

# Culvert Rating Curve using HY-8

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## Introduction

This tutorial describes how to create a rating curve for a box culvert on IH-10 using the HY-8 culvert hydraulic analysis program. The program can be obtained from:

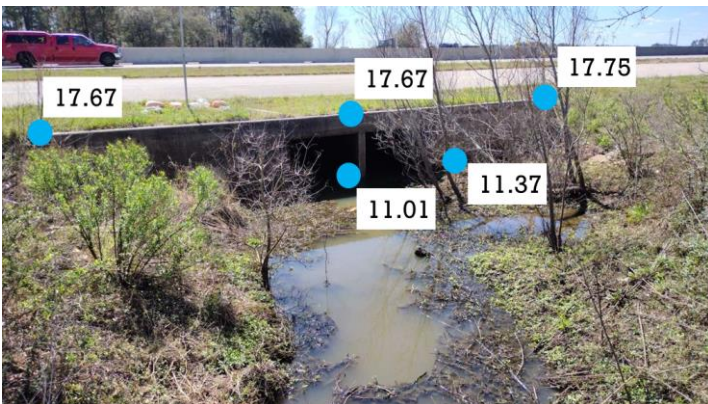
<https://www.fhwa.dot.gov/engineering/hydraulics/software/hy8/>

This tutorial uses information from an ArcGIS description of how to create a 3D culvert at:

<https://www.caee.utexas.edu/prof/maidment/RoadElevationModel/Culvert/IH10Culvert.pdf>

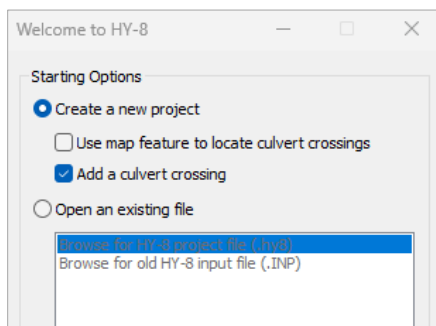
## Data

The culvert structure consists of two adjacent concrete box culverts that are 6ft wide and 5 ft high. The culvert is 293 ft long and passes under IH-10 southwest of Beaumont, Texas. The culvert invert is flat and is at elevation 11.35 ft. The overlaying road is also flat and is at elevation 17.71 ft. There is square edged entrance and a flat head wall.



## Procedure

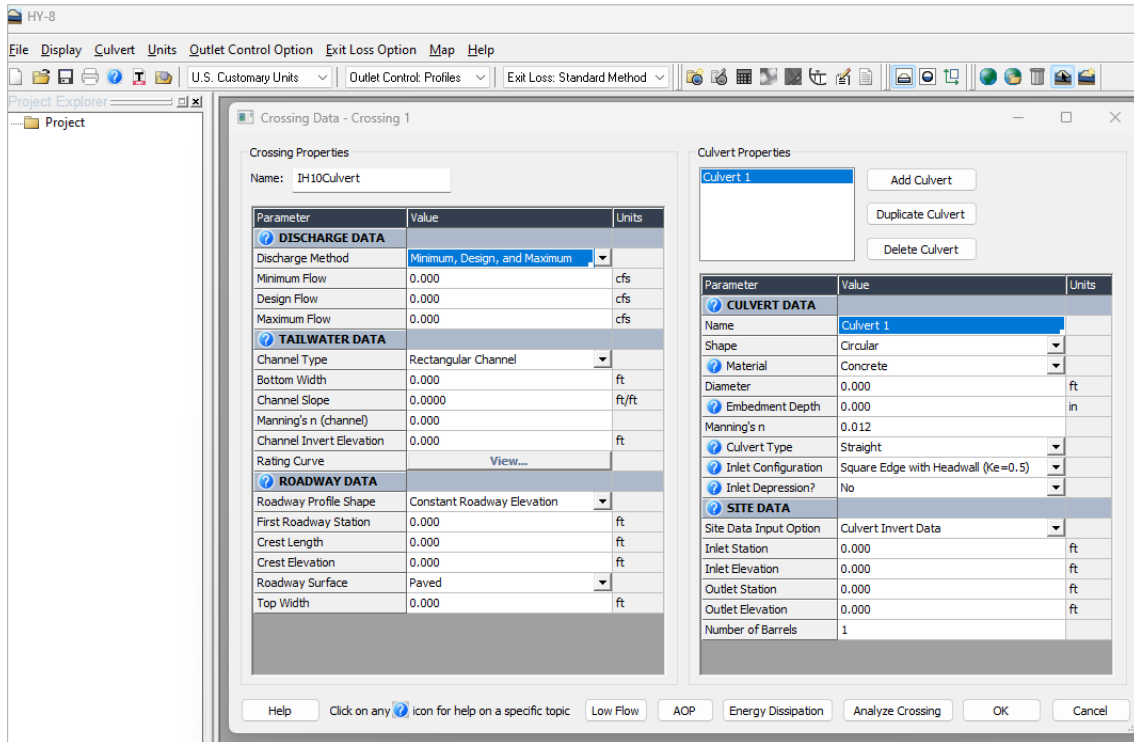
1. Open the HY-8 program and Create a new Project and add a culvert crossing called IH10Culvert.



Use File/Save to save the file as **IH10CulvertHY8**

File name:

Save as type:



Fill in the input data for the culvert as shown below. Note that this is one culvert with two barrels.

Crossing Data - Crossing 1

Crossing Properties

Name: IH10Culvert

Parameter	Value	Units
<b>DISCHARGE DATA</b>		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	0.000	cfs
Design Flow	600.000	cfs
Maximum Flow	1000.000	cfs
<b>TAILWATER DATA</b>		
Channel Type	Rectangular Channel	
Bottom Width	100.000	ft
Channel Slope	0.0010	ft/ft
Manning's n (channel)	0.040	
Channel Invert Elevation	11.350	ft
Rating Curve	View...	
<b>ROADWAY DATA</b>		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.000	ft
Crest Length	1000.000	ft
Crest Elevation	17.710	ft
Roadway Surface	Paved	
Top Width	293.000	ft

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

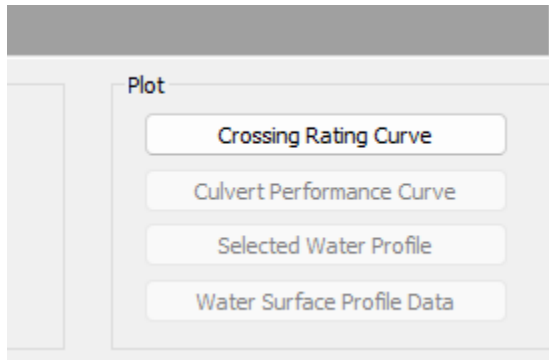
Parameter	Value	Unit
Name	Culvert 1	
Shape	Concrete Box	
Material	Concrete	
Span	6.000	ft
Rise	5.000	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Square Edge (90°) Headwall (Ke=0.5)	
Inlet Depression?	No	
<b>SITE DATA</b>		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	11.350	ft
Outlet Station	293.000	ft
Outlet Elevation	11.350	ft
Number of Barrels	2	
Computed Culvert Slope	0.000000	ft/ft

Help Click on any ? icon for help on a specific topic Low Flow AOP Energy Dissipation Analyze Crossing OK Cancel

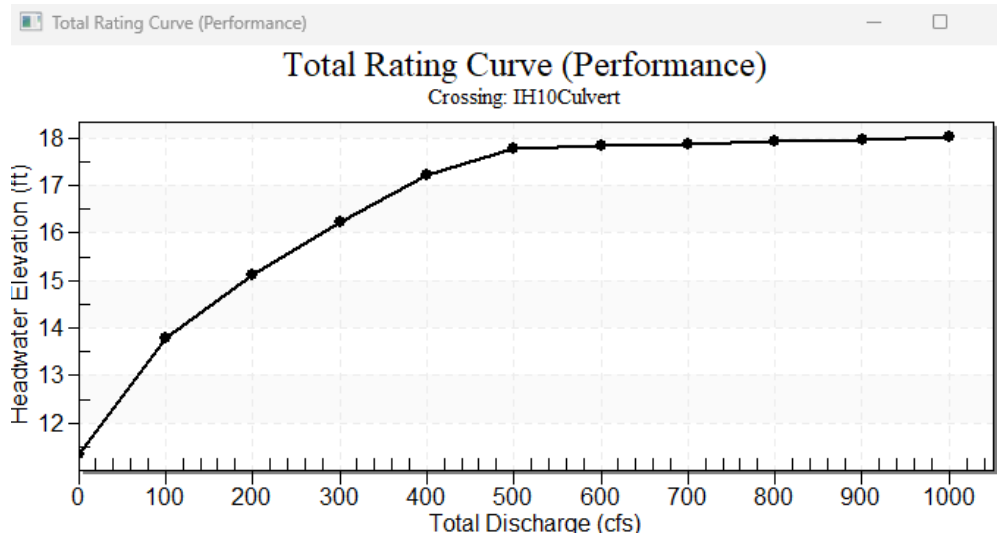
Hit the button at the bottom of the screen that says **Analyze Crossing** and the following result appears

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
11.35	0.00	0.00	0.00	1
13.78	100.00	100.00	0.00	1
15.11	200.00	200.00	0.00	1
16.22	300.00	300.00	0.00	1
17.21	400.00	400.00	0.00	1
17.76	500.00	466.60	31.83	18
17.83	600.00	477.75	120.32	5
17.88	700.00	486.41	211.74	4
17.93	800.00	491.97	307.02	4
17.97	900.00	495.74	403.81	4
18.01	1000.00	499.14	499.30	3
17.71	458.34	458.34	0.00	Overtopping

Select Plot Crossing Rating Curve



And the resulting rating curve appears as:



Use File/Save to resave the file as **IH10CulvertHY8**

## Results

The water surface profile within the culvert for a discharge of 600 cfs is shown below. Of this, 477.75 cfs passes through the pipe and 120.32 cfs across the road. The water surface elevation on the road is 17.83 ft, compared to the road surface elevation of 17.71 ft, so the depth of water on the road is 0.12 ft, or 1.4 inches. For a discharge of 1000 cfs, about half the water goes through the culvert and half over the road, the depth on the road surface being  $18.01 - 17.71 = 0.3$  ft or about 4 inches.

Crossing - IH10Culvert, Design Discharge - 600.0 cfs  
Culvert - Culvert 1, Culvert Discharge - 477.8 cfs

