	-0.034	0.000	1.044	2.50E+05	0.056	0.022	0.484	0.042
10.00	7747.00	7.75	-0.034	0.000	1.044	2.50E+05	0.056	0.022	0.482	0.045
Area ratio	0.061									



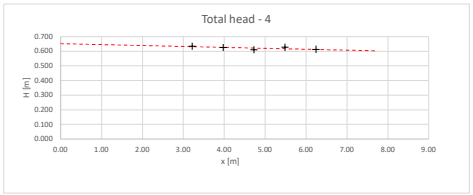
3		
Q	0.094	[m^3/s]
Approach		
y_a	0.680	[m]
w_a	2.000	[m]
A_a	1.360	[m^2]
v_a	0.069	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.027	[m]
Re	9.01E+04	[-]
Linear interpolation		
H_a	0.677	[m]
S_f	0.0047	[m/m]
H_0	0.578	[m]
ΔH_a	0.099	[m]
k_e	**1.050**	[-]
u_{ke}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.484	1.361		0.094		0.578	
1.00	445.00	0.45			1.361	3.25E+05			0.576	0.002
2.00	1049.00	1.05			1.361	3.25E+05			0.573	0.005
3.00	1799.00	1.80			1.361	3.25E+05			0.570	0.008
4.00	3217.00	3.22	-0.024	0.491	1.361	3.25E+05	0.094	0.561	0.563	0.576
5.00	3972.00	3.97	-0.026	0.482	1.361	3.25E+05	0.094	0.551	0.560	0.569
6.00	4726.00	4.73	-0.028	0.486	1.361	3.25E+05	0.094	0.552	0.556	0.574
7.00	5481.00	5.48	-0.028	0.496	1.361	3.25E+05	0.094	0.562	0.553	0.588
8.00	6238.00	6.24	-0.027	0.487	1.361	3.25E+05	0.094	0.554	0.549	0.584
9.00	6989.00	6.99	-0.034	0.000	1.361	3.25E+05	0.094	0.060	0.546	0.093
10.00	7747.00	7.75	-0.034	0.000	1.361	3.25E+05	0.094	0.060	0.542	0.097
Area ratio	0.051									



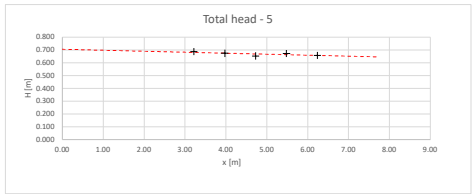
4		
Q	0.112	[m^3/s]
Approach		
y_a	0.801	[m]
w_a	2.000	[m]
A_a	1.602	[m^2]
v_a	0.070	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.025	[m]
Re	1.00E+05	[-]
Linear interpolation		
H_a	0.798	[m]
S_f	0.0064	[m/m]
H_0	0.652	[m]
ΔH_a	0.147	[m]
k_e	**1.089**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.798		
Face	0	0	0.000	0.517	1.624		0.134		0.652	
1.00	445.00	0.45			1.624	3.88E+05		0.000	0.649	0.003
2.00	1049.00	1.05			1.624	3.88E+05		0.000	0.645	0.007
3.00	1799.00	1.80			1.624	3.88E+05		0.000	0.640	0.011
4.00	3217.00	3.22	-0.024	0.524	1.624	3.88E+05	0.134	0.634	0.631	0.654
5.00	3972.00	3.97	-0.026	0.517	1.624	3.88E+05	0.134	0.625	0.627	0.651
6.00	4726.00	4.73	-0.028	0.503	1.624	3.88E+05	0.134	0.609	0.622	0.639
7.00	5481.00	5.48	-0.028	0.520	1.624	3.88E+05	0.134	0.626	0.617	0.661
8.00	6238.00	6.24	-0.027	0.506	1.624	3.88E+05	0.134	0.614	0.612	0.653
9.00	6989.00	6.99	-0.034	0.000	1.624	3.88E+05	0.134	0.100	0.607	0.145
10.00	7747.00	7.75	-0.034	0.000	1.624	3.88E+05	0.134	0.100	0.603	0.150
Area ratio	0.043									



5		
Q	0.125	[m^3/s]
Approach		
y_a	0.891	[m]
w_a	2.000	[m]
A_a	1.783	[m^2]
v_a	0.070	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.024	[m]
Re	1.07E+05	[-]
Linear interpolation		
H_a	0.889	[m]
S_f	0.0077	[m/m]
H_0	0.705	[m]
ΔH_a	0.183	[m]
k_e	**1.096**	[-]
u_{ke}	**0.064**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.889		
Face	0	0	0.000	0.538	1.811		0.167		0.705	
1.00	445.00	0.45	0.000	-1.017	1.811	4.33E+05	0.167	-0.850	0.702	-0.846
2.00	1049.00	1.05	0.000	-1.022	1.811	4.33E+05	0.167	-0.855	0.697	-0.847
3.00	1799.00	1.80	0.000	-1.008	1.811	4.33E+05	0.167	-0.840	0.692	-0.827
4.00	3217.00	3.22	-0.024	0.544	1.811	4.33E+05	0.167	0.687	0.681	0.712
5.00	3972.00	3.97	-0.026	0.533	1.811	4.33E+05	0.167	0.674	0.675	0.705
6.00	4726.00	4.73	-0.028	0.514	1.811	4.33E+05	0.167	0.653	0.669	0.690
7.00	5481.00	5.48	-0.028	0.534	1.811	4.33E+05	0.167	0.673	0.663	0.716
8.00	6238.00	6.24	-0.027	0.517	1.811	4.33E+05	0.167	0.657	0.657	0.705
9.00	6989.00	6.99	-0.034	0.000	1.811	4.33E+05	0.167	0.133	0.652	0.187
10.00	7747.00	7.75	-0.034	0.000	1.811	4.33E+05	0.167	0.133	0.646	0.193
Area ratio	0.039									



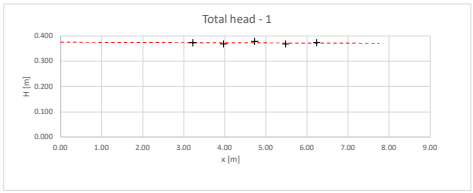
33.7 Deg Non Linear - Res 5 - 75%Block

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

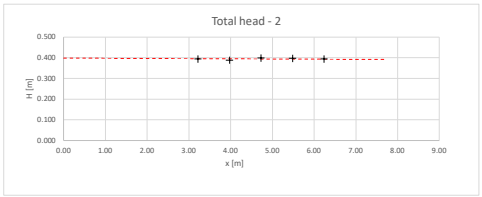
1		
Q	0.024	[m^3/s]
Approach		
y_a	0.465	[m]
w_a	2.000	[m]
A_a	0.931	[m^2]
v_a	0.026	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.012	[m]
Re	2.64E+04	[-]
Linear interpolation		
H_a	0.462	[m]
S_f	0.001	[m/m]
H_0	0.376	[m]
ΔH_a	0.087	[m]
k_e	**14.103**	[-]
u_{ke}	**0.352**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.369	0.348		0.006		0.376	
1.00	445.00	0.45			0.348	8.31E+04			0.375	0.000
2.00	1049.00	1.05			0.348	8.31E+04			0.375	0.001
3.00	1799.00	1.80			0.348	8.31E+04			0.375	0.001
4.00	3217.00	3.22	-0.024	0.391	0.348	8.31E+04	0.006	0.374	0.374	0.375
5.00	3972.00	3.97	-0.026	0.389	0.348	8.31E+04	0.006	0.369	0.373	0.371
6.00	4726.00	4.73	-0.027	0.400	0.348	8.31E+04	0.006	0.379	0.373	0.382
7.00	5481.00	5.48	-0.028	0.391	0.348	8.31E+04	0.006	0.369	0.373	0.372
8.00	6238.00	6.24	-0.027	0.395	0.348	8.31E+04	0.006	0.374	0.372	0.378
9.00	6989.00	6.99	-0.034	0.000	0.348	8.31E+04	0.006	-0.028	0.372	-0.024
10.00	7747.00	7.75	-0.034	0.000	0.348	8.31E+04	0.006	-0.028	0.371	-0.024
Area ratio	0.074									



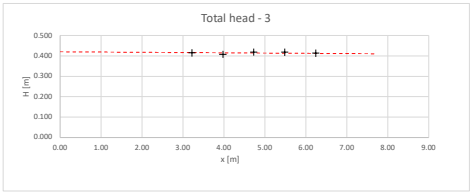
2		
Q	0.033	[m^3/s]
Approach		
y_a	0.563	[m]
w_a	2.000	[m]
A_a	1.126	[m^2]
v_a	0.029	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.013	[m]
Re	3.42E+04	[-]
Linear interpolation		
H_a	0.560	[m]
S_f	0.0009	[m/m]
H_0	0.398	[m]
ΔH_a	0.162	[m]
k_e	**13.758**	[-]
u_{ke}	**0.272**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.387	0.480		0.012		0.398	
1.00	445.00	0.45			0.480	1.15E+05			0.398	0.000
2.00	1049.00	1.05			0.480	1.15E+05			0.397	0.001
3.00	1799.00	1.80			0.480	1.15E+05			0.397	0.002
4.00	3217.00	3.22	-0.024	0.406	0.480	1.15E+05	0.012	0.394	0.396	0.397
5.00	3972.00	3.97	-0.026	0.402	0.480	1.15E+05	0.012	0.388	0.395	0.392
6.00	4726.00	4.73	-0.027	0.414	0.480	1.15E+05	0.012	0.399	0.394	0.403
7.00	5481.00	5.48	-0.028	0.413	0.480	1.15E+05	0.012	0.397	0.394	0.402
8.00	6238.00	6.24	-0.027	0.409	0.480	1.15E+05	0.012	0.394	0.393	0.399
9.00	6989.00	6.99	-0.034	0.000	0.480	1.15E+05	0.012	-0.022	0.392	-0.016
10.00	7747.00	7.75	-0.034	0.000	0.480	1.15E+05	0.012	-0.022	0.392	-0.015
Area ratio	0.061									



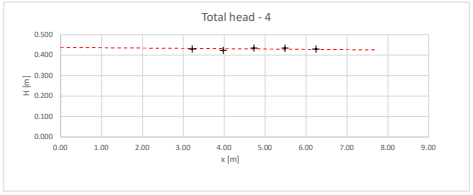
3		
Q	0.042	[m^3/s]
Approach		
y_a	0.687	[m]
w_a	2.000	[m]
A_a	1.374	[m^2]
v_a	0.031	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.012	[m]
Re	4.01E+04	[-]
Linear interpolation		
H_a	0.684	[m]
S_f	0.0013	[m/m]
H_0	0.420	[m]
ΔH_a	0.264	[m]
k_e	**13.974**	[-]
u_{ke}	**0.256**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.402	0.608		0.019		0.420	
1.00	445.00	0.45			0.608	1.45E+05			0.420	0.001
2.00	1049.00	1.05			0.608	1.45E+05			0.419	0.001
3.00	1799.00	1.80			0.608	1.45E+05			0.418	0.002
4.00	3217.00	3.22	-0.024	0.420	0.608	1.45E+05	0.019	0.415	0.416	0.419
5.00	3972.00	3.97	-0.026	0.415	0.608	1.45E+05	0.019	0.408	0.415	0.413
6.00	4726.00	4.73	-0.027	0.427	0.608	1.45E+05	0.019	0.419	0.415	0.424
7.00	5481.00	5.48	-0.028	0.427	0.608	1.45E+05	0.019	0.418	0.414	0.425
8.00	6238.00	6.24	-0.027	0.421	0.608	1.45E+05	0.019	0.413	0.413	0.421
9.00	6989.00	6.99	-0.034	0.000	0.608	1.45E+05	0.019	-0.015	0.412	-0.006
10.00	7747.00	7.75	-0.034	0.000	0.608	1.45E+05	0.019	-0.015	0.411	-0.005
Area ratio	0.050									



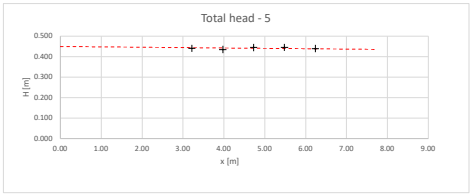
4		
Q	0.048	[m^3/s]
Approach		
y_a	0.804	[m]
w_a	2.000	[m]
A_a	1.608	[m^2]
v_a	0.030	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.011	[m]
Re	4.30E+04	[-]
Linear interpolation		
H_a	0.801	[m]
S_f	0.0016	[m/m]
H_0	0.437	[m]
ΔH_a	0.364	[m]
k_e	**14.678**	[-]
u_{ke}	**0.261**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.801		
Face	0	0	0.000	0.413	0.697		0.025		0.437	
1.00	445.00	0.45			0.697	1.67E+05		0.000	0.437	0.001
2.00	1049.00	1.05			0.697	1.67E+05		0.000	0.436	0.002
3.00	1799.00	1.80			0.697	1.67E+05		0.000	0.435	0.003
4.00	3217.00	3.22	-0.024	0.429	0.697	1.67E+05	0.025	0.430	0.432	0.435
5.00	3972.00	3.97	-0.026	0.425	0.697	1.67E+05	0.025	0.424	0.431	0.430
6.00	4726.00	4.73	-0.027	0.437	0.697	1.67E+05	0.025	0.434	0.430	0.442
7.00	5481.00	5.48	-0.028	0.437	0.697	1.67E+05	0.025	0.434	0.429	0.442
8.00	6238.00	6.24	-0.027	0.431	0.697	1.67E+05	0.025	0.429	0.428	0.439
9.00	6989.00	6.99	-0.034	0.000	0.697	1.67E+05	0.025	-0.009	0.427	0.002
10.00	7747.00	7.75	-0.034	0.000	0.697	1.67E+05	0.025	-0.009	0.425	0.003
Area ratio	0.043									



5		
Q	0.053	[m^3/s]
Approach		
y_a	0.894	[m]
w_a	2.000	[m]
A_a	1.788	[m^2]
v_a	0.030	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.010	[m]
Re	4.51E+04	[-]
Linear interpolation		
H_a	0.891	[m]
S_f	0.0018	[m/m]
H_0	0.450	[m]
ΔH_a	0.441	[m]
k_e	**14.684**	[-]
u_{ke}	**0.259**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.891		
Face	0	0	0.000	0.419	0.768		0.030		0.450	
1.00	445.00	0.45	0.000	-1.017	0.768	1.84E+05	0.030	-0.987	0.449	-0.986
2.00	1049.00	1.05	0.000	-1.022	0.768	1.84E+05	0.030	-0.992	0.448	-0.990
3.00	1799.00	1.80	0.000	-1.008	0.768	1.84E+05	0.030	-0.978	0.446	-0.974
4.00	3217.00	3.22	-0.024	0.434	0.768	1.84E+05	0.030	0.441	0.444	0.446
5.00	3972.00	3.97	-0.026	0.431	0.768	1.84E+05	0.030	0.435	0.442	0.442
6.00	4726.00	4.73	-0.027	0.441	0.768	1.84E+05	0.030	0.444	0.441	0.453
7.00	5481.00	5.48	-0.028	0.443	0.768	1.84E+05	0.030	0.445	0.440	0.455
8.00	6238.00	6.24	-0.027	0.437	0.768	1.84E+05	0.030	0.440	0.438	0.451
9.00	6989.00	6.99	-0.034	0.000	0.768	1.84E+05	0.030	-0.004	0.437	0.009
10.00	7747.00	7.75	-0.034	0.000	0.768	1.84E+05	0.030	-0.004	0.436	0.010
Area ratio	0.039									



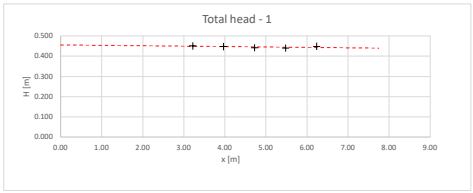
33.7 Deg Non Linear - Res 1 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

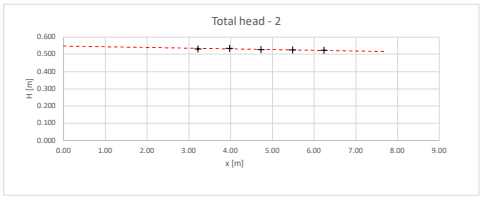
1		
Q	0.057	[m^3/s]
Approach		
y_a	0.463	[m]
w_a	2.000	[m]
A_a	0.926	[m^2]
v_a	0.062	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.31E+04	[-]
Linear interpolation		
H_a	0.460	[m]
S_f	0.002	[m/m]
H_0	0.456	[m]
ΔH_a	0.004	[m]
k_e	**0.115**	[-]
u_{be}	**0.100**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.421	0.830		0.035		0.456	
1.00	445.00	0.45			0.830	1.98E+05			0.455	0.001
2.00	1049.00	1.05			0.830	1.98E+05			0.454	0.002
3.00	1799.00	1.80			0.830	1.98E+05			0.452	0.004
4.00	3217.00	3.22	-0.024	0.440	0.830	1.98E+05	0.035	0.451	0.450	0.458
5.00	3972.00	3.97	-0.026	0.439	0.830	1.98E+05	0.035	0.448	0.448	0.456
6.00	4726.00	4.73	-0.027	0.435	0.830	1.98E+05	0.035	0.443	0.446	0.452
7.00	5481.00	5.48	-0.028	0.434	0.830	1.98E+05	0.035	0.441	0.445	0.452
8.00	6238.00	6.24	-0.027	0.441	0.830	1.98E+05	0.035	0.449	0.443	0.462
9.00	6989.00	6.99	-0.034	0.000	0.830	1.98E+05	0.035	0.001	0.442	0.015
10.00	7747.00	7.75	-0.034	0.000	0.830	1.98E+05	0.035	0.001	0.440	0.017
Area ratio	0.075									



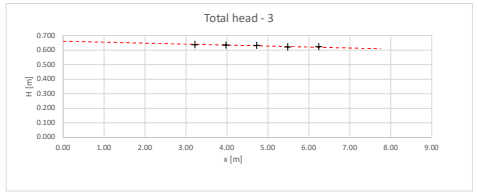
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.567	[m]
w_a	2.000	[m]
A_a	1.134	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	8.97E+04	[-]
Linear interpolation		
H_a	0.564	[m]
S_f	0.0041	[m/m]
H_0	0.548	[m]
ΔH_a	0.016	[m]
k_e	**0.203**	[-]
u_{be}	**0.067**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.467	1.262		0.081		0.548	
1.00	445.00	0.45			1.262	3.02E+05			0.546	0.002
2.00	1049.00	1.05			1.262	3.02E+05			0.543	0.004
3.00	1799.00	1.80			1.262	3.02E+05			0.540	0.007
4.00	3217.00	3.22	-0.024	0.474	1.262	3.02E+05	0.081	0.531	0.535	0.544
5.00	3972.00	3.97	-0.026	0.480	1.262	3.02E+05	0.081	0.535	0.531	0.551
6.00	4726.00	4.73	-0.027	0.473	1.262	3.02E+05	0.081	0.527	0.528	0.547
7.00	5481.00	5.48	-0.028	0.472	1.262	3.02E+05	0.081	0.525	0.525	0.548
8.00	6238.00	6.24	-0.027	0.469	1.262	3.02E+05	0.081	0.524	0.522	0.549
9.00	6989.00	6.99	-0.034	0.000	1.262	3.02E+05	0.081	0.047	0.519	0.076
10.00	7747.00	7.75	-0.034	0.000	1.262	3.02E+05	0.081	0.047	0.516	0.079
Area ratio	0.061									



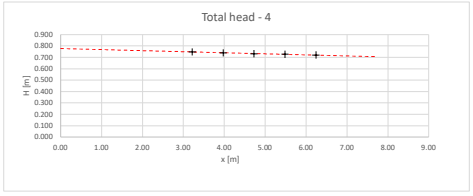
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.682	[m]
w_a	2.000	[m]
A_a	1.364	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.679	[m]
S_f	0.0066	[m/m]
H_0	0.661	[m]
ΔH_a	0.018	[m]
k_e	**0.128**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.520	1.663		0.141		0.661	
1.00	445.00	0.45			1.663	3.98E+05			0.658	0.003
2.00	1049.00	1.05			1.663	3.98E+05			0.654	0.007
3.00	1799.00	1.80			1.663	3.98E+05			0.649	0.012
4.00	3217.00	3.22	-0.024	0.520	1.663	3.98E+05	0.141	0.637	0.640	0.659
5.00	3972.00	3.97	-0.026	0.520	1.663	3.98E+05	0.141	0.635	0.635	0.661
6.00	4726.00	4.73	-0.027	0.518	1.663	3.98E+05	0.141	0.632	0.630	0.663
7.00	5481.00	5.48	-0.028	0.509	1.663	3.98E+05	0.141	0.622	0.625	0.658
8.00	6238.00	6.24	-0.027	0.510	1.663	3.98E+05	0.141	0.624	0.620	0.665
9.00	6989.00	6.99	-0.034	0.000	1.663	3.98E+05	0.141	0.107	0.615	0.153
10.00	7747.00	7.75	-0.034	0.000	1.663	3.98E+05	0.141	0.107	0.610	0.158
Area ratio	0.051									



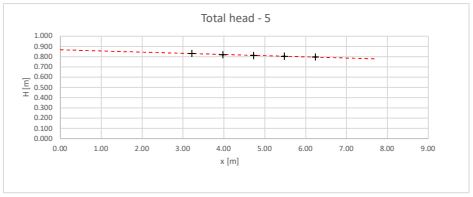
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.800	[m]
w_a	2.000	[m]
A_a	1.600	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.24E+05	[-]
Linear interpolation		
H_a	0.797	[m]
S_f	0.0093	[m/m]
H_0	0.778	[m]
ΔH_a	0.020	[m]
k_e	**0.096**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.797		
Face	0	0	0.000	0.572	2.010		0.206		0.778	
1.00	445.00	0.45			2.010	4.81E+05		0.000	0.773	0.004
2.00	1049.00	1.05			2.010	4.81E+05		0.000	0.768	0.010
3.00	1799.00	1.80			2.010	4.81E+05		0.000	0.761	0.017
4.00	3217.00	3.22	-0.024	0.566	2.010	4.81E+05	0.206	0.748	0.748	0.778
5.00	3972.00	3.97	-0.026	0.560	2.010	4.81E+05	0.206	0.740	0.741	0.777
6.00	4726.00	4.73	-0.027	0.553	2.010	4.81E+05	0.206	0.732	0.734	0.776
7.00	5481.00	5.48	-0.028	0.550	2.010	4.81E+05	0.206	0.728	0.727	0.779
8.00	6238.00	6.24	-0.027	0.541	2.010	4.81E+05	0.206	0.720	0.720	0.778
9.00	6989.00	6.99	-0.034	0.000	2.010	4.81E+05	0.206	0.172	0.713	0.237
10.00	7747.00	7.75	-0.034	0.000	2.010	4.81E+05	0.206	0.172	0.706	0.244
Area ratio	0.043									



5		
Q	0.156	[m^3/s]
Approach		
y_a	0.891	[m]
w_a	2.000	[m]
A_a	1.783	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.33E+05	[-]
Linear interpolation		
H_a	0.889	[m]
S_f	0.0115	[m/m]
H_0	0.867	[m]
ΔH_a	0.022	[m]
k_e	**0.083**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.889		
Face	0	0	0.000	0.606	2.265		0.261		0.867	
1.00	445.00	0.45	0.000	-1.017	2.265	5.42E+05	0.261	-0.756	0.862	-0.750
2.00	1049.00	1.05	0.000	-1.022	2.265	5.42E+05	0.261	-0.761	0.855	-0.749
3.00	1799.00	1.80	0.000	-1.008	2.265	5.42E+05	0.261	-0.746	0.846	-0.726
4.00	3217.00	3.22	-0.024	0.593	2.265	5.42E+05	0.261	0.831	0.830	0.867
5.00	3972.00	3.97	-0.026	0.584	2.265	5.42E+05	0.261	0.819	0.821	0.865
6.00	4726.00	4.73	-0.027	0.577	2.265	5.42E+05	0.261	0.812	0.813	0.866
7.00	5481.00	5.48	-0.028	0.571	2.265	5.42E+05	0.261	0.804	0.804	0.867
8.00	6238.00	6.24	-0.027	0.563	2.265	5.42E+05	0.261	0.798	0.795	0.869
9.00	6989.00	6.99	-0.034	0.000	2.265	5.42E+05	0.261	0.227	0.787	0.308
10.00	7747.00	7.75	-0.034	0.000	2.265	5.42E+05	0.261	0.227	0.778	0.316
Area ratio	0.039									



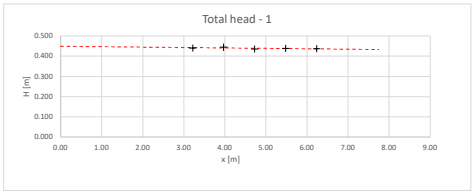
33.7 Deg Non Linear - Res 2 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

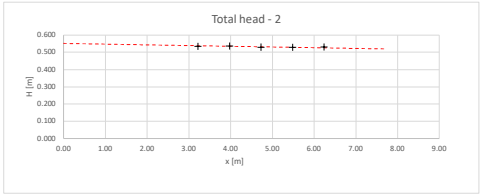
1		
Q	0.057	[m^3/s]
Approach		
y_a	0.462	[m]
w_a	2.000	[m]
A_a	0.924	[m^2]
v_a	0.062	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.27E+04	[-]
Linear interpolation		
H_a	0.459	[m]
S_f	0.002	[m/m]
H_0	0.449	[m]
ΔH_a	0.010	[m]
k_e	**0.286**	[-]
u_{be}	**0.100**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.415	0.824		0.035		0.449	
1.00	445.00	0.45			0.824	1.97E+05			0.448	0.001
2.00	1049.00	1.05			0.824	1.97E+05			0.447	0.002
3.00	1799.00	1.80			0.824	1.97E+05			0.446	0.004
4.00	3217.00	3.22	-0.024	0.430	0.824	1.97E+05	0.035	0.441	0.443	0.447
5.00	3972.00	3.97	-0.026	0.436	0.824	1.97E+05	0.035	0.445	0.441	0.453
6.00	4726.00	4.73	-0.027	0.429	0.824	1.97E+05	0.035	0.436	0.440	0.446
7.00	5481.00	5.48	-0.028	0.433	0.824	1.97E+05	0.035	0.439	0.438	0.451
8.00	6238.00	6.24	-0.027	0.430	0.824	1.97E+05	0.035	0.438	0.437	0.450
9.00	6989.00	6.99	-0.034	0.000	0.824	1.97E+05	0.035	0.001	0.435	0.015
10.00	7747.00	7.75	-0.034	0.000	0.824	1.97E+05	0.035	0.001	0.434	0.016
Area ratio	0.075									



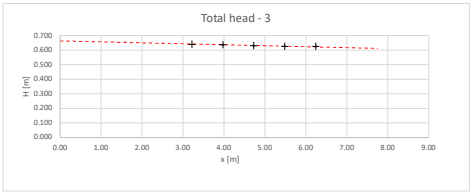
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.566	[m]
w_a	2.000	[m]
A_a	1.132	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	8.98E+04	[-]
Linear interpolation		
H_a	0.564	[m]
S_f	0.0041	[m/m]
H_0	0.551	[m]
ΔH_a	0.012	[m]
k_e	**0.150**	[-]
u_{be}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.470	1.263		0.081		0.551	
1.00	445.00	0.45			1.263	3.02E+05			0.549	0.002
2.00	1049.00	1.05			1.263	3.02E+05			0.547	0.004
3.00	1799.00	1.80			1.263	3.02E+05			0.544	0.007
4.00	3217.00	3.22	-0.024	0.477	1.263	3.02E+05	0.081	0.535	0.538	0.548
5.00	3972.00	3.97	-0.026	0.481	1.263	3.02E+05	0.081	0.536	0.535	0.553
6.00	4726.00	4.73	-0.027	0.476	1.263	3.02E+05	0.081	0.530	0.532	0.549
7.00	5481.00	5.48	-0.028	0.475	1.263	3.02E+05	0.081	0.528	0.529	0.551
8.00	6238.00	6.24	-0.027	0.476	1.263	3.02E+05	0.081	0.530	0.526	0.556
9.00	6989.00	6.99	-0.034	0.000	1.263	3.02E+05	0.081	0.047	0.523	0.076
10.00	7747.00	7.75	-0.034	0.000	1.263	3.02E+05	0.081	0.047	0.519	0.079
Area ratio	0.061									



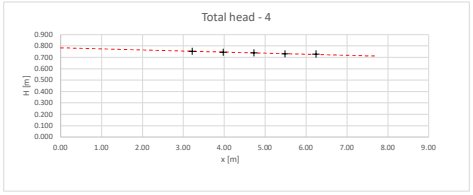
3		
Q	0.115	[m^3/s]
Approach		
y_a	0.684	[m]
w_a	2.000	[m]
A_a	1.368	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.032	[m]
Re	1.10E+05	[-]
Linear interpolation		
H_a	0.681	[m]
S_f	0.0066	[m/m]
H_0	0.664	[m]
ΔH_a	0.018	[m]
k_e	**0.125**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.522	1.666		0.141		0.664	
1.00	445.00	0.45			1.666	3.98E+05			0.661	0.003
2.00	1049.00	1.05			1.666	3.98E+05			0.657	0.007
3.00	1799.00	1.80			1.666	3.98E+05			0.652	0.012
4.00	3217.00	3.22	-0.024	0.523	1.666	3.98E+05	0.141	0.640	0.642	0.662
5.00	3972.00	3.97	-0.026	0.521	1.666	3.98E+05	0.141	0.637	0.637	0.663
6.00	4726.00	4.73	-0.027	0.517	1.666	3.98E+05	0.141	0.631	0.632	0.663
7.00	5481.00	5.48	-0.028	0.513	1.666	3.98E+05	0.141	0.626	0.627	0.663
8.00	6238.00	6.24	-0.027	0.512	1.666	3.98E+05	0.141	0.627	0.622	0.668
9.00	6989.00	6.99	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.617	0.154
10.00	7747.00	7.75	-0.034	0.000	1.666	3.98E+05	0.141	0.107	0.612	0.159
Area ratio	0.050									



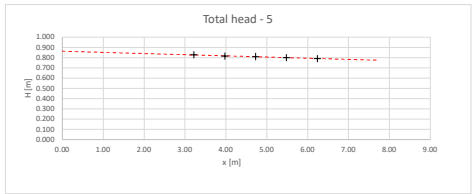
4		
Q	0.140	[m^3/s]
Approach		
y_a	0.806	[m]
w_a	2.000	[m]
A_a	1.611	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.25E+05	[-]
Linear interpolation		
H_a	0.803	[m]
S_f	0.0094	[m/m]
H_0	0.784	[m]
ΔH_a	0.019	[m]
k_e	**0.091**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.803		
Face	0	0	0.000	0.575	2.024		0.209		0.784	
1.00	445.00	0.45			2.024	4.84E+05		0.000	0.780	0.004
2.00	1049.00	1.05			2.024	4.84E+05		0.000	0.774	0.010
3.00	1799.00	1.80			2.024	4.84E+05		0.000	0.767	0.017
4.00	3217.00	3.22	-0.024	0.568	2.024	4.84E+05	0.209	0.753	0.754	0.783
5.00	3972.00	3.97	-0.026	0.561	2.024	4.84E+05	0.209	0.744	0.747	0.782
6.00	4726.00	4.73	-0.027	0.558	2.024	4.84E+05	0.209	0.740	0.740	0.784
7.00	5481.00	5.48	-0.028	0.551	2.024	4.84E+05	0.209	0.732	0.732	0.783
8.00	6238.00	6.24	-0.027	0.547	2.024	4.84E+05	0.209	0.729	0.725	0.788
9.00	6989.00	6.99	-0.034	0.000	2.024	4.84E+05	0.209	0.175	0.718	0.240
10.00	7747.00	7.75	-0.034	0.000	2.024	4.84E+05	0.209	0.175	0.711	0.247
Area ratio	0.043									



5		
Q	0.155	[m^3/s]
Approach		
y_a	0.889	[m]
w_a	2.000	[m]
A_a	1.778	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.33E+05	[-]
Linear interpolation		
H_a	0.886	[m]
S_f	0.0114	[m/m]
H_0	0.863	[m]
ΔH_a	0.024	[m]
k_e	**0.091**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.886		
Face	0	0	0.000	0.604	2.252		0.259		0.863	
1.00	445.00	0.45	0.000	-1.017	2.252	5.39E+05	0.259	-0.758	0.858	-0.753
2.00	1049.00	1.05	0.000	-1.022	2.252	5.39E+05	0.259	-0.764	0.851	-0.752
3.00	1799.00	1.80	0.000	-1.008	2.252	5.39E+05	0.259	-0.749	0.842	-0.729
4.00	3217.00	3.22	-0.024	0.593	2.252	5.39E+05	0.259	0.827	0.826	0.864
5.00	3972.00	3.97	-0.026	0.583	2.252	5.39E+05	0.259	0.816	0.818	0.861
6.00	4726.00	4.73	-0.027	0.579	2.252	5.39E+05	0.259	0.810	0.809	0.864
7.00	5481.00	5.48	-0.028	0.570	2.252	5.39E+05	0.259	0.800	0.800	0.863
8.00	6238.00	6.24	-0.027	0.560	2.252	5.39E+05	0.259	0.791	0.792	0.862
9.00	6989.00	6.99	-0.034	0.000	2.252	5.39E+05	0.259	0.225	0.783	0.304
10.00	7747.00	7.75	-0.034	0.000	2.252	5.39E+05	0.259	0.225	0.775	0.313
Area ratio	0.039									



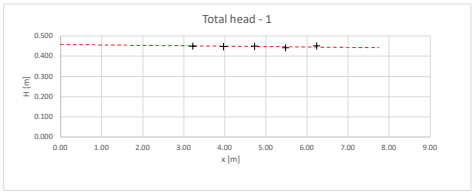
33.7 Deg Non Linear - Res 3 - NoBlock

Constants		
g	9.81	[m/s^2]
roh	1000	[kg/m^3]
A_{pipe}	0.069	[m^2]

Pipe	
x	z
0	0.2965
8	0.2965

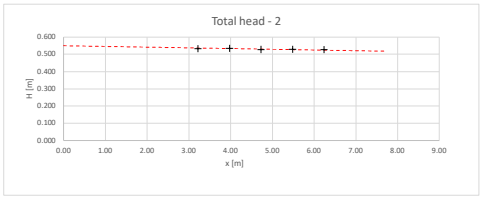
1		
Q	0.057	[m^3/s]
Approach		
y_a	0.462	[m]
w_a	2.000	[m]
A_a	0.924	[m^2]
v_a	0.062	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.029	[m]
Re	6.29E+04	[-]
Linear interpolation		
H_a	0.459	[m]
S_f	0.002	[m/m]
H_0	0.458	[m]
ΔH_a	0.001	[m]
k_e	**0.032**	[-]
u_{be}	**0.100**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.423	0.827		0.035		0.458	
1.00	445.00	0.45			0.827	1.98E+05			0.457	0.001
2.00	1049.00	1.05			0.827	1.98E+05			0.456	0.002
3.00	1799.00	1.80			0.827	1.98E+05			0.454	0.004
4.00	3217.00	3.22	-0.024	0.440	0.827	1.98E+05	0.035	0.450	0.452	0.457
5.00	3972.00	3.97	-0.026	0.439	0.827	1.98E+05	0.035	0.448	0.450	0.456
6.00	4726.00	4.73	-0.027	0.442	0.827	1.98E+05	0.035	0.450	0.448	0.459
7.00	5481.00	5.48	-0.028	0.436	0.827	1.98E+05	0.035	0.443	0.447	0.454
8.00	6238.00	6.24	-0.027	0.443	0.827	1.98E+05	0.035	0.451	0.445	0.464
9.00	6989.00	6.99	-0.034	0.000	0.827	1.98E+05	0.035	0.001	0.444	0.015
10.00	7747.00	7.75	-0.034	0.000	0.827	1.98E+05	0.035	0.001	0.442	0.017
Area ratio	0.075									



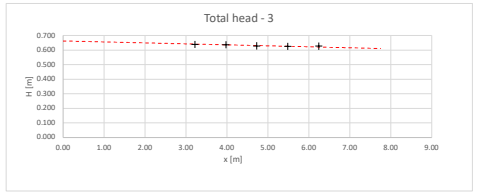
2		
Q	0.087	[m^3/s]
Approach		
y_a	0.566	[m]
w_a	2.000	[m]
A_a	1.131	[m^2]
v_a	0.077	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	8.98E+04	[-]
Linear interpolation		
H_a	0.563	[m]
S_f	0.0041	[m/m]
H_0	0.550	[m]
ΔH_a	0.013	[m]
k_e	**0.163**	[-]
u_{be}	**0.066**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.468	1.264		0.081		0.550	
1.00	445.00	0.45			1.264	3.02E+05			0.548	0.002
2.00	1049.00	1.05			1.264	3.02E+05			0.545	0.004
3.00	1799.00	1.80			1.264	3.02E+05			0.542	0.007
4.00	3217.00	3.22	-0.024	0.475	1.264	3.02E+05	0.081	0.532	0.536	0.545
5.00	3972.00	3.97	-0.026	0.479	1.264	3.02E+05	0.081	0.535	0.533	0.551
6.00	4726.00	4.73	-0.027	0.474	1.264	3.02E+05	0.081	0.528	0.530	0.548
7.00	5481.00	5.48	-0.028	0.475	1.264	3.02E+05	0.081	0.528	0.527	0.551
8.00	6238.00	6.24	-0.027	0.473	1.264	3.02E+05	0.081	0.527	0.524	0.553
9.00	6989.00	6.99	-0.034	0.000	1.264	3.02E+05	0.081	0.047	0.521	0.076
10.00	7747.00	7.75	-0.034	0.000	1.264	3.02E+05	0.081	0.047	0.518	0.079
Area ratio	0.061									



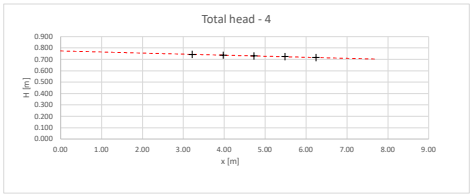
3		
Q	0.116	[m^3/s]
Approach		
y_a	0.685	[m]
w_a	2.000	[m]
A_a	1.370	[m^2]
v_a	0.084	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.033	[m]
Re	1.11E+05	[-]
Linear interpolation		
H_a	0.682	[m]
S_f	0.0067	[m/m]
H_0	0.663	[m]
ΔH_a	0.019	[m]
k_e	**0.134**	[-]
u_{be}	**0.062**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003							
Face	0	0	0.000	0.520	1.675		0.143		0.663	
1.00	445.00	0.45			1.675	4.00E+05			0.660	0.003
2.00	1049.00	1.05			1.675	4.00E+05			0.656	0.007
3.00	1799.00	1.80			1.675	4.00E+05			0.651	0.012
4.00	3217.00	3.22	-0.024	0.520	1.675	4.00E+05	0.143	0.639	0.642	0.661
5.00	3972.00	3.97	-0.026	0.520	1.675	4.00E+05	0.143	0.637	0.637	0.664
6.00	4726.00	4.73	-0.027	0.513	1.675	4.00E+05	0.143	0.629	0.632	0.661
7.00	5481.00	5.48	-0.028	0.511	1.675	4.00E+05	0.143	0.626	0.627	0.663
8.00	6238.00	6.24	-0.027	0.511	1.675	4.00E+05	0.143	0.627	0.621	0.669
9.00	6989.00	6.99	-0.034	0.000	1.675	4.00E+05	0.143	0.109	0.616	0.156
10.00	7747.00	7.75	-0.034	0.000	1.675	4.00E+05	0.143	0.109	0.611	0.161
Area ratio	0.050									



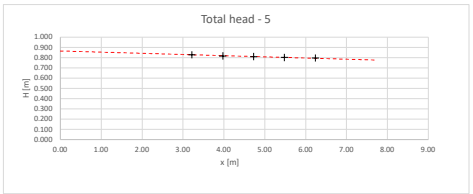
4		
Q	0.139	[m^3/s]
Approach		
y_a	0.799	[m]
w_a	2.000	[m]
A_a	1.598	[m^2]
v_a	0.087	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.031	[m]
Re	1.24E+05	[-]
Linear interpolation		
H_a	0.796	[m]
S_f	0.0093	[m/m]
H_0	0.774	[m]
ΔH_a	0.022	[m]
k_e	**0.109**	[-]
u_{be}	**0.061**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.796		
Face	0	0	0.000	0.568	2.011		0.206		0.774	
1.00	445.00	0.45			2.011	4.81E+05		0.000	0.770	0.004
2.00	1049.00	1.05			2.011	4.81E+05		0.000	0.764	0.010
3.00	1799.00	1.80			2.011	4.81E+05		0.000	0.757	0.017
4.00	3217.00	3.22	-0.024	0.562	2.011	4.81E+05	0.206	0.744	0.744	0.774
5.00	3972.00	3.97	-0.026	0.556	2.011	4.81E+05	0.206	0.736	0.737	0.773
6.00	4726.00	4.73	-0.027	0.551	2.011	4.81E+05	0.206	0.730	0.730	0.774
7.00	5481.00	5.48	-0.028	0.546	2.011	4.81E+05	0.206	0.724	0.723	0.775
8.00	6238.00	6.24	-0.027	0.537	2.011	4.81E+05	0.206	0.716	0.716	0.774
9.00	6989.00	6.99	-0.034	0.000	2.011	4.81E+05	0.206	0.172	0.709	0.237
10.00	7747.00	7.75	-0.034	0.000	2.011	4.81E+05	0.206	0.172	0.702	0.244
Area ratio	0.043									



5		
Q	0.156	[m^3/s]
Approach		
y_a	0.891	[m]
w_a	2.000	[m]
A_a	1.782	[m^2]
v_a	0.088	[m/s]
$H(v_a)$	0.000	[m]
Fr	0.030	[m]
Re	1.33E+05	[-]
Linear interpolation		
H_a	0.888	[m]
S_f	0.0115	[m/m]
H_0	0.865	[m]
ΔH_a	0.023	[m]
k_e	**0.089**	[-]
u_{be}	**0.060**	[-]

Sensor	x	x	z	Pressure	Velocity	Re	Velocity head	Total head	Total head ext	Ext. Average
[-]	[mm]	[m]	[m]	[m]	[m/s]	[-]	[m]	[m]	[m]	[m]
Approach	0	-0.5	-0.003					0.888		
Face	0	0	0.000	0.604	2.263		0.261		0.865	
1.00	445.00	0.45	0.000	-1.017	2.263	5.41E+05	0.261	-0.756	0.860	-0.751
2.00	1049.00	1.05	0.000	-1.022	2.263	5.41E+05	0.261	-0.761	0.853	-0.749
3.00	1799.00	1.80	0.000	-1.008	2.263	5.41E+05	0.261	-0.747	0.845	-0.726
4.00	3217.00	3.22	-0.024	0.590	2.263	5.41E+05	0.261	0.827	0.828	0.864
5.00	3972.00	3.97	-0.026	0.582	2.263	5.41E+05	0.261	0.817	0.820	0.863
6.00	4726.00	4.73	-0.027	0.576	2.263	5.41E+05	0.261	0.811	0.811	0.865
7.00	5481.00	5.48	-0.028	0.570	2.263	5.41E+05	0.261	0.803	0.802	0.866
8.00	6238.00	6.24	-0.027	0.563	2.263	5.41E+05	0.261	0.797	0.794	0.868
9.00	6989.00	6.99	-0.034	0.000	2.263	5.41E+05	0.261	0.227	0.785	0.307
10.00	7747.00	7.75	-0.034	0.000	2.263	5.41E+05	0.261	0.227	0.776	0.316
Area ratio	0.039									



Appendix B

Inlet Control Data Sheets

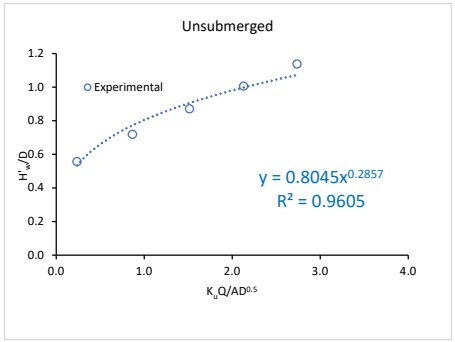
10 DEG LINEAR - EXP 4 - 37.5 BLOCK

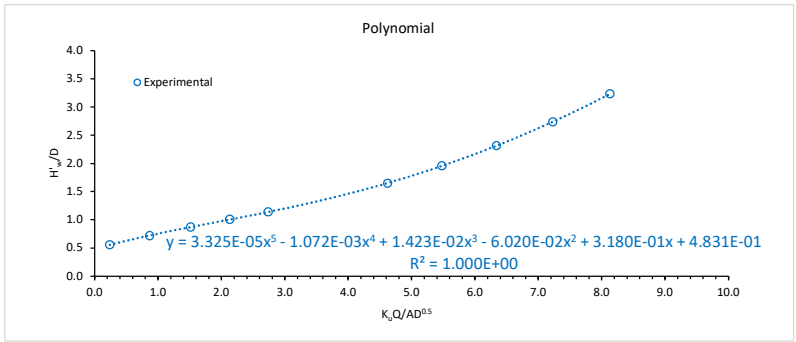
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0049	0.113	**0.24**	0.06	0.02	**0.557**	3.1	0.555	0.2	0.534	4.1
0.0180	0.161	**0.87**	0.75	0.06	**0.719**	3.0	0.722	0.5	0.773	7.4
0.0314	0.206	**1.51**	2.29	0.08	**0.871**	3.0	0.871	0.1	0.906	3.9
0.0442	0.246	**2.13**	4.54	0.09	**1.007**	3.1	1.004	0.2	0.999	0.8
0.0568	0.285	**2.74**	7.49	0.10	**1.139**	0.0	1.139	0.0	1.073	5.8
0.0959	0.436	**4.62**	21.35	0.11	**1.649**	2.6	1.652	0.2	1.650	0.1
0.1137	0.528	**5.48**	30.03	0.11	**1.959**	2.4	1.957	0.1	1.956	0.1
0.1315	0.634	**6.34**	40.18	0.10	**2.316**	2.1	2.313	0.1	2.315	0.1
0.1500	0.759	**7.23**	52.29	0.10	**2.738**	1.9	2.741	0.1	2.743	0.2
0.1686	0.906	**8.13**	66.10	0.09	**3.234**	0.0	3.233	0.0	3.231	0.1
					Maximum	**3.1**	**Maximum**	**0.5**	**Maximum**	**7.4**
					Average	**2.1**	**Average**	**0.2**	**Average**	**2.3**

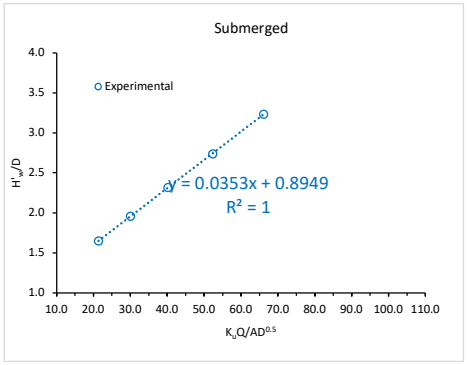
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.8045	0.2857	0.0353	0.8949

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
3.325E-05	-1.072E-03	1.423E-02	-6.020E-02	3.180E-01	4.831E-01







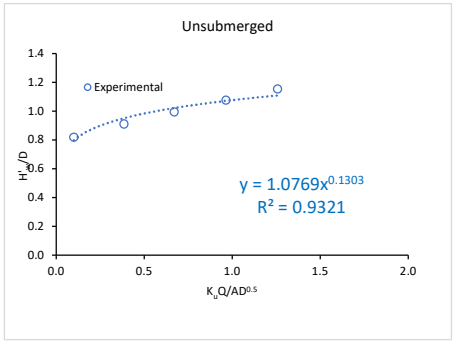
10 DEG LINEAR - EXP 5 - 75% BLOCK

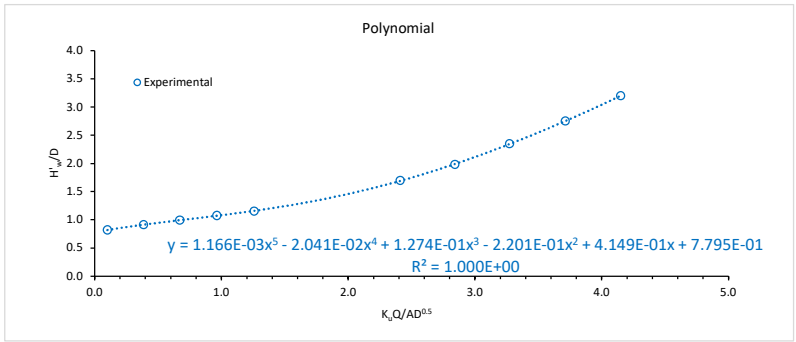
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0021	0.191	**0.10**	0.01	0.01	**0.820**	2.6	0.819	0.1	0.798	2.6
0.0080	0.218	**0.39**	0.15	0.02	**0.911**	2.6	0.914	0.3	0.951	4.4
0.0139	0.243	**0.67**	0.45	0.03	**0.995**	2.5	0.994	0.2	1.023	2.7
0.0200	0.267	**0.97**	0.93	0.04	**1.076**	2.5	1.073	0.4	1.072	0.4
0.0261	0.290	**1.26**	1.58	0.04	**1.154**	0.0	1.159	0.4	1.110	3.9
0.0500	0.451	**2.41**	5.81	0.06	**1.698**	1.9	1.691	0.4	1.693	0.3
0.0590	0.535	**2.84**	8.08	0.06	**1.981**	1.8	1.991	0.5	1.993	0.6
0.0679	0.644	**3.27**	10.71	0.05	**2.349**	1.7	2.342	0.3	2.340	0.3
0.0770	0.763	**3.71**	13.79	0.05	**2.750**	1.6	2.752	0.1	2.748	0.1
0.0861	0.896	**4.15**	17.22	0.05	**3.199**	0.0	3.198	0.0	3.201	0.1
					Maximum	**2.6**	**Maximum**	**0.5**	**Maximum**	**4.4**
					Average	**1.7**	**Average**	**0.3**	**Average**	**1.5**

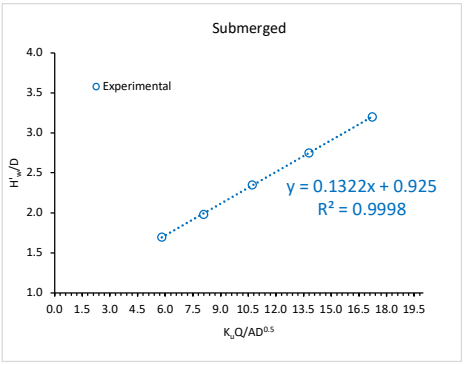
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
1.0769	0.1303	0.1322	0.9250

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.166E-03	-2.041E-02	1.274E-01	-2.201E-01	4.149E-01	7.795E-01







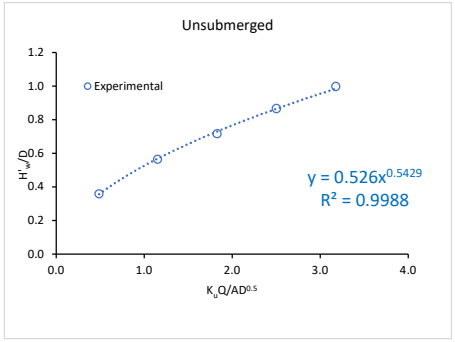
10 DEG LINEAR - EXP 1 - NO BLOCK

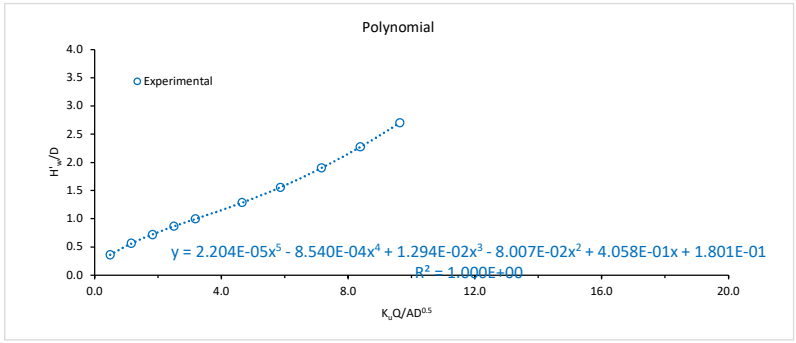
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0101	0.054	**0.49**	0.24	0.09	**0.359**	6.4	0.361	0.4	0.356	0.8
0.0239	0.115	**1.15**	1.33	0.10	**0.565**	5.1	0.560	1.0	0.568	0.5
0.0379	0.160	**1.83**	3.35	0.12	**0.718**	5.0	0.724	0.9	0.730	1.7
0.0519	0.204	**2.50**	6.26	0.13	**0.866**	4.7	0.865	0.1	0.865	0.1
0.0659	0.243	**3.18**	10.10	0.14	**0.998**	0.0	0.996	0.2	0.985	1.3
0.0964	0.328	**4.65**	21.62	0.15	**1.286**	4.2	1.285	0.0	1.299	1.1
0.1216	0.408	**5.86**	34.35	0.15	**1.556**	3.7	1.558	0.2	1.552	0.2
0.1485	0.511	**7.16**	51.25	0.15	**1.903**	3.2	1.901	0.1	1.888	0.8
0.1739	0.621	**8.39**	70.31	0.14	**2.274**	2.7	2.275	0.0	2.267	0.3
0.1998	0.748	**9.63**	92.79	0.13	**2.702**	0.0	2.702	0.0	2.714	0.4
					Maximum	**6.4**	**Maximum**	**1.0**	**Maximum**	**1.7**
					Average	**3.5**	**Average**	**0.3**	**Average**	**0.7**

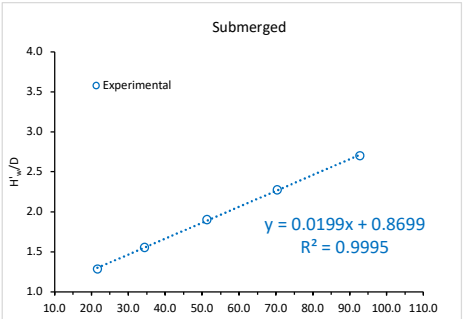
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.5260	0.5429	0.0199	0.8699

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.204E-05	-8.540E-04	1.294E-02	-8.007E-02	4.058E-01	1.801E-01







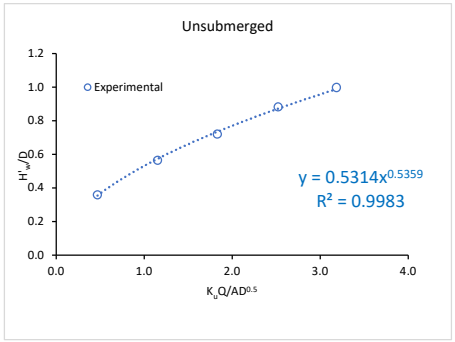
10 DEG LINEAR - EXP 2 - NO BLOCK

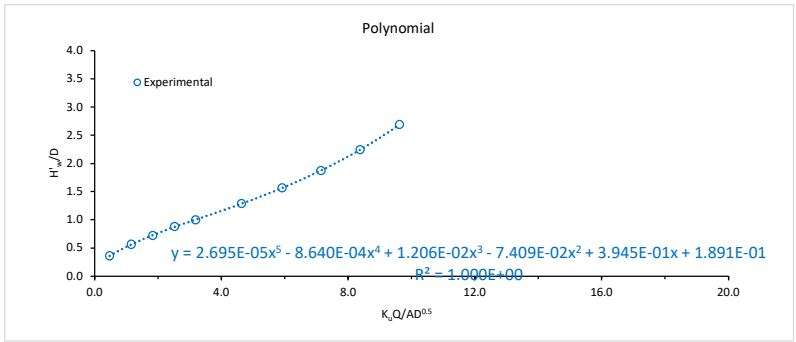
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0098	0.054	**0.47**	0.22	0.09	**0.359**	6.1	0.360	0.1	0.355	1.2
0.0239	0.115	**1.15**	1.33	0.10	**0.565**	5.1	0.562	0.5	0.573	1.4
0.0380	0.161	**1.83**	3.36	0.12	**0.721**	4.9	0.728	1.0	0.735	2.0
0.0523	0.209	**2.52**	6.36	0.13	**0.883**	4.6	0.874	1.0	0.872	1.2
0.0661	0.243	**3.19**	10.15	0.14	**0.998**	0.0	1.004	0.5	0.989	1.0
0.0961	0.328	**4.63**	21.45	0.15	**1.286**	4.2	1.285	0.1	1.292	0.5
0.1228	0.411	**5.92**	35.02	0.15	**1.566**	3.7	1.565	0.1	1.558	0.5
0.1481	0.502	**7.14**	50.96	0.15	**1.873**	3.3	1.874	0.1	1.871	0.1
0.1738	0.612	**8.38**	70.17	0.14	**2.244**	2.8	2.243	0.0	2.248	0.2
0.1996	0.744	**9.62**	92.57	0.13	**2.689**	0.0	2.689	0.0	2.688	0.0
					Maximum	**6.1**	**Maximum**	**1.0**	**Maximum**	**2.0**
					Average	**3.5**	**Average**	**0.3**	**Average**	**0.8**

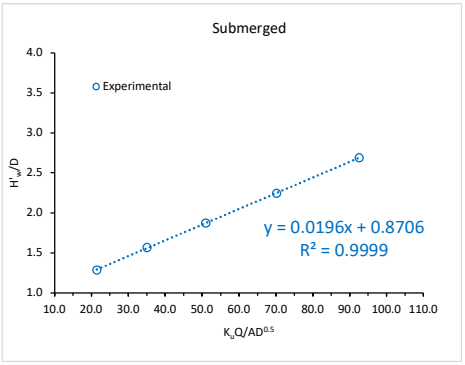
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.5314	0.5359	0.0196	0.8706

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.695E-05	-8.640E-04	1.206E-02	-7.409E-02	3.945E-01	1.891E-01







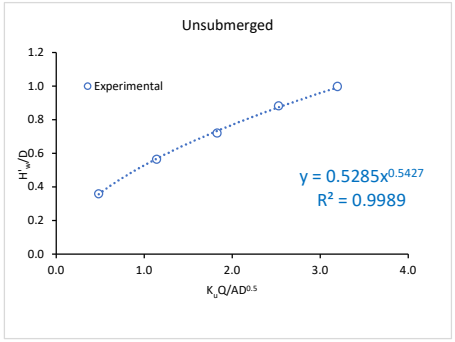
10 DEG LINEAR - EXP 3 - NO BLOCK

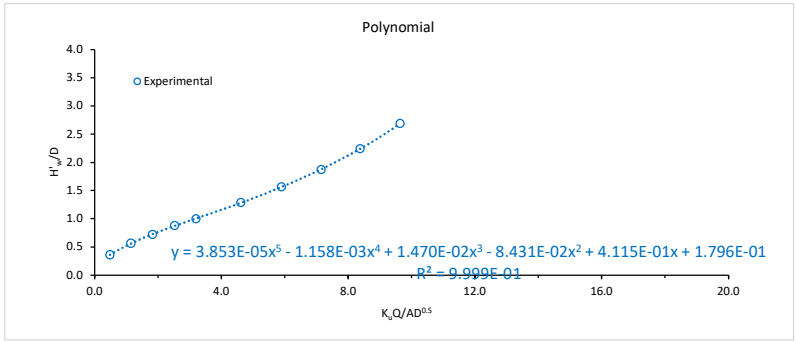
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0100	0.054	**0.48**	0.23	0.09	**0.359**	6.3	0.361	0.5	0.357	0.7
0.0237	0.115	**1.14**	1.31	0.10	**0.565**	5.0	0.560	1.0	0.568	0.5
0.0380	0.161	**1.83**	3.35	0.12	**0.721**	4.9	0.728	1.0	0.734	1.8
0.0524	0.209	**2.53**	6.38	0.13	**0.883**	4.6	0.875	0.9	0.874	1.0
0.0663	0.243	**3.20**	10.21	0.14	**0.998**	0.0	1.006	0.7	0.993	0.6
0.0957	0.328	**4.61**	21.29	0.15	**1.286**	4.2	1.283	0.2	1.293	0.6
0.1222	0.411	**5.89**	34.71	0.15	**1.566**	3.7	1.562	0.2	1.555	0.7
0.1483	0.502	**7.15**	51.08	0.15	**1.873**	3.3	1.879	0.3	1.874	0.1
0.1737	0.612	**8.38**	70.16	0.14	**2.244**	2.8	2.240	0.2	2.246	0.1
0.1999	0.744	**9.64**	92.85	0.13	**2.689**	0.0	2.689	0.0	2.689	0.0
					Maximum	**6.3**	**Maximum**	**1.0**	**Maximum**	**1.8**
					Average	**3.5**	**Average**	**0.5**	**Average**	**0.6**

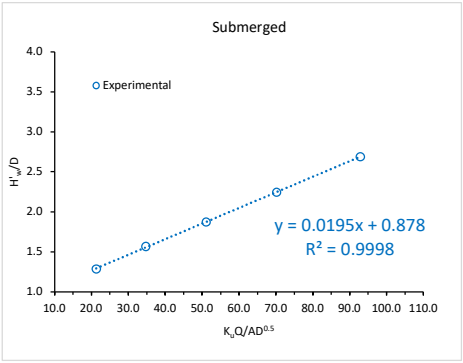
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.5285	0.5427	0.0195	0.8780

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
3.853E-05	-1.158E-03	1.470E-02	-8.431E-02	4.115E-01	1.796E-01







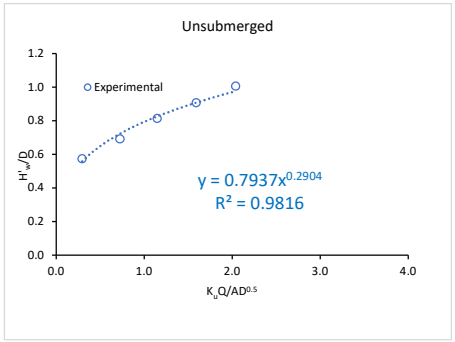
10 DEG NON LINEAR - EXP 4 - 37.5% BLOCK

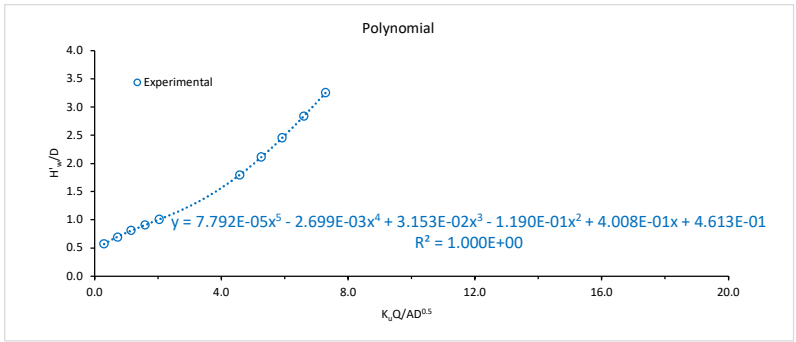
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0062	0.120	**0.30**	0.09	0.03	**0.574**	3.0	0.571	0.5	0.558	2.8
0.0150	0.155	**0.73**	0.53	0.05	**0.692**	2.9	0.701	1.2	0.723	4.5
0.0238	0.191	**1.15**	1.32	0.06	**0.814**	2.9	0.808	0.7	0.826	1.5
0.0330	0.219	**1.59**	2.53	0.08	**0.909**	3.0	0.908	0.0	0.908	0.0
0.0423	0.248	**2.04**	4.16	0.09	**1.007**	0.0	1.007	0.0	0.976	3.0
0.0950	0.481	**4.58**	20.96	0.10	**1.793**	2.3	1.797	0.2	1.806	0.7
0.1090	0.576	**5.25**	27.61	0.09	**2.114**	2.1	2.109	0.2	2.108	0.3
0.1227	0.677	**5.92**	35.01	0.09	**2.454**	1.9	2.453	0.1	2.443	0.5
0.1370	0.791	**6.60**	43.61	0.09	**2.839**	1.8	2.842	0.1	2.833	0.2
0.1512	0.914	**7.29**	53.13	0.08	**3.254**	0.0	3.252	0.0	3.264	0.3
					Maximum	**3.0**	**Maximum**	**1.2**	**Maximum**	**4.5**
					Average	**2.0**	**Average**	**0.3**	**Average**	**1.4**

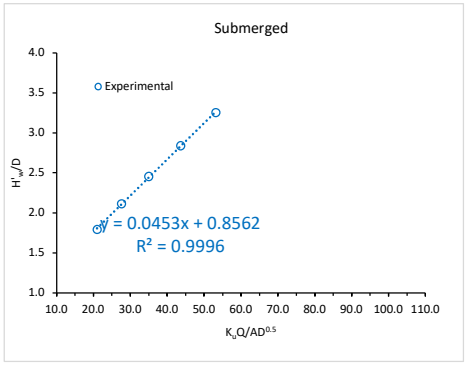
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.7937	0.2904	0.0453	0.8562

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
7.792E-05	-2.699E-03	3.153E-02	-1.190E-01	4.008E-01	4.613E-01







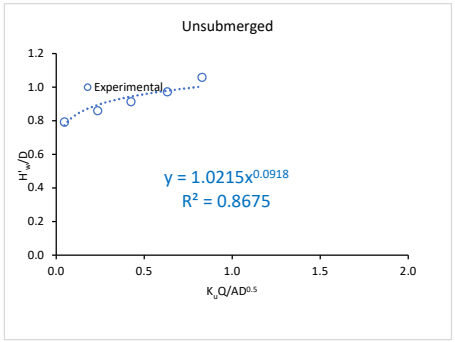
10 DEG NON LINEAR - EXP 5 - 75% BLOCK

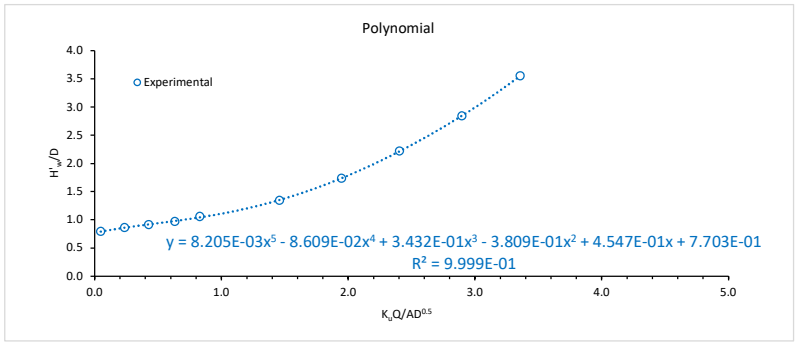
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0010	0.185	**0.05**	0.00	0.00	**0.793**	2.7	0.791	0.2	0.773	2.5
0.0049	0.205	**0.24**	0.06	0.01	**0.860**	2.6	0.861	0.0	0.895	4.0
0.0088	0.221	**0.43**	0.18	0.02	**0.914**	2.6	0.919	0.5	0.945	3.3
0.0131	0.238	**0.63**	0.40	0.03	**0.972**	2.5	0.979	0.8	0.979	0.8
0.0172	0.264	**0.83**	0.69	0.03	**1.060**	0.0	1.044	1.5	1.004	5.2
0.0302	0.348	**1.46**	2.12	0.04	**1.343**	2.1	1.352	0.7	1.338	0.4
0.0404	0.465	**1.95**	3.79	0.04	**1.738**	1.9	1.737	0.0	1.740	0.1
0.0499	0.608	**2.41**	5.79	0.04	**2.220**	1.7	2.215	0.2	2.222	0.1
0.0601	0.792	**2.90**	8.39	0.04	**2.841**	1.6	2.845	0.1	2.850	0.3
0.0696	1.003	**3.36**	11.27	0.03	**3.553**	0.0	3.552	0.0	3.545	0.2
					Maximum	**2.7**	**Maximum**	**1.5**	**Maximum**	**5.2**
					Average	**1.8**	**Average**	**0.4**	**Average**	**1.7**

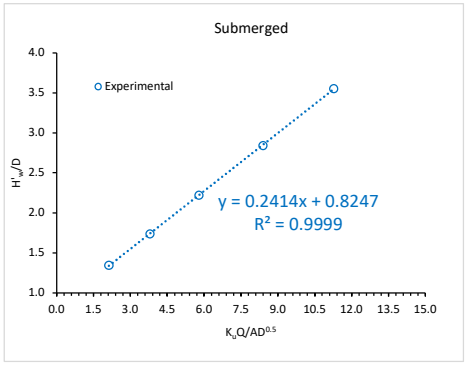
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
1.0215	0.0918	0.2414	0.8247

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
8.205E-03	-8.609E-02	3.432E-01	-3.809E-01	4.547E-01	7.703E-01







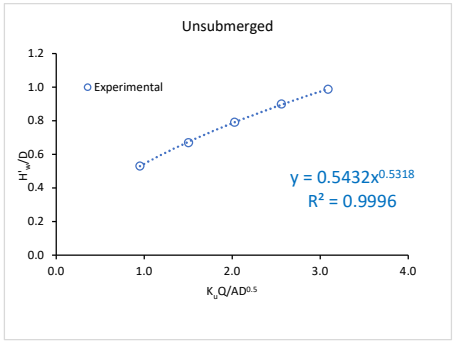
10 DEG NON LINEAR - EXP 1 - NO BLOCK

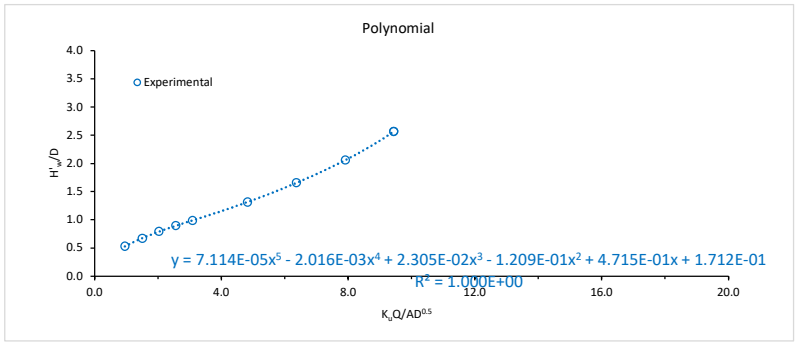
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0197	0.107	**0.95**	0.91	0.09	**0.531**	4.7	0.529	0.4	0.529	0.4
0.0312	0.148	**1.51**	2.27	0.11	**0.670**	4.6	0.676	0.9	0.675	0.8
0.0421	0.184	**2.03**	4.11	0.11	**0.792**	4.4	0.791	0.1	0.791	0.1
0.0531	0.216	**2.56**	6.56	0.12	**0.900**	4.4	0.894	0.7	0.896	0.5
0.0641	0.242	**3.09**	9.55	0.13	**0.988**	0.0	0.990	0.2	0.990	0.2
0.1001	0.338	**4.83**	23.28	0.15	**1.313**	4.2	1.315	0.2	1.319	0.4
0.1320	0.440	**6.36**	40.51	0.15	**1.657**	3.6	1.655	0.2	1.646	0.7
0.1641	0.559	**7.91**	62.61	0.15	**2.058**	3.0	2.059	0.1	2.065	0.3
0.1957	0.710	**9.44**	89.05	0.14	**2.567**	2.5	2.567	0.0	2.567	0.0
0.1957	0.710	**9.44**	89.05	0.14	**2.567**	0.0	2.567	0.0	2.567	0.0
					Maximum	**4.7**	**Maximum**	**0.9**	**Maximum**	**0.8**
					Average	**3.1**	**Average**	**0.3**	**Average**	**0.3**

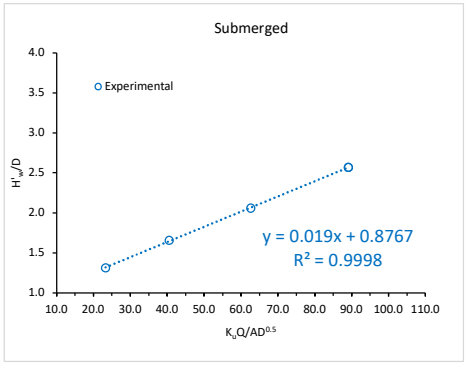
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5432	0.5318	0.0190	0.8767

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
7.114E-05	-2.016E-03	2.305E-02	-1.209E-01	4.715E-01	1.712E-01







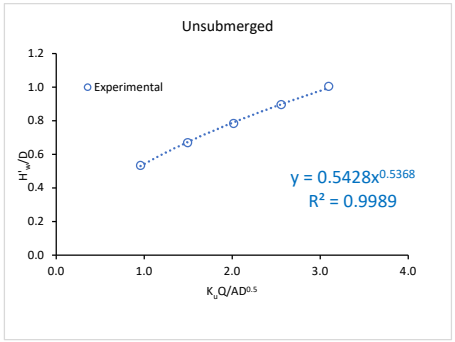
10 DEG NON LINEAR - EXP 2 - NO BLOCK

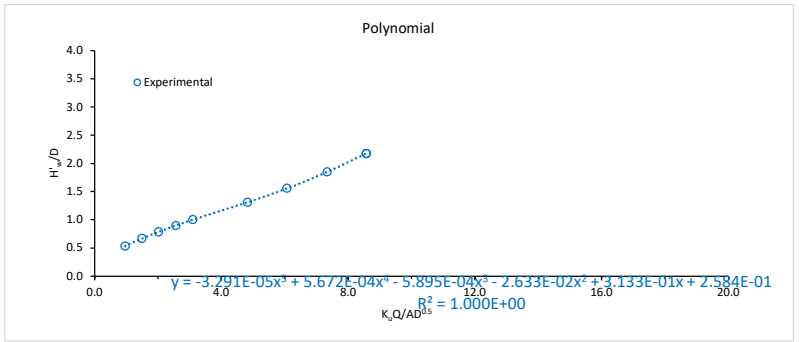
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0199	0.108	**0.96**	0.92	0.09	**0.535**	4.6	0.535	0.0	0.531	0.7
0.0310	0.148	**1.50**	2.24	0.10	**0.670**	4.5	0.669	0.2	0.674	0.6
0.0419	0.182	**2.02**	4.07	0.11	**0.785**	4.5	0.787	0.2	0.791	0.8
0.0531	0.215	**2.56**	6.54	0.12	**0.897**	4.4	0.898	0.2	0.899	0.2
0.0642	0.247	**3.10**	9.59	0.13	**1.005**	0.0	1.001	0.4	0.996	0.9
0.1001	0.337	**4.83**	23.31	0.15	**1.309**	4.2	1.312	0.2	1.318	0.7
0.1259	0.411	**6.07**	36.85	0.15	**1.559**	3.8	1.557	0.2	1.551	0.5
0.1522	0.497	**7.34**	53.83	0.15	**1.850**	3.4	1.851	0.1	1.843	0.4
0.1778	0.594	**8.57**	73.44	0.15	**2.177**	3.0	2.177	0.0	2.180	0.1
0.1778	0.594	**8.57**	73.44	0.15	**2.177**	0.0	2.177	0.0	2.180	0.1
					Maximum	**4.6**	**Maximum**	**0.4**	**Maximum**	**0.9**
					Average	**3.3**	**Average**	**0.1**	**Average**	**0.5**

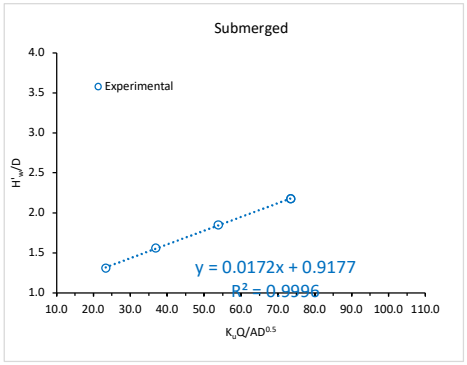
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5428	0.5368	0.0172	0.9177

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
-3.291E-05	5.672E-04	-5.895E-04	-2.633E-02	3.133E-01	2.584E-01







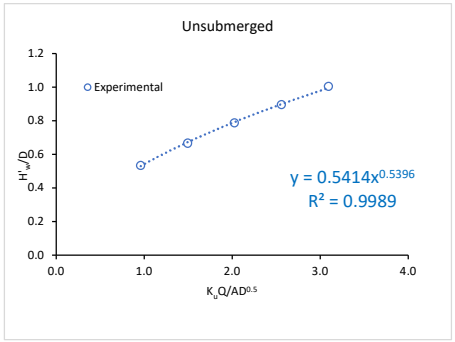
10 DEG NON LINEAR - EXP 3 - NO BLOCK

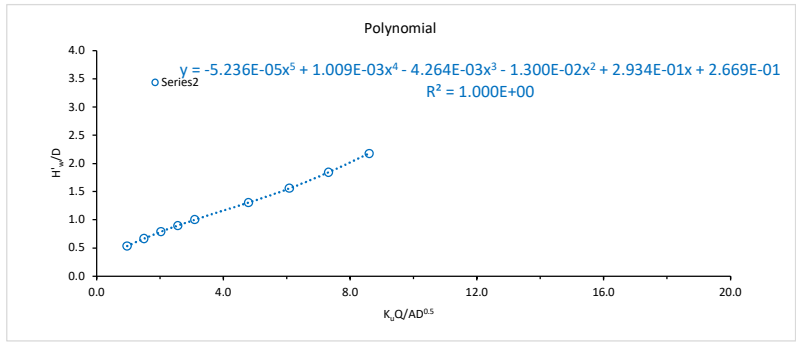
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0200	0.108	**0.96**	0.93	0.09	**0.535**	4.7	0.534	0.0	0.530	0.8
0.0310	0.147	**1.50**	2.24	0.11	**0.667**	4.6	0.667	0.1	0.673	0.9
0.0420	0.183	**2.03**	4.11	0.11	**0.788**	4.5	0.788	0.1	0.793	0.5
0.0531	0.215	**2.56**	6.56	0.12	**0.897**	4.4	0.899	0.3	0.899	0.3
0.0642	0.247	**3.09**	9.57	0.13	**1.005**	0.0	1.002	0.3	0.996	0.9
0.0994	0.335	**4.79**	22.96	0.15	**1.303**	4.2	1.305	0.2	1.312	0.7
0.1262	0.411	**6.08**	37.01	0.15	**1.559**	3.9	1.557	0.1	1.552	0.5
0.1518	0.495	**7.32**	53.58	0.15	**1.843**	3.4	1.844	0.0	1.835	0.4
0.1784	0.594	**8.60**	74.00	0.15	**2.177**	3.0	2.176	0.0	2.184	0.3
0.2038	0.767	**9.83**	96.56	0.13	**2.759**	0.0	2.465	10.7	2.569	6.9
					Maximum	**4.7**	**Maximum**	**0.3**	**Maximum**	**0.9**
					Average	**3.6**	**Average**	**0.1**	**Average**	**0.6**

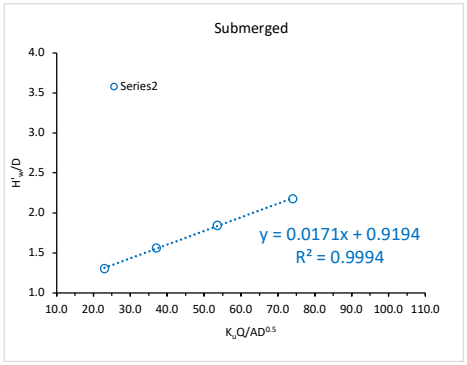
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5414	0.5396	0.0171	0.9194

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
-5.236E-05	1.009E-03	-4.264E-03	-1.300E-02	2.934E-01	2.669E-01







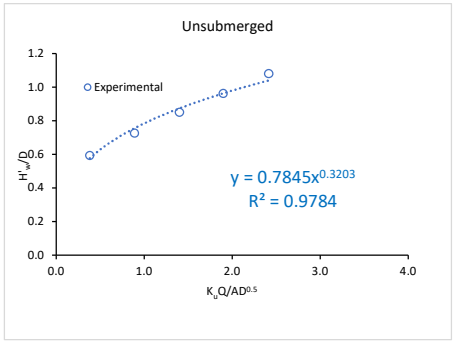
20 DEG LINEAR - EXP 4 - 37.5% BLOCK

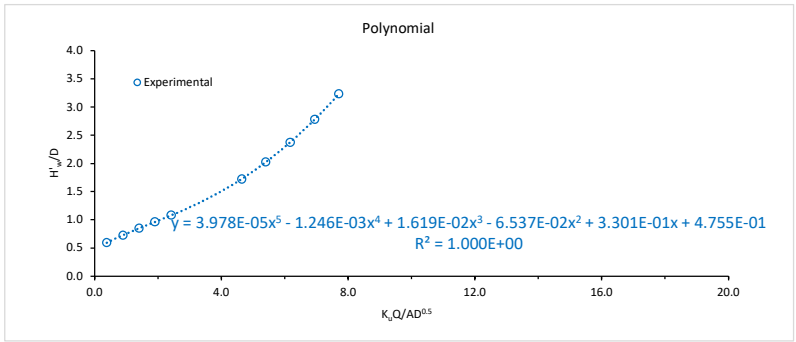
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0079	0.125	**0.38**	0.15	0.03	**0.594**	3.0	0.593	0.2	0.576	3.0
0.0185	0.164	**0.89**	0.79	0.06	**0.726**	2.9	0.729	0.4	0.756	4.2
0.0291	0.201	**1.40**	1.96	0.07	**0.851**	3.0	0.850	0.2	0.874	2.7
0.0394	0.234	**1.90**	3.61	0.08	**0.963**	3.1	0.962	0.0	0.964	0.1
0.0501	0.269	**2.42**	5.84	0.09	**1.081**	0.0	1.081	0.0	1.041	3.7
0.0963	0.459	**4.64**	21.56	0.10	**1.723**	2.5	1.726	0.2	1.722	0.0
0.1119	0.549	**5.39**	29.09	0.10	**2.026**	2.2	2.021	0.2	2.022	0.2
0.1280	0.652	**6.17**	38.06	0.10	**2.373**	2.0	2.375	0.1	2.379	0.2
0.1441	0.773	**6.94**	48.23	0.09	**2.782**	1.9	2.782	0.0	2.785	0.1
0.1599	0.907	**7.71**	59.40	0.09	**3.233**	0.0	3.233	0.0	3.230	0.1
					Maximum	**3.1**	**Maximum**	**0.4**	**Maximum**	**4.2**
					Average	**2.1**	**Average**	**0.1**	**Average**	**1.4**

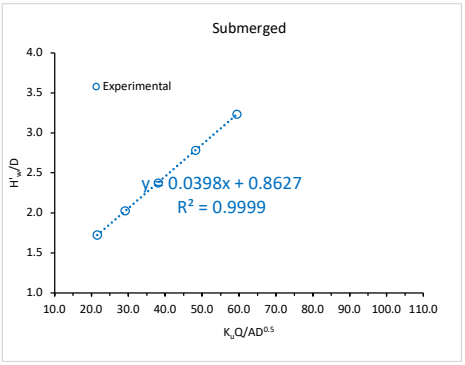
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.047

Regression - Schall et al. (2012)			
K	M	c	Y
0.7845	0.3203	0.0398	0.8627

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
3.978E-05	-1.246E-03	1.619E-02	-6.537E-02	3.301E-01	4.755E-01







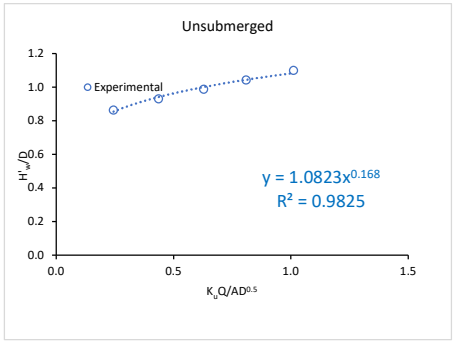
20 DEG LINEAR - EXP 5 - 75% BLOCK

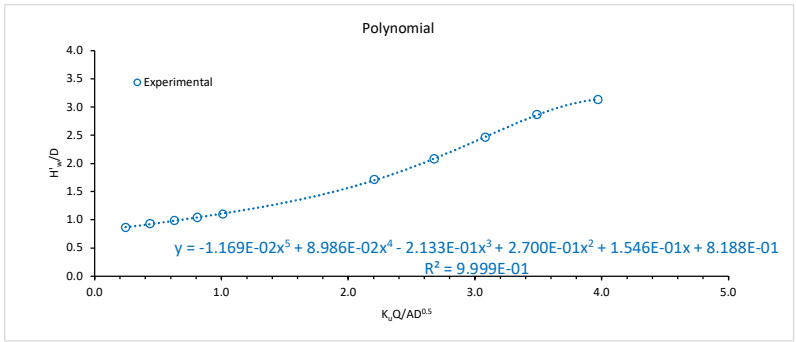
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0051	0.206	**0.24**	0.06	0.01	**0.864**	2.6	0.870	0.7	0.854	1.1
0.0091	0.226	**0.44**	0.19	0.02	**0.931**	2.6	0.923	0.9	0.942	1.1
0.0130	0.243	**0.63**	0.40	0.03	**0.989**	2.5	0.983	0.6	1.001	1.3
0.0168	0.259	**0.81**	0.66	0.03	**1.043**	2.5	1.042	0.0	1.045	0.2
0.0210	0.276	**1.01**	1.02	0.04	**1.100**	0.0	1.113	1.1	1.084	1.4
0.0458	0.458	**2.21**	4.87	0.05	**1.714**	1.9	1.702	0.7	1.781	3.9
0.0556	0.566	**2.68**	7.17	0.05	**2.079**	1.8	2.085	0.3	2.088	0.5
0.0639	0.680	**3.08**	9.50	0.05	**2.463**	1.7	2.473	0.4	2.398	2.6
0.0724	0.800	**3.49**	12.18	0.05	**2.868**	1.6	2.858	0.4	2.755	3.9
0.0824	0.878	**3.97**	15.77	0.05	**3.131**	0.0	3.134	0.1	3.233	3.2
					Maximum	**2.6**	**Maximum**	**1.1**	**Maximum**	**3.9**
					Average	**1.7**	**Average**	**0.5**	**Average**	**1.9**

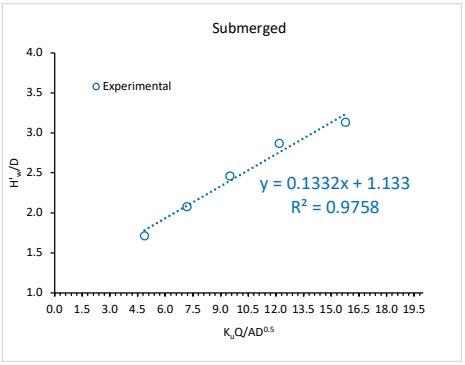
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
1.0823	0.1680	0.1332	1.1330

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
-1.169E-02	8.986E-02	-2.133E-01	2.700E-01	1.546E-01	8.188E-01







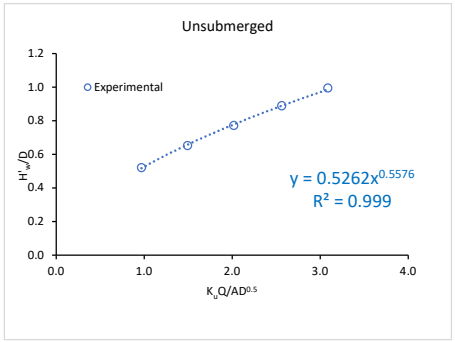
20 DEG LINEAR - EXP 1 - NO BLOCK

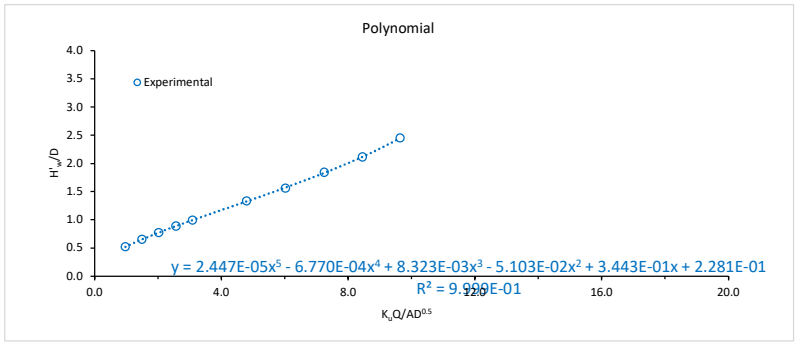
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0201	0.103	**0.97**	0.94	0.10	**0.521**	5.0	0.521	0.1	0.517	0.8
0.0310	0.142	**1.49**	2.23	0.11	**0.653**	4.8	0.653	0.0	0.658	0.7
0.0419	0.177	**2.02**	4.08	0.12	**0.772**	4.7	0.773	0.2	0.779	0.9
0.0532	0.212	**2.57**	6.58	0.13	**0.890**	4.6	0.889	0.1	0.890	0.0
0.0641	0.243	**3.09**	9.54	0.13	**0.995**	0.0	0.995	0.0	0.987	0.8
0.0995	0.343	**4.80**	23.00	0.15	**1.333**	4.0	1.327	0.4	1.348	1.1
0.1248	0.410	**6.02**	36.21	0.15	**1.559**	3.8	1.571	0.7	1.558	0.1
0.1503	0.494	**7.24**	52.49	0.15	**1.843**	3.4	1.832	0.6	1.817	1.4
0.1753	0.574	**8.45**	71.42	0.15	**2.113**	3.1	2.118	0.2	2.118	0.2
0.1998	0.674	**9.63**	92.82	0.15	**2.450**	0.0	2.449	0.0	2.458	0.3
					Maximum	**5.0**	**Maximum**	**0.7**	**Maximum**	**1.4**
					Average	**3.3**	**Average**	**0.2**	**Average**	**0.6**

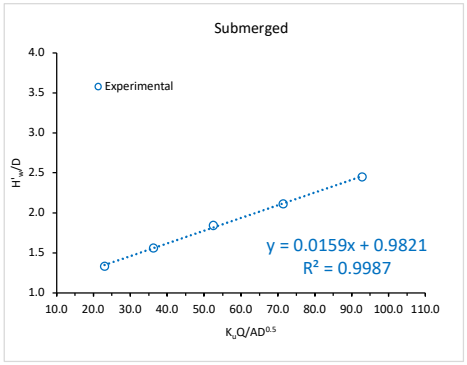
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.047

Regression - Schall et al. (2012)			
K	M	c	Y
0.5262	0.5576	0.0159	0.9821

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.447E-05	-6.770E-04	8.323E-03	-5.103E-02	3.443E-01	2.281E-01







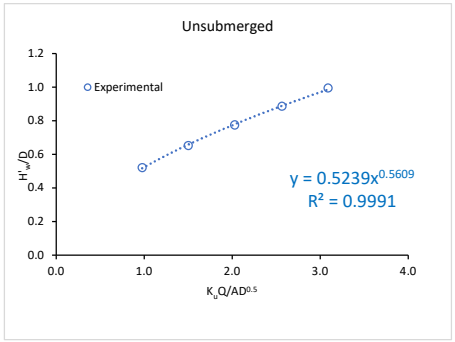
20 DEG LINEAR - EXP 2 - NO BLOCK

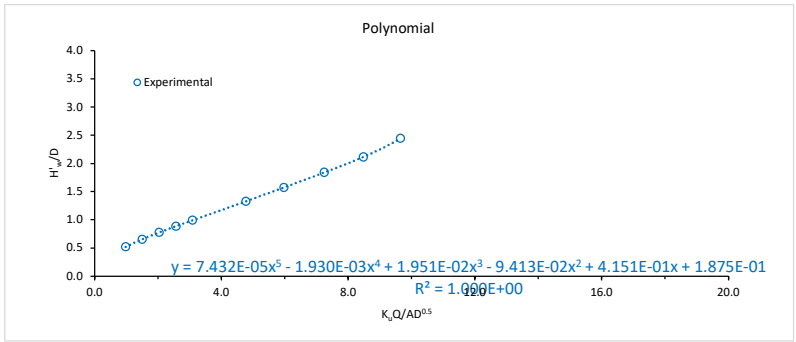
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0203	0.103	**0.98**	0.96	0.10	**0.521**	5.1	0.520	0.2	0.518	0.7
0.0311	0.142	**1.50**	2.25	0.11	**0.653**	4.8	0.655	0.3	0.658	0.7
0.0421	0.178	**2.03**	4.12	0.12	**0.775**	4.7	0.775	0.0	0.779	0.6
0.0532	0.211	**2.57**	6.59	0.13	**0.887**	4.6	0.887	0.1	0.889	0.3
0.0641	0.243	**3.09**	9.54	0.13	**0.995**	0.0	0.992	0.3	0.986	0.9
0.0990	0.341	**4.77**	22.76	0.15	**1.326**	4.0	1.328	0.1	1.353	2.0
0.1239	0.414	**5.97**	35.65	0.15	**1.573**	3.7	1.574	0.1	1.555	1.2
0.1503	0.494	**7.24**	52.47	0.15	**1.843**	3.4	1.839	0.2	1.817	1.4
0.1759	0.574	**8.48**	71.89	0.15	**2.113**	3.1	2.115	0.1	2.121	0.4
0.2001	0.672	**9.65**	93.06	0.15	**2.443**	0.0	2.443	0.0	2.452	0.3
					Maximum	**5.1**	**Maximum**	**0.3**	**Maximum**	**2.0**
					Average	**3.3**	**Average**	**0.1**	**Average**	**0.8**

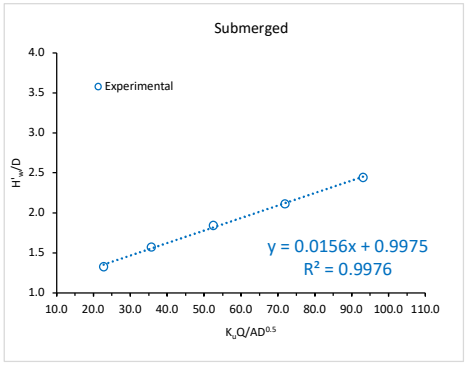
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.047

Regression - Schall et al. (2012)			
K	M	c	Y
0.5239	0.5609	0.0156	0.9975

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
7.432E-05	-1.930E-03	1.951E-02	-9.413E-02	4.151E-01	1.875E-01







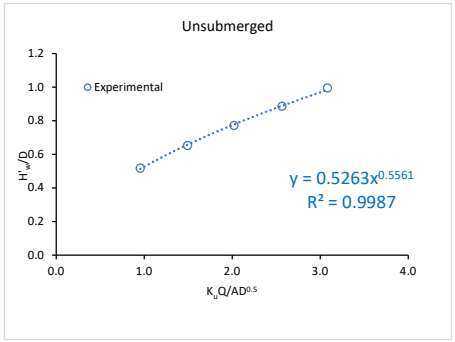
20 DEG LINEAR - EXP 3 - NO BLOCK

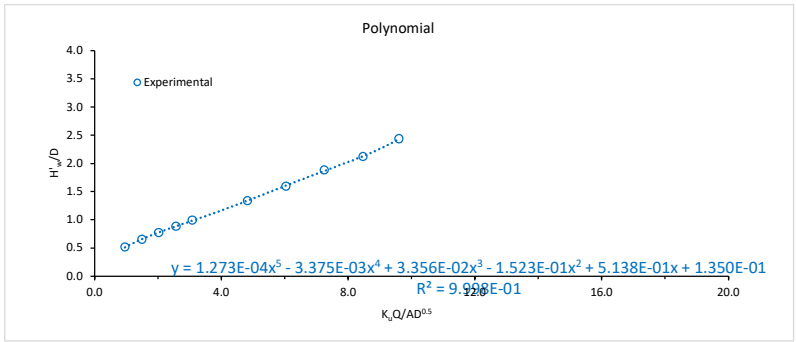
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0199	0.102	**0.96**	0.92	0.10	**0.518**	5.0	0.514	0.7	0.514	0.8
0.0310	0.142	**1.49**	2.23	0.11	**0.653**	4.8	0.659	0.8	0.658	0.7
0.0419	0.177	**2.02**	4.09	0.12	**0.772**	4.7	0.776	0.6	0.778	0.9
0.0532	0.211	**2.57**	6.59	0.13	**0.887**	4.6	0.885	0.1	0.889	0.3
0.0640	0.243	**3.08**	9.51	0.13	**0.995**	0.0	0.985	1.0	0.984	1.0
0.0999	0.344	**4.82**	23.21	0.15	**1.336**	4.0	1.340	0.3	1.375	2.9
0.1252	0.421	**6.04**	36.43	0.15	**1.596**	3.7	1.607	0.7	1.581	0.9
0.1502	0.506	**7.24**	52.44	0.15	**1.883**	3.3	1.866	0.9	1.831	2.8
0.1757	0.576	**8.47**	71.71	0.15	**2.119**	3.1	2.129	0.5	2.132	0.6
0.1992	0.670	**9.60**	92.19	0.15	**2.436**	0.0	2.434	0.1	2.452	0.7
					Maximum	**5.0**	**Maximum**	**1.0**	**Maximum**	**2.9**
					Average	**3.3**	**Average**	**0.6**	**Average**	**1.2**

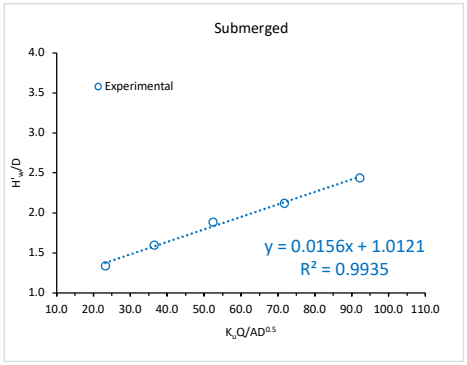
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.047

Regression - Schall et al. (2012)			
K	M	c	Y
0.5263	0.5561	0.0156	1.0121

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.273E-04	-3.375E-03	3.356E-02	-1.523E-01	5.138E-01	1.350E-01







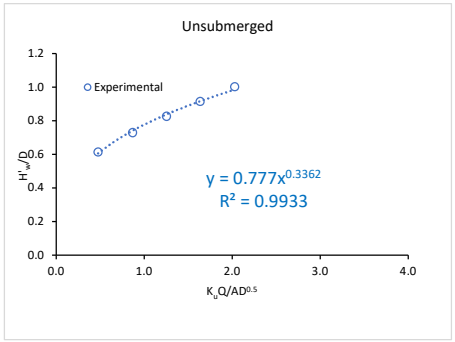
20 DEG NON LINEAR - EXP 4 - 37.4 BLOCK

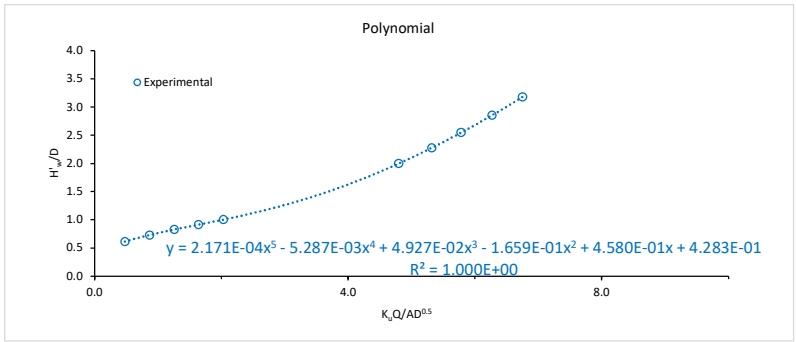
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0099	0.134	**0.48**	0.23	0.04	**0.614**	3.0	0.614	0.1	0.606	1.4
0.0180	0.168	**0.87**	0.76	0.05	**0.729**	2.9	0.730	0.2	0.741	1.6
0.0260	0.197	**1.26**	1.58	0.07	**0.827**	2.9	0.827	0.1	0.839	1.4
0.0340	0.223	**1.64**	2.68	0.08	**0.915**	3.0	0.914	0.1	0.917	0.2
0.0421	0.249	**2.03**	4.12	0.08	**1.003**	0.0	1.004	0.1	0.986	1.7
0.0995	0.544	**4.80**	23.03	0.09	**1.999**	2.1	1.998	0.0	2.000	0.1
0.1103	0.626	**5.32**	28.30	0.09	**2.275**	2.0	2.277	0.1	2.276	0.0
0.1200	0.707	**5.78**	33.44	0.08	**2.548**	1.8	2.547	0.1	2.545	0.1
0.1300	0.797	**6.27**	39.30	0.08	**2.852**	1.7	2.853	0.0	2.852	0.0
0.1400	0.894	**6.75**	45.58	0.08	**3.179**	0.0	3.179	0.0	3.181	0.0
					Maximum	**3.0**	**Maximum**	**0.2**	**Maximum**	**1.7**
					Average	**2.0**	**Average**	**0.1**	**Average**	**0.7**

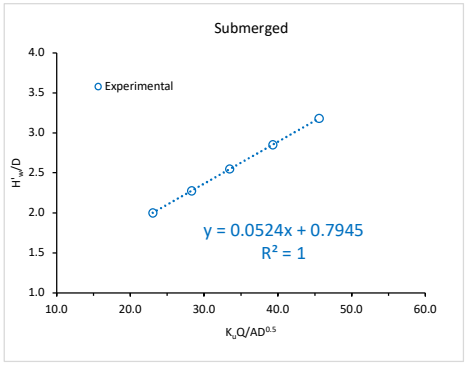
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.044

Regression - Schall et al. (2012)			
K	M	c	Y
0.7770	0.3362	0.0524	0.7945

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.171E-04	-5.287E-03	4.927E-02	-1.659E-01	4.580E-01	4.283E-01







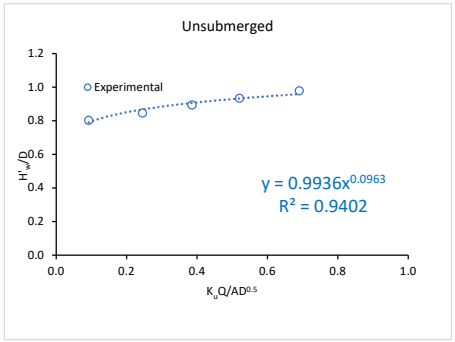
20 DEG NON LINEAR - EXP 5 - 75% BLOCK

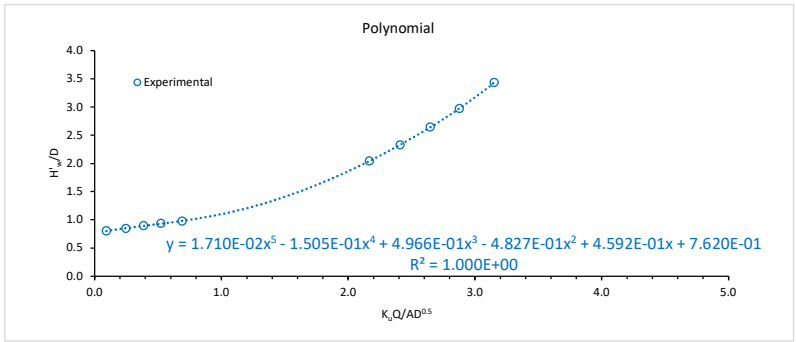
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0019	0.190	**0.09**	0.01	0.01	**0.803**	2.7	0.801	0.3	0.790	1.6
0.0051	0.203	**0.25**	0.06	0.01	**0.847**	2.6	0.853	0.7	0.868	2.5
0.0080	0.217	**0.39**	0.15	0.02	**0.894**	2.6	0.893	0.2	0.906	1.4
0.0108	0.229	**0.52**	0.27	0.02	**0.935**	2.6	0.930	0.5	0.933	0.2
0.0143	0.242	**0.69**	0.48	0.03	**0.979**	0.0	0.981	0.3	0.959	2.0
0.0449	0.557	**2.17**	4.69	0.04	**2.041**	1.8	2.042	0.0	2.035	0.3
0.0500	0.642	**2.41**	5.80	0.04	**2.328**	1.7	2.329	0.0	2.329	0.0
0.0549	0.736	**2.65**	7.01	0.04	**2.645**	1.6	2.642	0.1	2.649	0.1
0.0597	0.833	**2.88**	8.28	0.04	**2.973**	1.6	2.976	0.1	2.985	0.4
0.0654	0.970	**3.15**	9.94	0.03	**3.435**	0.0	3.434	0.0	3.424	0.3
					Maximum	**2.7**	**Maximum**	**0.7**	**Maximum**	**2.5**
					Average	**1.7**	**Average**	**0.2**	**Average**	**0.9**

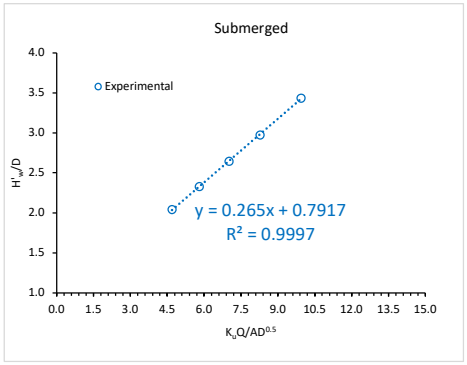
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.044

Regression - Schall et al. (2012)			
K	M	c	Y
0.9936	0.0963	0.2650	0.7917

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.710E-02	-1.505E-01	4.966E-01	-4.827E-01	4.592E-01	7.620E-01







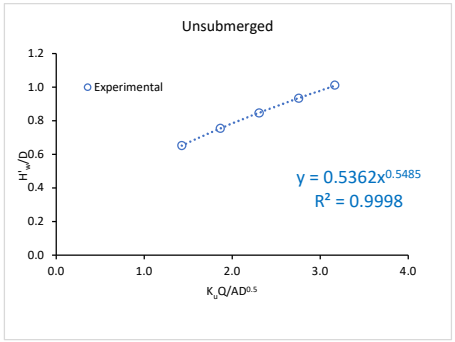
20 DEG NON LINEAR - EXP 1 - NO BLOCK

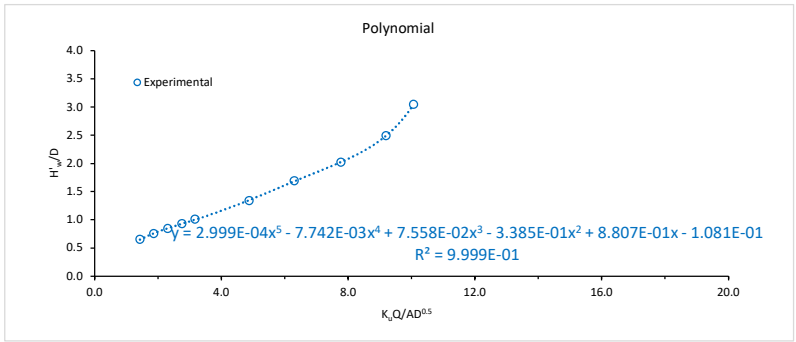
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0296	0.145	**1.43**	2.04	0.10	**0.653**	4.5	0.649	0.6	0.652	0.2
0.0387	0.175	**1.87**	3.48	0.11	**0.754**	4.4	0.761	0.8	0.755	0.1
0.0479	0.202	**2.31**	5.33	0.12	**0.846**	4.4	0.851	0.5	0.848	0.3
0.0572	0.228	**2.76**	7.60	0.13	**0.934**	4.4	0.931	0.3	0.935	0.1
0.0657	0.251	**3.17**	10.02	0.13	**1.012**	0.0	1.003	0.9	1.009	0.3
0.1011	0.348	**4.88**	23.78	0.15	**1.340**	4.0	1.350	0.7	1.316	1.8
0.1307	0.452	**6.30**	39.69	0.14	**1.691**	3.4	1.683	0.5	1.651	2.4
0.1612	0.550	**7.77**	60.36	0.15	**2.021**	3.1	2.025	0.2	2.085	3.2
0.1907	0.690	**9.19**	84.54	0.14	**2.493**	2.6	2.492	0.0	2.593	4.0
0.2088	0.854	**10.06**	101.28	0.12	**3.046**	0.0	3.046	0.0	2.945	3.3
					Maximum	**4.5**	**Maximum**	**0.9**	**Maximum**	**4.0**
					Average	**3.1**	**Average**	**0.5**	**Average**	**1.6**

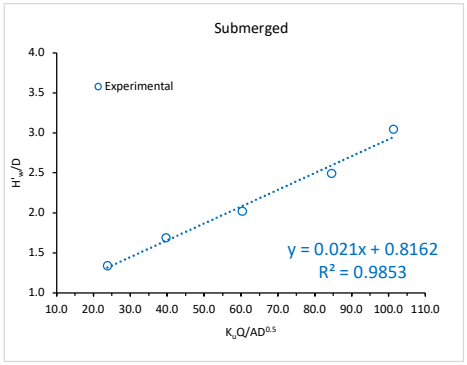
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.044

Regression - Schall et al. (2012)			
K	M	c	Y
0.5362	0.5485	0.0210	0.8162

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.999E-04	-7.742E-03	7.558E-02	-3.385E-01	8.807E-01	-1.081E-01







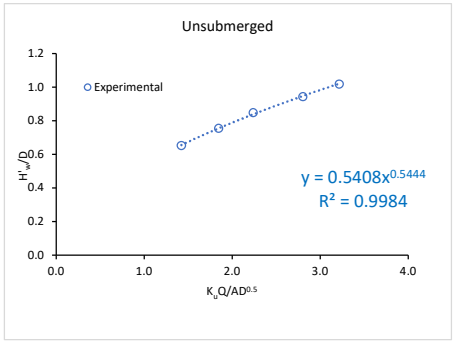
20 DEG NON LINEAR - EXP 2 - NO BLOCK

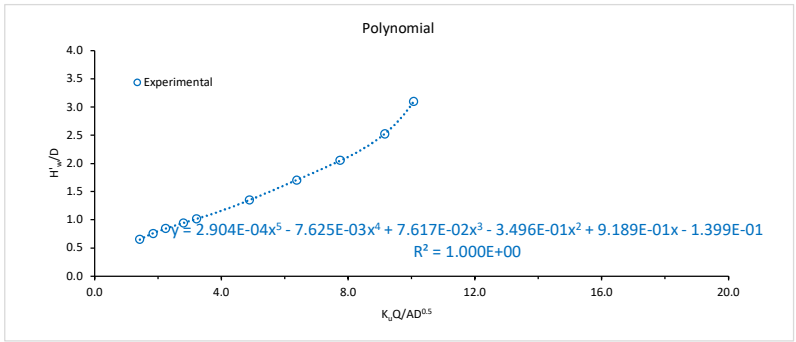
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0295	0.145	**1.42**	2.03	0.10	**0.653**	4.5	0.650	0.5	0.655	0.4
0.0383	0.175	**1.85**	3.41	0.11	**0.754**	4.4	0.762	1.0	0.755	0.1
0.0465	0.203	**2.24**	5.02	0.11	**0.849**	4.2	0.845	0.5	0.839	1.2
0.0582	0.231	**2.80**	7.86	0.13	**0.944**	4.4	0.946	0.2	0.948	0.4
0.0667	0.253	**3.22**	10.34	0.13	**1.019**	0.0	1.017	0.2	1.021	0.3
0.1014	0.352	**4.89**	23.90	0.14	**1.353**	3.9	1.351	0.1	1.318	2.6
0.1323	0.455	**6.38**	40.66	0.15	**1.701**	3.4	1.707	0.4	1.683	1.0
0.1607	0.560	**7.75**	59.99	0.14	**2.055**	3.0	2.048	0.3	2.104	2.4
0.1899	0.699	**9.16**	83.85	0.14	**2.523**	2.5	2.528	0.2	2.623	4.0
0.2088	0.870	**10.06**	101.30	0.12	**3.100**	0.0	3.098	0.0	3.003	3.1
					Maximum	**4.5**	**Maximum**	**1.0**	**Maximum**	**4.0**
					Average	**3.0**	**Average**	**0.3**	**Average**	**1.5**

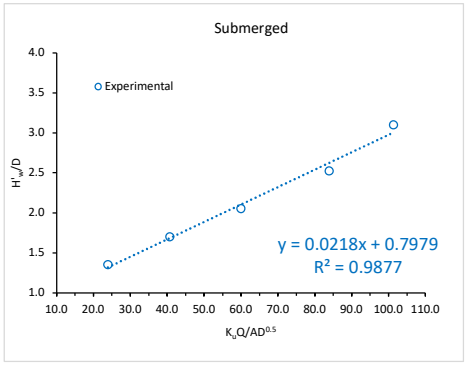
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.044

Regression - Schall et al. (2012)			
K	M	c	Y
0.5408	0.5444	0.0218	0.7979

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.904E-04	-7.625E-03	7.617E-02	-3.496E-01	9.189E-01	-1.399E-01







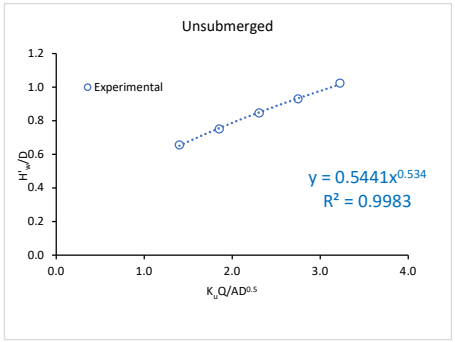
20 DEG NON LINEAR - EXP 3 - NO BLOCK

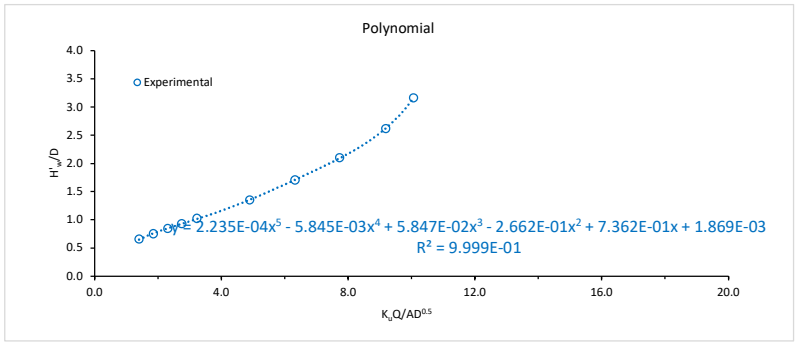
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0291	0.146	**1.40**	1.96	0.10	**0.656**	4.4	0.650	0.9	0.651	0.7
0.0384	0.174	**1.85**	3.44	0.11	**0.751**	4.4	0.760	1.2	0.756	0.7
0.0478	0.202	**2.31**	5.32	0.12	**0.846**	4.4	0.850	0.5	0.850	0.5
0.0570	0.227	**2.75**	7.56	0.13	**0.931**	4.4	0.930	0.1	0.934	0.3
0.0669	0.255	**3.23**	10.40	0.13	**1.025**	0.0	1.014	1.1	1.017	0.8
0.1015	0.352	**4.89**	23.96	0.14	**1.353**	4.0	1.357	0.3	1.326	2.0
0.1312	0.456	**6.32**	39.98	0.14	**1.704**	3.4	1.711	0.4	1.690	0.8
0.1603	0.574	**7.73**	59.72	0.14	**2.102**	2.9	2.091	0.5	2.139	1.8
0.1907	0.727	**9.19**	84.48	0.13	**2.618**	2.4	2.625	0.3	2.702	3.2
0.2088	0.889	**10.06**	101.29	0.12	**3.164**	0.0	3.161	0.1	3.084	2.5
					Maximum	**4.4**	**Maximum**	**1.2**	**Maximum**	**3.2**
					Average	**3.0**	**Average**	**0.5**	**Average**	**1.3**

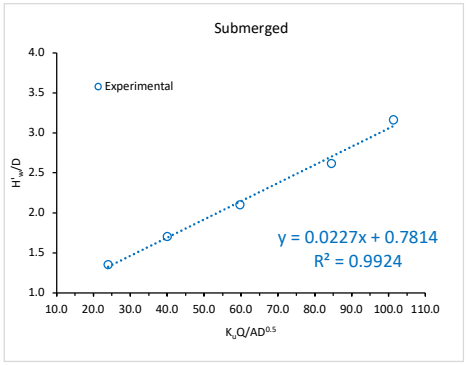
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.044

Regression - Schall et al. (2012)			
K	M	c	Y
0.5441	0.5340	0.0227	0.7814

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.235E-04	-5.845E-03	5.847E-02	-2.662E-01	7.362E-01	1.869E-03







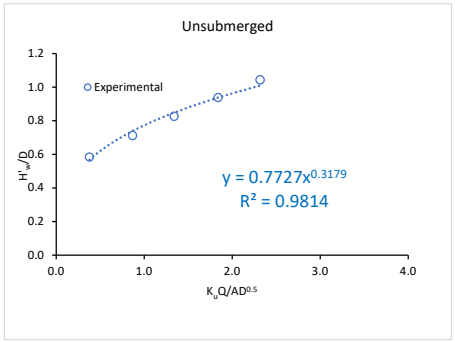
33.7 DEG LINEAR - EXP 4 - 37.5 BLOCK

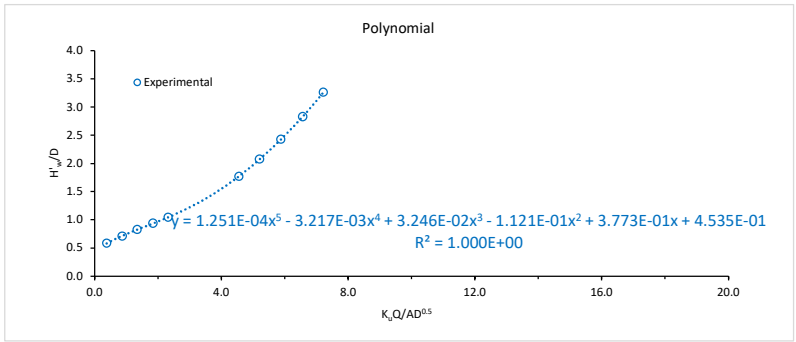
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0079	0.123	**0.38**	0.14	0.03	**0.584**	3.0	0.582	0.3	0.568	2.7
0.0181	0.161	**0.87**	0.76	0.06	**0.712**	3.0	0.717	0.6	0.739	3.8
0.0278	0.195	**1.34**	1.80	0.07	**0.827**	3.0	0.826	0.2	0.848	2.5
0.0382	0.228	**1.84**	3.39	0.08	**0.939**	3.1	0.936	0.3	0.938	0.1
0.0481	0.259	**2.32**	5.38	0.09	**1.044**	0.0	1.045	0.1	1.010	3.3
0.0945	0.474	**4.55**	20.74	0.10	**1.770**	2.4	1.773	0.2	1.772	0.1
0.1079	0.565	**5.20**	27.08	0.10	**2.076**	2.1	2.073	0.2	2.073	0.2
0.1219	0.669	**5.88**	34.53	0.09	**2.427**	1.9	2.426	0.1	2.426	0.0
0.1361	0.788	**6.56**	43.08	0.09	**2.829**	1.8	2.831	0.1	2.832	0.1
0.1497	0.916	**7.22**	52.06	0.08	**3.260**	0.0	3.259	0.0	3.259	0.1
					Maximum	**3.1**	**Maximum**	**0.6**	**Maximum**	**3.8**
					Average	**2.0**	**Average**	**0.2**	**Average**	**1.3**

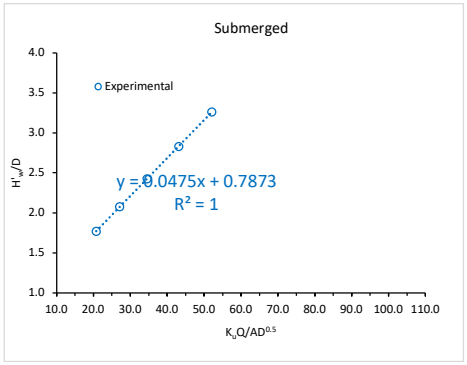
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.7727	0.3179	0.0475	0.7873

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.251E-04	-3.217E-03	3.246E-02	-1.121E-01	3.773E-01	4.535E-01







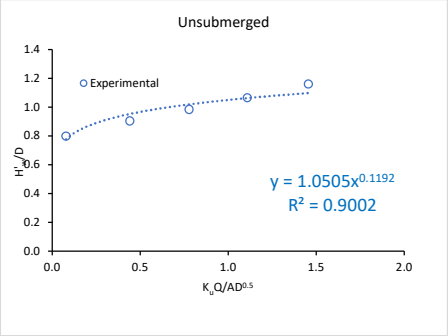
33.7 DEG LINEAR - EXP 5 - 75% BLOCK

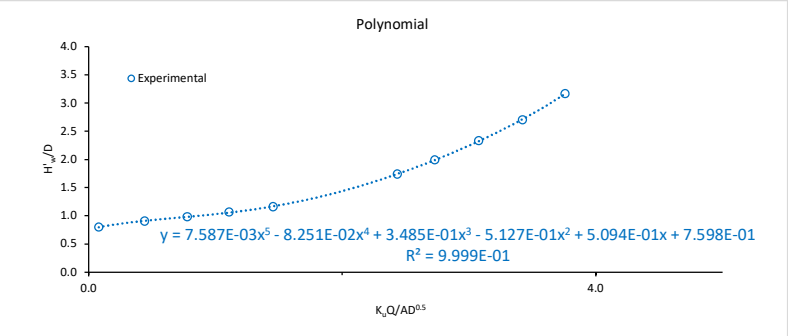
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0017	0.187	**0.08**	0.01	0.00	**0.800**	2.7	0.797	0.3	0.777	2.8
0.0092	0.218	**0.44**	0.20	0.02	**0.904**	2.6	0.912	0.8	0.953	5.4
0.0161	0.242	**0.78**	0.61	0.03	**0.985**	2.5	0.982	0.3	1.020	3.5
0.0230	0.266	**1.11**	1.23	0.04	**1.066**	2.5	1.057	0.9	1.064	0.3
0.0302	0.294	**1.46**	2.12	0.05	**1.161**	0.0	1.169	0.7	1.099	5.4
0.0505	0.465	**2.43**	5.93	0.05	**1.738**	1.9	1.741	0.2	1.727	0.7
0.0566	0.540	**2.73**	7.46	0.05	**1.991**	1.8	1.989	0.1	1.991	0.0
0.0638	0.641	**3.08**	9.47	0.05	**2.332**	1.7	2.324	0.3	2.340	0.3
0.0710	0.751	**3.42**	11.71	0.05	**2.703**	1.6	2.712	0.3	2.727	0.9
0.0780	0.888	**3.76**	14.13	0.04	**3.165**	0.0	3.162	0.1	3.145	0.6
					Maximum	**2.7**	**Maximum**	**0.9**	**Maximum**	**5.4**
					Average	**1.7**	**Average**	**0.4**	**Average**	**2.0**

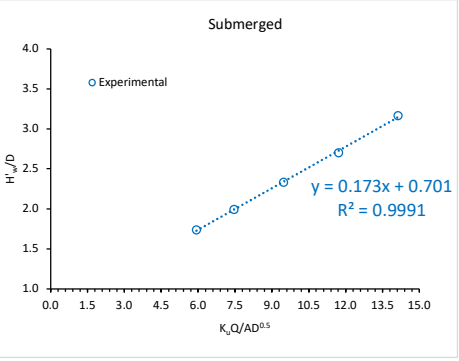
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
1.0505	0.1192	0.1730	0.7010

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
7.587E-03	-8.251E-02	3.485E-01	-5.127E-01	5.094E-01	7.598E-01







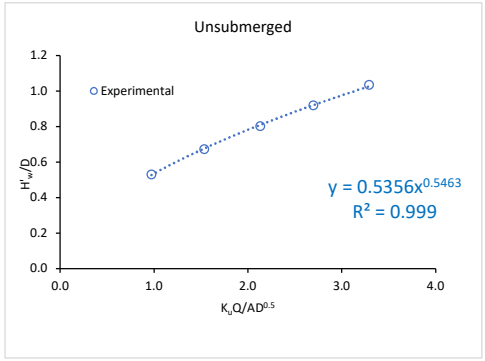
33.7 DEG LINEAR - EXP 1 - NO BLOCK

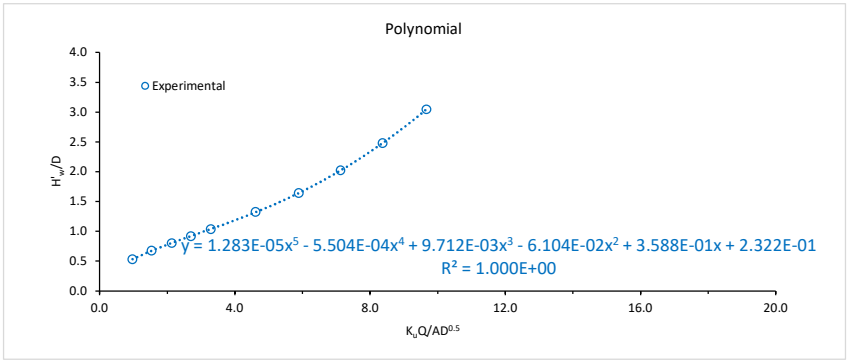
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0202	0.107	**0.97**	0.95	0.09	**0.531**	4.8	0.532	0.1	0.528	0.7
0.0319	0.149	**1.54**	2.36	0.11	**0.673**	4.6	0.672	0.3	0.677	0.6
0.0442	0.187	**2.13**	4.54	0.12	**0.802**	4.6	0.803	0.1	0.810	1.0
0.0559	0.222	**2.70**	7.27	0.13	**0.920**	4.5	0.919	0.2	0.921	0.0
0.0683	0.256	**3.29**	10.84	0.13	**1.035**	0.0	1.039	0.3	1.027	0.8
0.0957	0.341	**4.61**	21.27	0.14	**1.323**	3.9	1.319	0.2	1.319	0.2
0.1222	0.435	**5.89**	34.69	0.14	**1.640**	3.4	1.641	0.1	1.640	0.0
0.1478	0.548	**7.13**	50.79	0.13	**2.021**	2.8	2.021	0.0	2.024	0.2
0.1735	0.684	**8.37**	70.00	0.13	**2.479**	2.4	2.479	0.0	2.483	0.2
0.2005	0.852	**9.66**	93.39	0.12	**3.046**	0.0	3.046	0.0	3.042	0.1
					Maximum	**4.8**	**Maximum**	**0.3**	**Maximum**	**1.0**
					Average	**3.1**	**Average**	**0.1**	**Average**	**0.4**

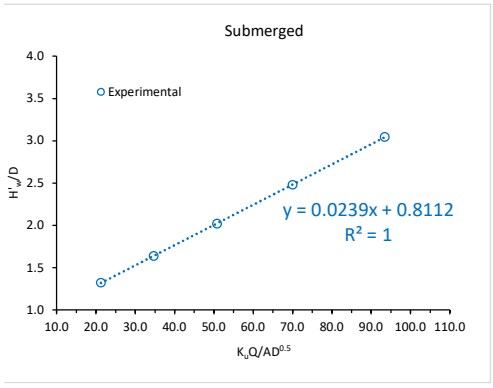
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5356	0.5463	0.0239	0.8112

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.283E-05	-5.504E-04	9.712E-03	-6.104E-02	3.588E-01	2.322E-01







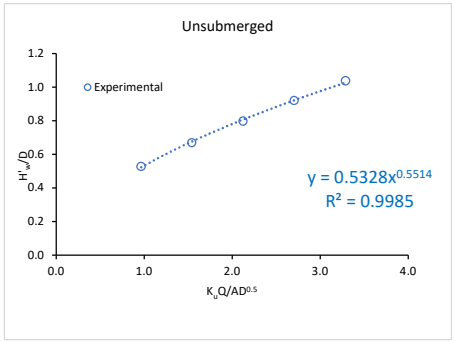
33.7 DEG LINEAR - EXP 2 - NO BLOCK

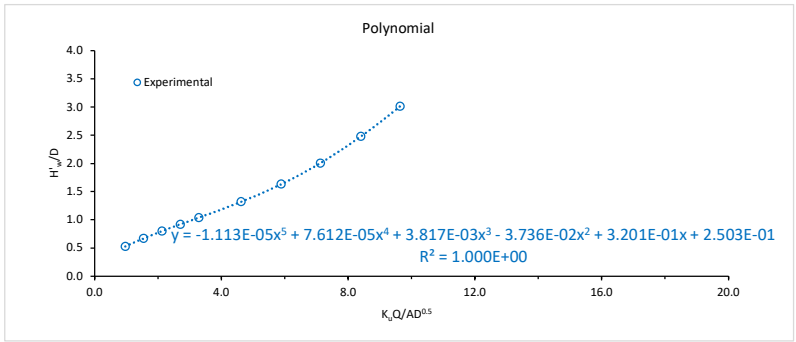
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0200	0.106	**0.97**	0.93	0.09	**0.528**	4.8	0.528	0.1	0.523	0.9
0.0320	0.148	**1.54**	2.37	0.11	**0.670**	4.7	0.669	0.1	0.676	0.9
0.0440	0.186	**2.12**	4.51	0.12	**0.799**	4.6	0.799	0.0	0.807	1.0
0.0561	0.222	**2.70**	7.31	0.13	**0.920**	4.5	0.920	0.0	0.922	0.2
0.0682	0.257	**3.29**	10.81	0.13	**1.039**	0.0	1.039	0.0	1.027	1.1
0.0958	0.340	**4.62**	21.35	0.14	**1.319**	3.9	1.319	0.0	1.316	0.2
0.1221	0.433	**5.89**	34.67	0.14	**1.633**	3.4	1.632	0.1	1.631	0.1
0.1477	0.543	**7.12**	50.72	0.14	**2.004**	2.9	2.006	0.1	2.011	0.4
0.1742	0.684	**8.40**	70.56	0.13	**2.479**	2.4	2.478	0.0	2.480	0.1
0.1999	0.842	**9.64**	92.86	0.12	**3.012**	0.0	3.012	0.0	3.008	0.1
					Maximum	**4.8**	**Maximum**	**0.1**	**Maximum**	**1.1**
					Average	**3.1**	**Average**	**0.1**	**Average**	**0.5**

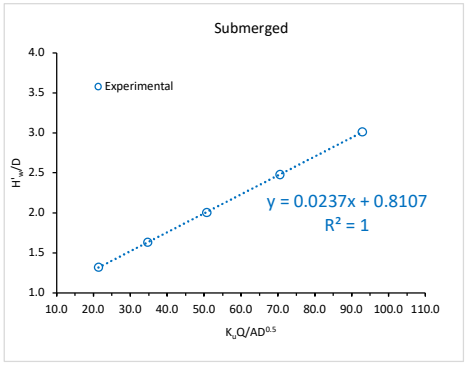
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5328	0.5514	0.0237	0.8107

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
-1.113E-05	7.612E-05	3.817E-03	-3.736E-02	3.201E-01	2.503E-01







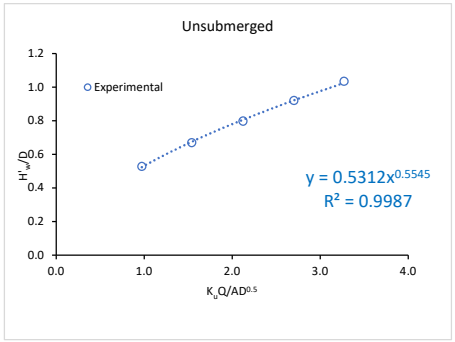
33.7 DEG LINEAR - EXP 3 - NO BLOCK

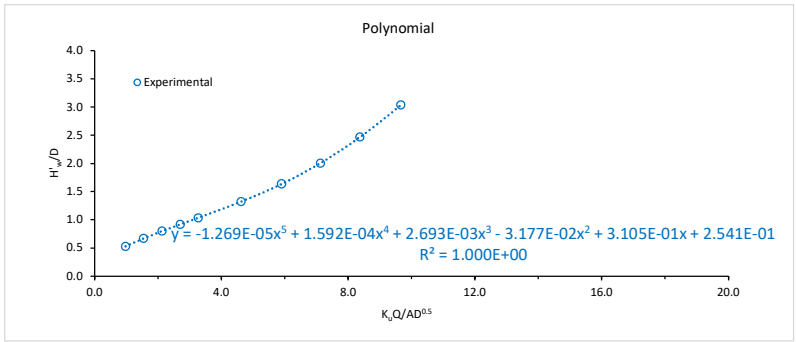
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0202	0.106	**0.97**	0.95	0.10	**0.528**	4.9	0.529	0.2	0.523	0.9
0.0320	0.148	**1.54**	2.38	0.11	**0.670**	4.7	0.668	0.3	0.675	0.8
0.0441	0.186	**2.12**	4.51	0.12	**0.799**	4.6	0.799	0.0	0.807	1.0
0.0560	0.222	**2.70**	7.30	0.13	**0.920**	4.5	0.921	0.0	0.922	0.1
0.0678	0.256	**3.27**	10.69	0.13	**1.035**	0.0	1.037	0.2	1.025	1.0
0.0958	0.341	**4.62**	21.32	0.14	**1.323**	3.9	1.321	0.1	1.315	0.6
0.1223	0.434	**5.90**	34.78	0.14	**1.636**	3.4	1.635	0.1	1.635	0.1
0.1477	0.542	**7.12**	50.71	0.14	**2.000**	2.9	2.004	0.2	2.013	0.6
0.1737	0.681	**8.37**	70.10	0.13	**2.469**	2.4	2.467	0.1	2.474	0.2
0.2004	0.849	**9.66**	93.35	0.12	**3.035**	0.0	3.036	0.0	3.027	0.3
					Maximum	**4.9**	**Maximum**	**0.3**	**Maximum**	**1.0**
					Average	**3.1**	**Average**	**0.1**	**Average**	**0.6**

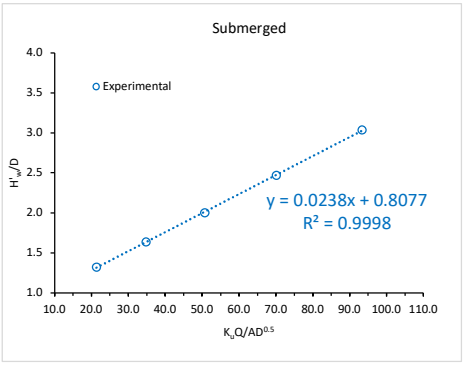
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.046

Regression - Schall et al. (2012)			
K	M	c	Y
0.5312	0.5545	0.0238	0.8077

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
-1.269E-05	1.592E-04	2.693E-03	-3.177E-02	3.105E-01	2.541E-01







33.7 DEG NON LINEAR - EXP 4 - 37.5 BLOCK

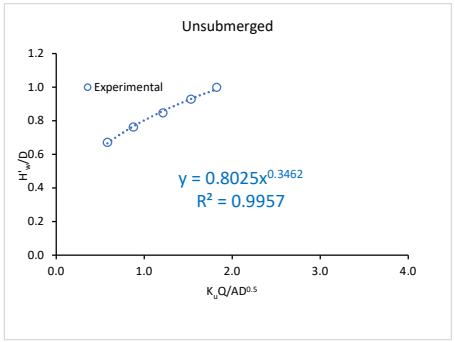
Input

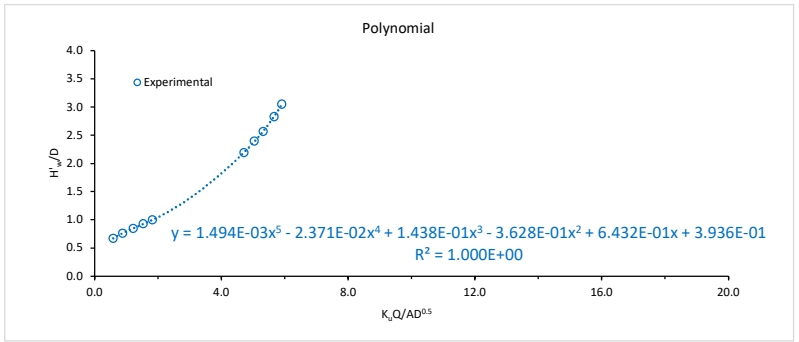
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0121	0.147	**0.58**	0.34	0.04	**0.672**	2.9	0.671	0.0	0.666	0.8
0.0182	0.174	**0.88**	0.77	0.05	**0.763**	2.8	0.763	0.0	0.768	0.6
0.0252	0.199	**1.21**	1.47	0.06	**0.848**	2.9	0.849	0.2	0.858	1.3
0.0318	0.223	**1.53**	2.35	0.07	**0.929**	2.9	0.927	0.2	0.930	0.2
0.0378	0.244	**1.82**	3.33	0.08	**1.000**	0.0	1.000	0.0	0.988	1.1
0.0978	0.597	**4.71**	22.21	0.08	**2.191**	1.9	2.196	0.2	2.181	0.5
0.1045	0.658	**5.04**	25.36	0.08	**2.396**	1.8	2.387	0.4	2.392	0.2
0.1103	0.709	**5.32**	28.28	0.08	**2.569**	1.8	2.572	0.1	2.588	0.8
0.1174	0.786	**5.66**	32.06	0.07	**2.828**	1.7	2.832	0.1	2.842	0.5
0.1225	0.852	**5.91**	34.87	0.07	**3.051**	0.0	3.049	0.1	3.032	0.6
					Maximum	**2.9**	**Maximum**	**0.4**	**Maximum**	**1.3**
					Average	**1.9**	**Average**	**0.2**	**Average**	**0.7**

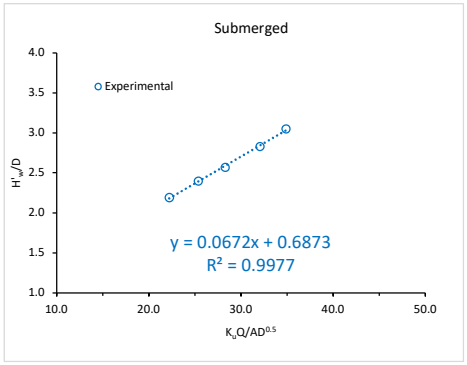
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.8025	0.3462	0.0672	0.6873

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
1.494E-03	-2.371E-02	1.438E-01	-3.628E-01	6.432E-01	3.936E-01







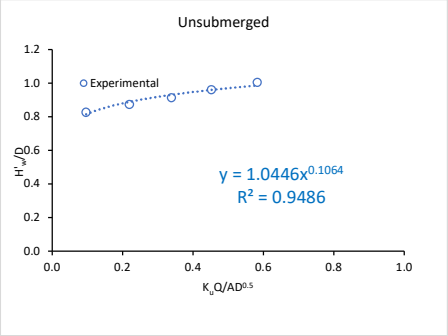
33.7 DEG NON LINEAR - EXP 5 - 75% BLOCK

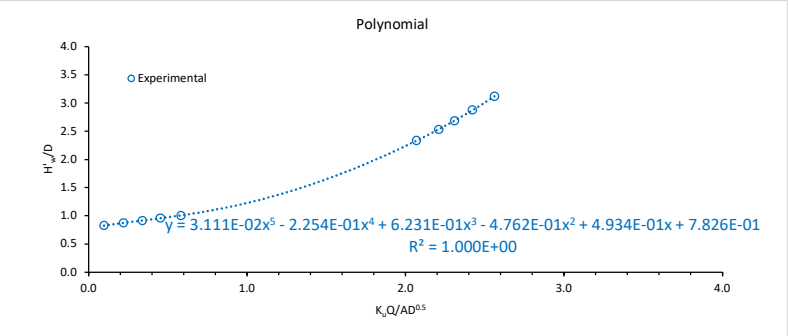
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0020	0.193	**0.10**	0.01	0.01	**0.827**	2.6	0.826	0.0	0.815	1.5
0.0046	0.207	**0.22**	0.05	0.01	**0.874**	2.6	0.874	0.0	0.889	1.7
0.0070	0.219	**0.34**	0.11	0.02	**0.914**	2.6	0.917	0.2	0.931	1.8
0.0094	0.233	**0.45**	0.20	0.02	**0.962**	2.5	0.957	0.5	0.960	0.2
0.0121	0.246	**0.58**	0.34	0.02	**1.006**	0.0	1.008	0.2	0.986	1.9
0.0429	0.640	**2.07**	4.28	0.03	**2.335**	1.7	2.332	0.1	2.328	0.3
0.0458	0.698	**2.21**	4.88	0.03	**2.531**	1.6	2.535	0.2	2.536	0.2
0.0479	0.744	**2.31**	5.33	0.03	**2.686**	1.6	2.688	0.1	2.692	0.2
0.0502	0.801	**2.42**	5.87	0.03	**2.878**	1.6	2.873	0.2	2.876	0.1
0.0531	0.872	**2.56**	6.56	0.03	**3.118**	0.0	3.119	0.1	3.115	0.1
					Maximum	**2.6**	**Maximum**	**0.5**	**Maximum**	**1.9**
					Average	**1.7**	**Average**	**0.2**	**Average**	**0.8**

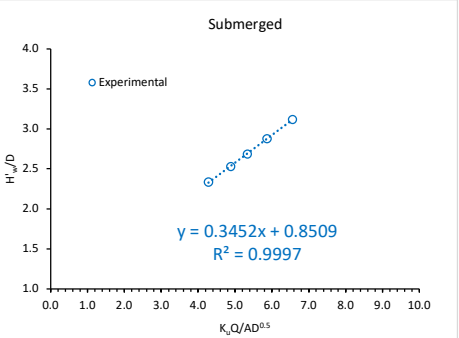
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
1.0446	0.1064	0.3452	0.8509

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
3.111E-02	-2.254E-01	6.231E-01	-4.762E-01	4.934E-01	7.826E-01





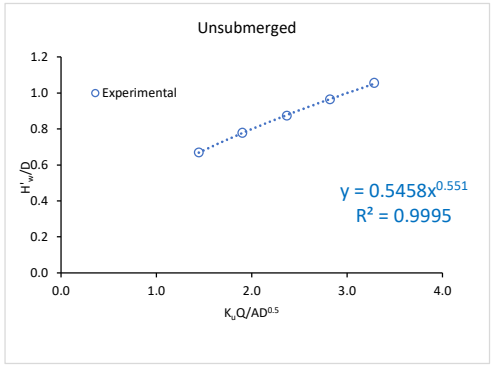


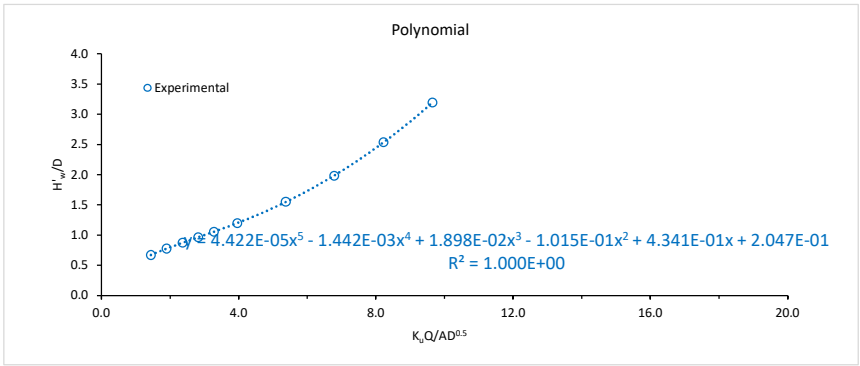
33.7 DEG NON LINEAR - EXP 1 - NO BLOCK

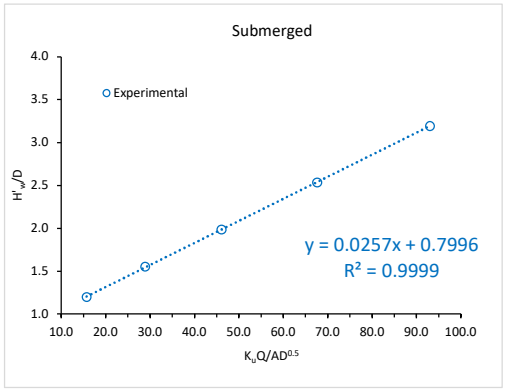
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0300	0.146	**1.44**	2.09	0.10	**0.670**	4.4	0.671	0.2	0.668	0.2
0.0394	0.178	**1.90**	3.61	0.11	**0.778**	4.3	0.776	0.3	0.778	0.1
0.0491	0.206	**2.37**	5.60	0.12	**0.873**	4.3	0.873	0.0	0.877	0.5
0.0585	0.233	**2.82**	7.95	0.13	**0.964**	4.3	0.964	0.1	0.966	0.2
0.0681	0.260	**3.28**	10.78	0.13	**1.056**	0.0	1.057	0.1	1.051	0.5
0.0822	0.302	**3.96**	15.70	0.14	**1.198**	4.0	1.200	0.2	1.204	0.5
0.1115	0.407	**5.37**	28.87	0.14	**1.552**	3.4	1.548	0.3	1.543	0.6
0.1408	0.535	**6.79**	46.06	0.13	**1.983**	2.8	1.987	0.2	1.985	0.1
0.1705	0.699	**8.22**	67.59	0.12	**2.536**	2.3	2.535	0.1	2.539	0.1
0.2001	0.894	**9.64**	93.01	0.11	**3.194**	0.0	3.194	0.0	3.193	0.0
					Maximum	**4.4**	**Maximum**	**0.3**	**Maximum**	**0.6**
					Average	**3.0**	**Average**	**0.1**	**Average**	**0.3**

Regression - Schall et al. (2012)			
K	M	c	Y
0.5458	0.5510	0.0257	0.7996

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
4.422E-05	-1.442E-03	1.898E-02	-1.015E-01	4.341E-01	2.047E-01







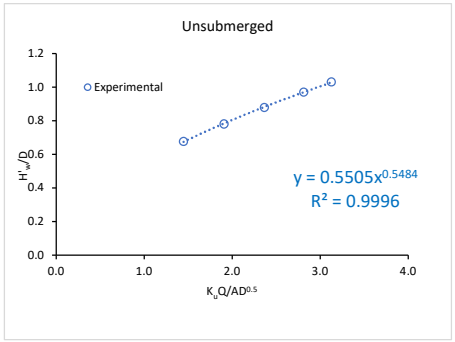
33.7 DEG NON LINEAR - EXP 2 - NO BLOCK

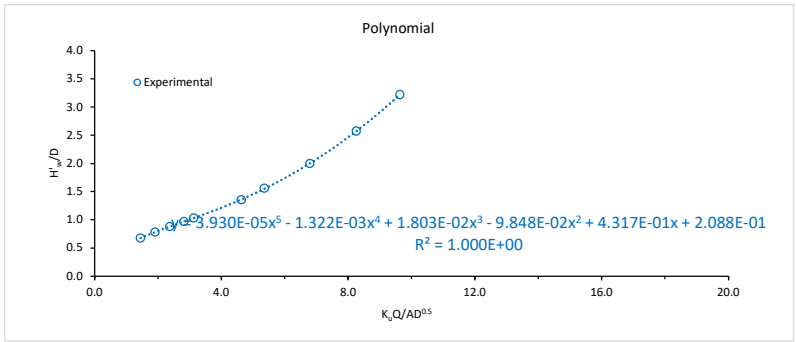
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0300	0.148	**1.45**	2.09	0.10	**0.677**	4.3	0.676	0.0	0.674	0.4
0.0396	0.179	**1.91**	3.64	0.11	**0.781**	4.3	0.782	0.1	0.784	0.4
0.0491	0.208	**2.37**	5.60	0.12	**0.880**	4.3	0.879	0.0	0.883	0.4
0.0584	0.235	**2.81**	7.91	0.12	**0.971**	4.2	0.969	0.2	0.971	0.0
0.0649	0.253	**3.13**	9.78	0.13	**1.032**	0.0	1.032	0.0	1.028	0.3
0.0960	0.349	**4.63**	21.43	0.14	**1.356**	3.7	1.362	0.4	1.360	0.3
0.1111	0.409	**5.36**	28.69	0.14	**1.559**	3.3	1.552	0.4	1.549	0.6
0.1408	0.539	**6.79**	46.06	0.13	**1.997**	2.8	2.000	0.2	2.002	0.2
0.1713	0.710	**8.26**	68.17	0.12	**2.573**	2.2	2.572	0.0	2.577	0.2
0.1998	0.902	**9.63**	92.74	0.11	**3.221**	0.0	3.221	0.0	3.217	0.1
					Maximum	**4.3**	**Maximum**	**0.4**	**Maximum**	**0.6**
					Average	**2.9**	**Average**	**0.1**	**Average**	**0.3**

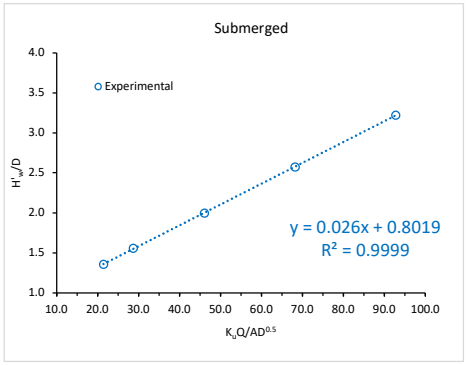
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.5505	0.5484	0.0260	0.8019

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
3.930E-05	-1.322E-03	1.803E-02	-9.848E-02	4.317E-01	2.088E-01







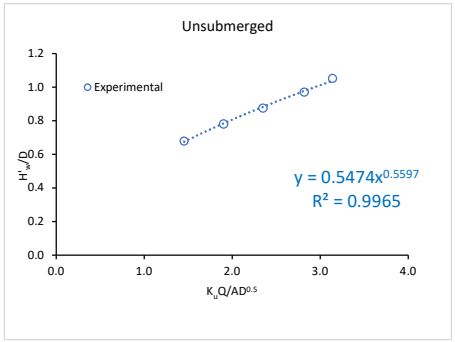
33.7 DEG NON LINEAR - EXP 3 - NO BLOCK

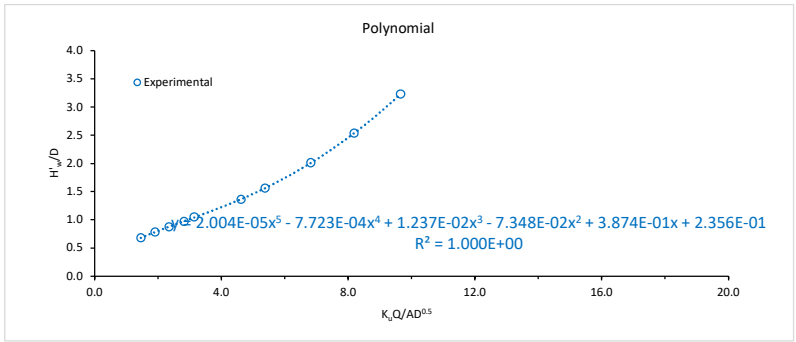
Input										
Q	y	$K_u Q/AD^{0.5}$	$(K_u Q/AD^{0.5})^2$	v_a	H_w'/D	Unc(H_w'/D)	Estimate (poly)	Abs. error	Estimate (Schall et al.)	Error
[m^3/s]	[m]	[$m^{0.5}/s$]	[m0.5/s]	[m/s]	[-]	[%]	[-]	[%]	[-]	[%]
0.0302	0.149	**1.45**	2.12	0.10	**0.680**	4.3	0.679	0.2	0.675	0.7
0.0395	0.179	**1.90**	3.62	0.11	**0.781**	4.3	0.782	0.1	0.785	0.4
0.0488	0.207	**2.35**	5.53	0.12	**0.876**	4.3	0.879	0.3	0.883	0.8
0.0585	0.235	**2.82**	7.95	0.12	**0.971**	4.3	0.976	0.5	0.978	0.7
0.0651	0.259	**3.14**	9.86	0.13	**1.052**	0.0	1.042	1.0	1.039	1.3
0.0958	0.351	**4.62**	21.34	0.14	**1.363**	3.7	1.367	0.3	1.361	0.1
0.1116	0.410	**5.38**	28.93	0.14	**1.562**	3.3	1.562	0.0	1.558	0.2
0.1414	0.543	**6.82**	46.48	0.13	**2.010**	2.7	2.008	0.1	2.013	0.1
0.1698	0.699	**8.19**	67.03	0.12	**2.536**	2.3	2.538	0.1	2.545	0.4
0.2003	0.905	**9.66**	93.26	0.11	**3.231**	0.0	3.231	0.0	3.225	0.2
					Maximum	**4.3**	**Maximum**	**1.0**	**Maximum**	**1.3**
					Average	**2.9**	**Average**	**0.3**	**Average**	**0.5**

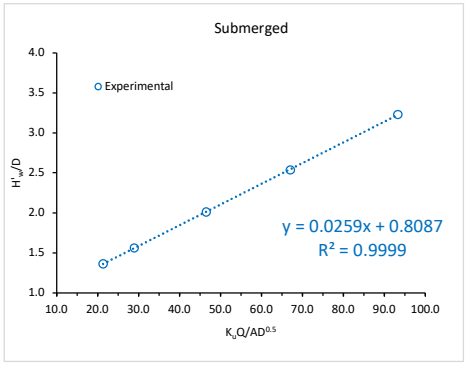
Model geometry	
W_a	2.000
D_{pipe}	0.296
A_{pipe}	0.069
S	0.027
$0.5 \times S$	0.014
Offset (y_a)	-0.048

Regression - Schall et al. (2012)			
K	M	c	Y
0.5474	0.5597	0.0259	0.8087

Regression - 5th deg. polynomial					
C_5	C_4	C_3	C_2	C_1	C_0
2.004E-05	-7.723E-04	1.237E-02	-7.348E-02	3.874E-01	2.356E-01







Appendix C

Outlet Control Calibration Graphs

34 Deg Linear

SENSOR 4		DONE
Run	Average	
Atmospheric Pressure	0.995936076	
Hydrostatic Pressure 0.5	1.481630961	
Hydrostatic Pressure 1.0	1.985811259	
Hydrostatic Pressure 1.5	2.483479258	

SENSOR 5		DONE
Run	Average	
Atmospheric Pressure	0.993581594	
Hydrostatic Pressure 0.5	1.481924998	
Hydrostatic Pressure 1.0	1.988341624	
Hydrostatic Pressure 1.5	2.505415141	

SENSOR 6		DONE
Run	Average	
Atmospheric Pressure	1.003694712	
Hydrostatic Pressure 0.5	1.502026215	
Hydrostatic Pressure 1.0	2.001358083	
Hydrostatic Pressure 1.5	2.511455638	

SENSOR 7		DONE
Run	Average	
Atmospheric Pressure	1.022590586	
Hydrostatic Pressure 0.5	1.525333405	
Hydrostatic Pressure 1.0	2.011941172	
Hydrostatic Pressure 1.5	2.521777191	

SENSOR 8		DONE
Run	Average	
Atmospheric Pressure	0.999879303	
Hydrostatic Pressure 0.5	1.484039358	
Hydrostatic Pressure 1.0	1.975852102	
Hydrostatic Pressure 1.5	2.480777486	

10 Deg Linear

SENSOR 4		DONE
Run	Average	
Atmospheric Pressure	0.996714528	
Hydrostatic Pressure 0.5	1.490062408	
Hydrostatic Pressure 1.0	1.980367432	
Hydrostatic Pressure 1.5	2.489664408	

SENSOR 5		DONE
Run	Average	
Atmospheric Pressure	0.993008626	
Hydrostatic Pressure 0.5	1.483947906	
Hydrostatic Pressure 1.0	1.987279561	
Hydrostatic Pressure 1.5	2.494063568	

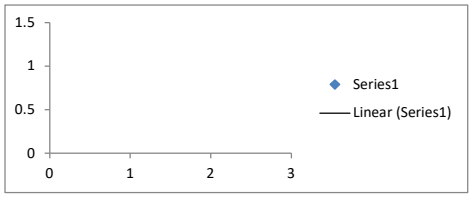
SENSOR 6		DONE
Run	Average	
Atmospheric Pressure	1.004318644	
Hydrostatic Pressure 0.5	1.498815409	
Hydrostatic Pressure 1.0	2.000578512	
Hydrostatic Pressure 1.5	2.520019480	

SENSOR 7		DONE
Run	Average	
Atmospheric Pressure	1.027383423	
Hydrostatic Pressure 0.5	1.528299357	
Hydrostatic Pressure 1.0	2.014289551	
Hydrostatic Pressure 1.5	2.522766978	

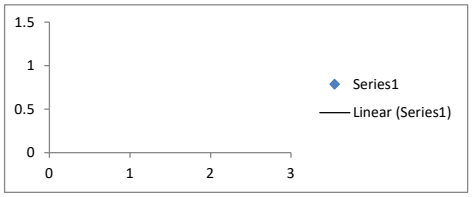
SENSOR 8		DONE
Run	Average	
Atmospheric Pressure	1.00069575	
Hydrostatic Pressure 0.5	1.48674113	
Hydrostatic Pressure 1.0	1.97883041	
Hydrostatic Pressure 1.5	2.48215749	

20 Deg NON Linear

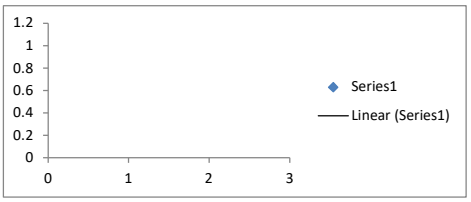
SENSOR 4	DONE
Run	Average
Atmospheric Pressure	0.995349935
Hydrostatic Pressure 0.5	1.485159403
Hydrostatic Pressure 1.0	1.980505896
Hydrostatic Pressure 1.5	2.488051453



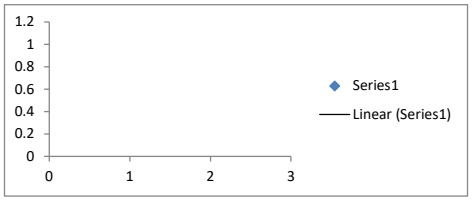
SENSOR 5	DONE
Run	Average
Atmospheric Pressure	0.993135681
Hydrostatic Pressure 0.5	1.490114390
Hydrostatic Pressure 1.0	1.984562531
Hydrostatic Pressure 1.5	2.501142069



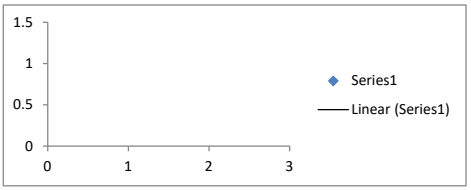
SENSOR 6	DONE
Run	Average
Atmospheric Pressure	1.002231496
Hydrostatic Pressure 0.5	1.505426381
Hydrostatic Pressure 1.0	1.998844910
Hydrostatic Pressure 1.5	2.514975739



SENSOR 7	DONE
Run	Average
Atmospheric Pressure	1.023607330
Hydrostatic Pressure 0.5	1.523368327
Hydrostatic Pressure 1.0	2.010973002
Hydrostatic Pressure 1.5	2.515303497



SENSOR 8	DONE
Run	Average
Atmospheric Pressure	1.000568237
Hydrostatic Pressure 0.5	1.486696116
Hydrostatic Pressure 1.0	1.977819875
Hydrostatic Pressure 1.5	2.482309316



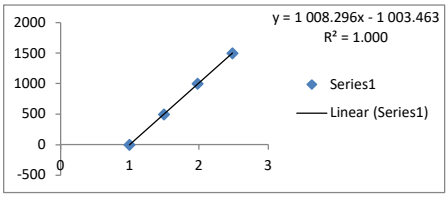
34 Deg NON Linear

% difference 10 Deg Linear vs 20 Deg NON Linear

SENSOR 4

DONE

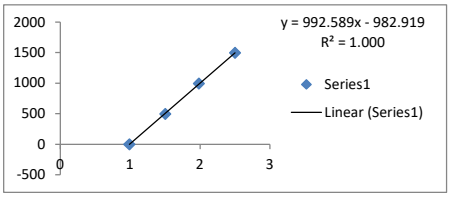
	Run	Average	
0	Atmospheric Pressure	0.994025981	0.133 %
497	Hydrostatic Pressure 0.5	1.492968648	0.524 %
997	Hydrostatic Pressure 1.0	1.977965240	0.128 %
1497	Hydrostatic Pressure 1.5	2.482252808	0.233 %



SENSOR 5

DONE

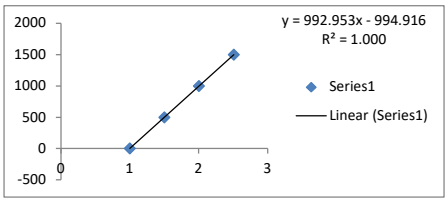
	Run	Average	
0	Atmospheric Pressure	0.987185262	0.601 %
497	Hydrostatic Pressure 0.5	1.500361328	0.685 %
997	Hydrostatic Pressure 1.0	1.985495300	0.047 %
1497	Hydrostatic Pressure 1.5	2.501322021	0.007 %



SENSOR 6

DONE

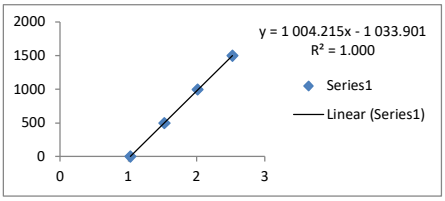
	Run	Average	
0	Atmospheric Pressure	1.0011359151	0.109 %
497	Hydrostatic Pressure 0.5	1.505256755	0.011 %
997	Hydrostatic Pressure 1.0	2.003104858	0.213 %
1497	Hydrostatic Pressure 1.5	2.510640259	0.173 %



SENSOR 7

DONE

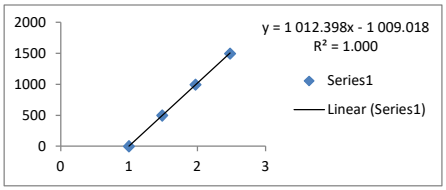
	Run	Average	
0	Atmospheric Pressure	1.029862518	0.609 %
497	Hydrostatic Pressure 0.5	1.528301646	0.323 %
997	Hydrostatic Pressure 1.0	2.014032949	0.152 %
1497	Hydrostatic Pressure 1.5	2.524498545	0.365 %



SENSOR 8

DONE

	Run	Average	
0	Atmospheric Pressure	1.000855103	0.029 %
497	Hydrostatic Pressure 0.5	1.485288239	0.095 %
997	Hydrostatic Pressure 1.0	1.973705953	0.208 %
1497	Hydrostatic Pressure 1.5	2.481167247	0.046 %



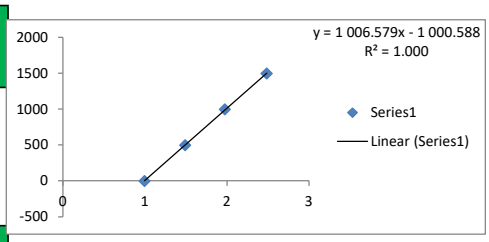
	A	B
PS4	1008.296	1003.463
PS5	992.589	982.919
PS6	992.953	994.916
PS7	1004.215	1033.901
PS8	1012.398	1009.018

34 Deg NON Linear

SENSOR 4

DONE

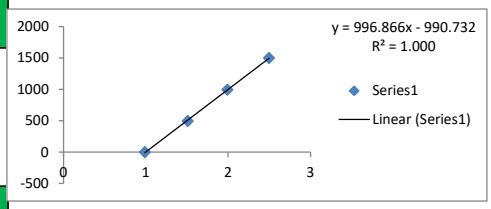
	Run	Average
0	Atmospheric Pressure	0.993714803
497	Hydrostatic Pressure 0.5	1.492577108
997	Hydrostatic Pressure 1.0	1.976191711
1497	Hydrostatic Pressure 1.5	2.485159556



SENSOR 5

DONE

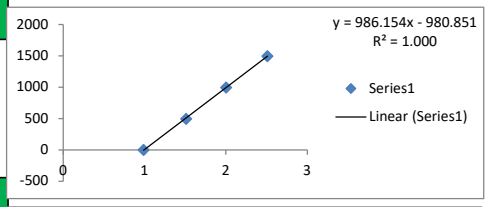
	Run	Average
0	Atmospheric Pressure	0.987651062
497	Hydrostatic Pressure 0.5	1.505226644
997	Hydrostatic Pressure 1.0	1.987388560
1497	Hydrostatic Pressure 1.5	2.495524851



SENSOR 6

DONE

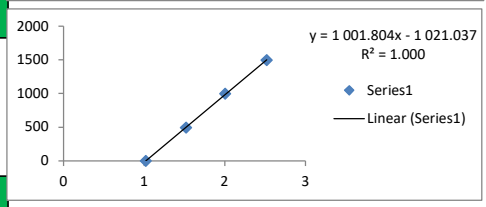
	Run	Average
0	Atmospheric Pressure	0.988215129
497	Hydrostatic Pressure 0.5	1.510059713
997	Hydrostatic Pressure 1.0	2.002251892
1497	Hydrostatic Pressure 1.5	2.510956726



SENSOR 7

DONE

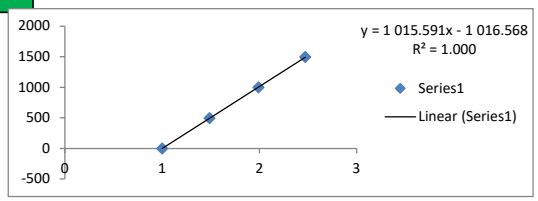
	Run	Average
0	Atmospheric Pressure	1.020102132
497	Hydrostatic Pressure 0.5	1.520030212
997	Hydrostatic Pressure 1.0	2.00264801
1497	Hydrostatic Pressure 1.5	2.519631704



SENSOR 8

DONE

	Run	Average
0	Atmospheric Pressure	1.000831095
497	Hydrostatic Pressure 0.5	1.486859792
997	Hydrostatic Pressure 1.0	1.990162557
1497	Hydrostatic Pressure 1.5	2.471076660

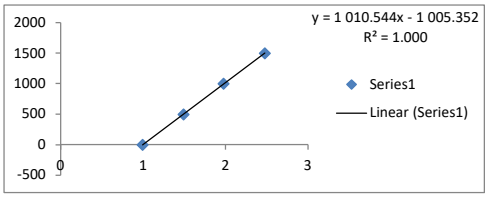


	A	B
PS4	1006.579	1000.588
PS5	996.866	990.732
PS6	986.154	980.851
PS7	1001.804	1021.037
PS8	1015.591	1016.568

10 Deg NON Linear

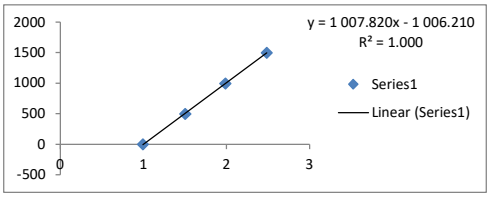
SENSOR 4 — DONE

	Run	Average
0	Atmospheric Pressure	0.993092499
497	Hydrostatic Pressure 0.5	1.491644491
997	Hydrostatic Pressure 1.0	1.976923523
1497	Hydrostatic Pressure 1.5	2.477580557



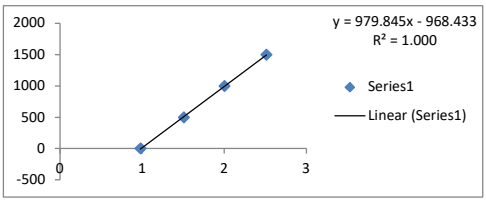
SENSOR 5 — DONE

	Run	Average
0	Atmospheric Pressure	0.99283193
497	Hydrostatic Pressure 0.5	1.502376200
997	Hydrostatic Pressure 1.0	1.983023173
1497	Hydrostatic Pressure 1.5	2.483166707



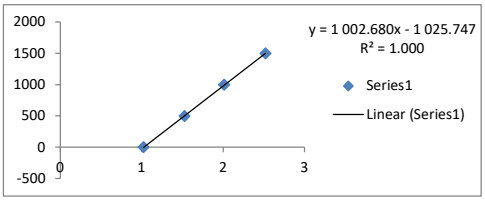
SENSOR 6 — DONE

	Run	Average
0	Atmospheric Pressure	0.979909363
497	Hydrostatic Pressure 0.5	1.5101399740
997	Hydrostatic Pressure 1.0	2.002608032
1497	Hydrostatic Pressure 1.5	2.513280691



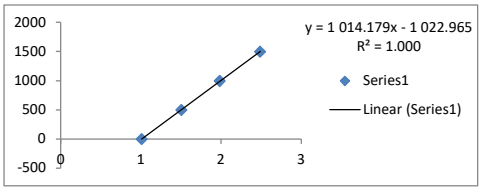
SENSOR 7 — DONE

	Run	Average
0	Atmospheric Pressure	1.021540883
497	Hydrostatic Pressure 0.5	1.523872375
997	Hydrostatic Pressure 1.0	2.011474202
1497	Hydrostatic Pressure 1.5	2.518142395



SENSOR 8 — DONE

	Run	Average
0	Atmospheric Pressure	1.007189636
497	Hydrostatic Pressure 0.5	1.505483108
997	Hydrostatic Pressure 1.0	1.982883759
1497	Hydrostatic Pressure 1.5	2.488282064



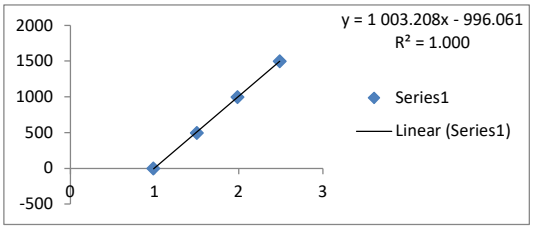
	A	B
PS4	1010.544	1005.352
PS5	1007.820	1006.210
PS6	979.845	968.433
PS7	1002.680	1025.747
PS8	1014.179	1022.965

Appendix D

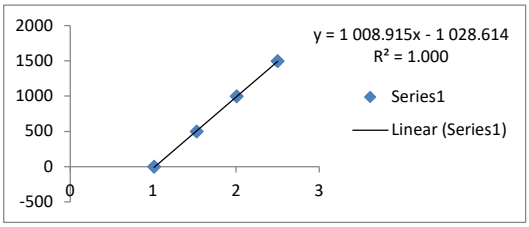
Inlet Control Calibration Graphs

34 Deg NON Linear

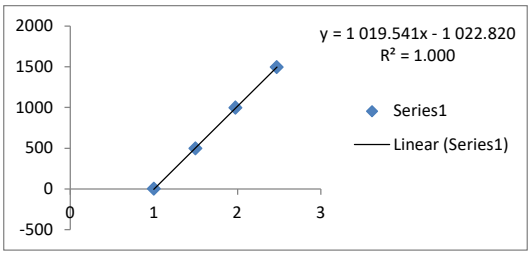
	SENSOR 5	DONE
	Run	Average
0	Atmospheric Pressure	0.987484538
497	Hydrostatic Pressure 0.5	1.498660126
997	Hydrostatic Pressure 1.0	1.982398122
1497	Hydrostatic Pressure 1.5	2.484399516



	SENSOR 7	DONE
	Run	Average
0	Atmospheric Pressure	1.012077026
497	Hydrostatic Pressure 0.5	1.523040975
997	Hydrostatic Pressure 1.0	2.008591715
1497	Hydrostatic Pressure 1.5	2.498961894

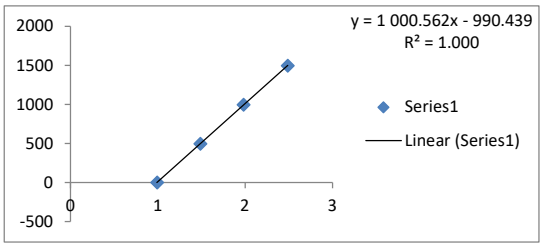


	SENSOR 9	DONE
	Run	Average
0	Atmospheric Pressure	1.000934753
497	Hydrostatic Pressure 0.5	1.4959617106
997	Hydrostatic Pressure 1.0	1.977491964
1497	Hydrostatic Pressure 1.5	2.472150777

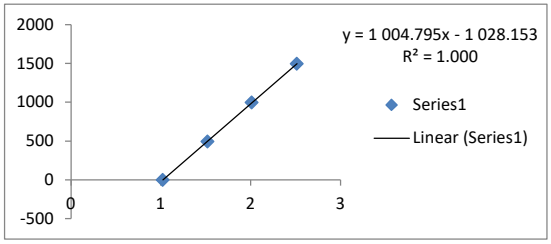


20 Deg NON Linear

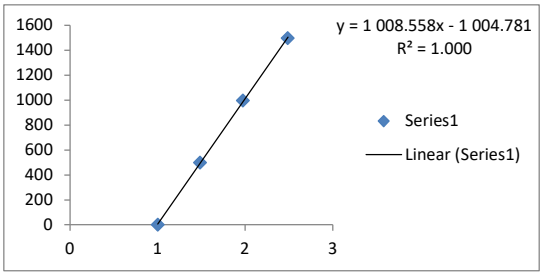
SENSOR 5		DONE
	Run	Average
0	Atmospheric Pressure	0.989854482
497	Hydrostatic Pressure 0.5	1.488795013
997	Hydrostatic Pressure 1.0	1.982083384
1497	Hydrostatic Pressure 1.5	2.488121745



SENSOR 7		DONE
	Run	Average
0	Atmospheric Pressure	1.021896566
497	Hydrostatic Pressure 0.5	1.521763865
997	Hydrostatic Pressure 1.0	2.011821289
1497	Hydrostatic Pressure 1.5	2.514234975



SENSOR 9		DONE
	Run	Average
0	Atmospheric Pressure	1.002583771
497	Hydrostatic Pressure 0.5	1.4841618347
997	Hydrostatic Pressure 1.0	1.975990295
1497	Hydrostatic Pressure 1.5	2.487902120

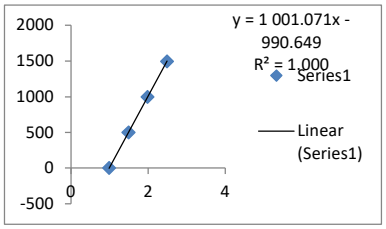


	A	B
PS5	1003.208	996.061
PS7	1008.915	1028.614
PS9	1019.541	1022.820

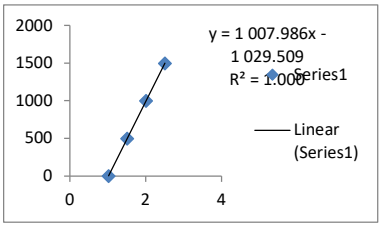
2nd Calibration 080823

20 Deg NON Linear
Blocked Elements

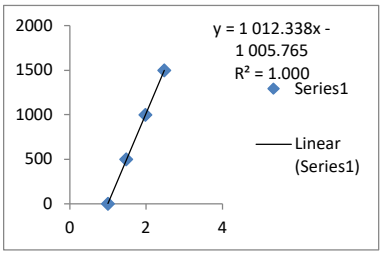
SENSOR 5		DONE
Run		Average
0	Atmospheric Pressure	0.988787537
497	Hydrostatic Pressure 0.5	1.489737295
997	Hydrostatic Pressure 1.0	1.980645243
1497	Hydrostatic Pressure 1.5	2.486984863



SENSOR 7		DONE
Run		Average
0	Atmospheric Pressure	1.023332113
497	Hydrostatic Pressure 0.5	1.513170471
997	Hydrostatic Pressure 1.0	2.007066345
1497	Hydrostatic Pressure 1.5	2.509146118



SENSOR 9		DONE
Run		Average
0	Atmospheric Pressure	0.997852936
497	Hydrostatic Pressure 0.5	1.478894958
997	Hydrostatic Pressure 1.0	1.976579386
1497	Hydrostatic Pressure 1.5	2.475248260



A	B
1000.562	990.439
1004.795	1028.153
1008.558	1004.781

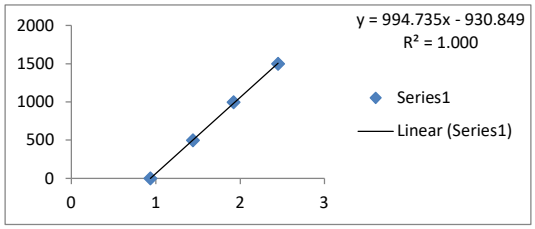
10 Deg NON Linear
Blocked Elements

	A	B
PS5	994.735	930.849
PS7	1014.946	1038.256
PS9	1006.821	1001.009

SENSOR 5

DONE

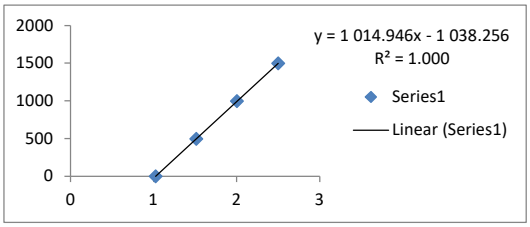
	Run	Average
0	Atmospheric Pressure	0.936879018
497	Hydrostatic Pressure 0.5	1.441660868
997	Hydrostatic Pressure 1.0	1.922902578
1497	Hydrostatic Pressure 1.5	2.448495229



SENSOR 7

DONE

	Run	Average
0	Atmospheric Pressure	1.023747864
497	Hydrostatic Pressure 0.5	1.513275909
997	Hydrostatic Pressure 1.0	2.001732127
1497	Hydrostatic Pressure 1.5	2.500069631



SENSOR 9

DONE

	Run	Average
0	Atmospheric Pressure	0.996103617
497	Hydrostatic Pressure 0.5	1.488919322
997	Hydrostatic Pressure 1.0	1.976900228
1497	Hydrostatic Pressure 1.5	2.485718740