



DRAINAGE DESIGN MANAGEMENT SYSTEM FOR WINDOWS

VERSION 6.8.0

TUTORIAL # 22

PIER INFLUENCE ZONE CALCULATION

HEC-18 PROCEDURE



KVL Consultants, Inc.

PIER INFLUENCE ZONE CALCULATION [HEC-18 PROCEDURE]

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PIER INFLUENCE ZONE CALCULATION

[HEC-18 PROCEDURE]

DATE UPDATED: MAY 7, 2024

TUTORIAL TIME: 15 MINUTES

1.0 INTRODUCTION

A pier influence zone is the top width (W_T as shown in the figure below) of a pier local scour hole in cohesionless bed material. This tutorial computes the pier influence zone by using the procedure outlined in the Federal Highway Administration HEC-18 Manual (April 2012).

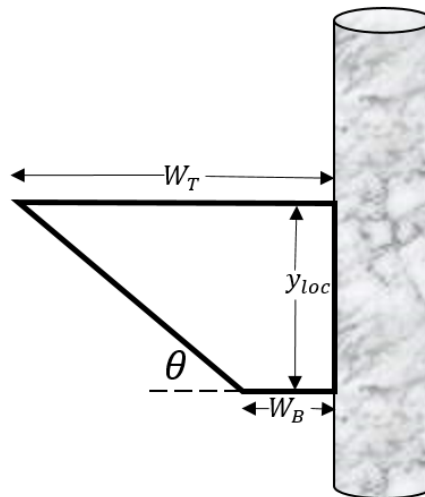


Figure 1: Top Width of Scour Hole Sketch Adapted from FHWA (2012)

2.0 REQUIRED DATA

For this tutorial on calculating pier influence zone, use the following conditions:

- Pier Scour Depth, Y_s (ft): 15.00
- Ratio of bottom width to depth of local pier scour, B : 1.0
- Angle of repose of the bed material in water, θ (degrees): 44.00
- Distance from outside edge of pier, X (ft): 10.00

3.0 STEP-BY-STEP PROCEDURE

The step-by-step procedure for calculating pier influence zone is described as follows:

- Step 1: Establish a New Project and Set-up the Defaults
- Step 2: Prepare the Data

- Step 3: Calculate the Pier Influence Zone Width
Step 4: Reporting and Documentation of Results

3.1 Step 1 - Establish a New Project and Set-up the Defaults

- (a) Click the **DDMSW** icon on the Desktop or Program menu to launch the **DDMSW**. Click the **OK** button to accept the software disclaimer as shown in the following figure.



After the **DDMSW** is launched, the **SELECT PROJECT** form is automatically opened as shown in the following figure.

Select Project

| List | | Details | |
|-----------------|-----------------|-------------------|--|
| Group | River Mechanics | | |
| Project Group | ID | Reference | Title |
| Rational Method | 00115 | KVLEXAMPLE3 | Example 3 Rational Method tutorial project |
| Rational Method | 00144 | KVLEXAMPLE3A | |
| Rational Method | 00100 | KVLEXAMPLE7 | Rational Method Tutorial |
| River Mechanics | 00057 | ABUTMENT_NCHRP1 | Abutment Scour using HEC-18 NCHRP Procedure |
| River Mechanics | 00058 | ABUTMENT_NCHRP2 | Abutment Scour using HEC-18 NCHRP Procedure |
| River Mechanics | 00138 | AFDFD | |
| River Mechanics | 00106 | BANKPROTECTIONFCD | River Mechanics Example - Bank Protection |
| River Mechanics | 00109 | BRIDGEPIERFCD | River Mechanics Example - Bridge Pier |
| River Mechanics | 00056 | GUIDEBANK_NCHRP | Guide Bank Scour using HEC-18 NCHRP Procedure |
| River Mechanics | 00055 | GUIDEBANK_NCHRP2 | Guide Bank Scour using HEC-18 NCHRP Procedure |
| River Mechanics | 00112 | LATEROSIONEXAMPLE | Lateral Erosion Example |
| River Mechanics | 00111 | LAUNCHABLERIPRAP | River Mechanics Example - Launchable RipRap |
| River Mechanics | 00117 | MODELTHALWEG | Sedimentation Model Examples |
| River Mechanics | 00054 | PIER_INFLUENCE | Pier Influence Zone calculation using HEC-18 Procedure |
| River Mechanics | 00053 | PRESSURE_SCOUR | Pressure Flow Scour using HEC-18 Procedure |
| River Mechanics | 00107 | PROJECTXSECTIONS | River Mechanics Cross Sections |

Date: 05/15/2018

- (b) Click the **Add** button on the **SELECT PROJECT** form to start a new project (Alternatively, **File → New Project → Add**).
- (c) On the **NEW PROJECT OPTIONS** dialog box, select the **River Mechanics** checkbox, then click the **OK** button to close / exit the form.
- (d) On the **SELECT PROJECT** form (**Details** tab), enter "**V605_PIER_INFLUENCE**" into the **Reference** textbox. This is the name of the new project. Users can choose any name for the **Reference** textbox as long as it does not exist already in the current **DDMSW** project database.
- (e) Type into the **Title** textbox a brief descriptive title for this project. (Optional) (e.g., '*Pier Influence Zone Calculation using HEC-18 Procedure*').
- (f) Type into the **Location** textbox the location of this project. (Optional) (e.g., '*Maricopa County, Arizona*').
- (g) Type into the **Agency** textbox the agency or company name. (Optional) (e.g., '*Flood Control District of Maricopa County*').
- (h) Check the **River Mechanics Only** checkbox.
- (i) Type a detailed description of this project into the comment area under the **Project Reference** frame. (Optional) (e.g., '*This is a tutorial project for calculating Pier Influence Zone Width using HEC-18 Procedure*').
- (j) Set the **Modification Date** using today's date by clicking on the Calendar icon.

- (k) Click the **Save** button to save the entered data. The following figure shows what the current form looks like.

The screenshot shows the 'Select Project' dialog box with the 'List' tab selected. The 'Project Reference' section contains the following information:

| | | | |
|--|--|-----------|---------------------|
| Project ID | 00146 | Reference | V680_PIER_INFLUENCE |
| Title | Pier Influence Zone calculation using HEC-18 Procedure | | |
| Location | Maricopa County, Arizona | | |
| Agency | Flood Control District of Maricopa County | | |
| <input type="checkbox"/> Hydrology and Hydraulics Only | | | |
| <input checked="" type="checkbox"/> River Mechanics Only | | | |

The 'Project Defaults' section shows:

| | |
|----------|-------|
| Soils | FCDMC |
| Land Use | FCDMC |

A text box at the bottom of the dialog contains the following text:

This is a tutorial project about the pier influence zone computation using HEC-18 procedure.

The bottom bar of the dialog includes a 'Date' field set to '05/16/2018' and buttons for 'Update Defaults', 'Default Versions', 'Info', 'Print...', 'Delete', 'Add', and 'OK'.

- (l) Click the **OK** button to exit the **SELECT PROJECT** form.

Note: The **Project ID** "00146" in the above figure is the unique database record identifier for the project, which is automatically generated by the program. Each time a new project is created, a **Project ID** is assigned by the program. The **Project ID** assigned to your project will not necessary be the same as the **Project ID** shown in the above figure.

3.2 Step 2 - Prepare the Data

- (a) From the menu bar of the main application window, click **River Mechanics** → **Scour**, to open the **TOTAL SCOUR** form.

Total Scour - MB: 01 - ID: PIERINF01

List **Total** Long Term General Local Bedform Low Flow Pier Influence

ID

Major Basin ID 01

ID PIERINF01

Scour Depth

Include Calc FS Value Custom Calc FS Method

Long Term ☐

General ☐

Local ☐

Bedform ☐

Low Flow ☐

Headcut ☐

Tailcut ☐

Total (ft)

Pier Influence ☒ 1.3

Help Info Print... Delete Add MB Update OK

3.3 Step 3 – Calculate the Pier Influence Zone Width

- On the **TOTAL SCOUR** form, select the **Pier Influence** Tab
- Enter “15” into the **Pier Scour Depth, Y_s (ft)** textbox.
- Enter “1.0” into the **Ratio of bottom width to depth of local pier scour, B** textbox.
- Enter “44” into the **Angle of repose of the bed material in water, (degrees)** textbox.
- Enter “10” into the **Distance from outside edge of pier, X (ft)** textbox.
- Click the **Save** button to save the entered data.
- Click the **Update** button to update or perform the analysis.
- Select “*This Record*” from the **SELECTION OPTION** dialog box, then click **Yes** on the **CALCULATE PIER INFLUENCE SCOUR** dialog box to continue.

Select Option

| Option |
|------------------|
| This Record |
| This Major Basin |
| All |

OK Cancel

Calculate Pier Influence Scour

i This will calculate the Pier Influence Scour for the current record.

If you want to calculate the Total Scour, Click 'Update' on the Total Tab.

Do you want to continue?

Yes No

(i) After the update, the form should look like the figure below.

Total Scour - MB: 01 - ID: PIERINFO1

| List | Total | Long Term | General | Local | Bedform | Low Flow | Pier Influence |
|------|-------|-----------|---------|-------|---------|----------|----------------|
|------|-------|-----------|---------|-------|---------|----------|----------------|

Pier Scour Influence Zone

| | |
|---|-------|
| Pier Local Scour Depth, Ys (ft) | 15.00 |
| Ratio of bottom width to depth of local pier scour, B | 1.00 |
| Angle of repose of the bed material in water, (degrees) | 44.00 |
| Pier Local Scour Hole Bottom Width, Wb (ft) | 15.00 |
| Top width of the scour hole from pier or footing, Wt (ft) | 30.53 |

Pier Scour Depth in Influence Zone



| | |
|--|-------|
| Distance from outside edge of pier, X (ft) | 10.00 |
| Scour hole depth from ground, Y (ft) | 15.00 |

Help Info Print... Delete Add MB Update OK

3.4 Step 4 - Reporting and Documentation of Results

- (a) To view the results on the screen, click the **Print ...** button on the **Local** tab of the **TOTAL SCOUR – MB: 01 – ID: PIERINF01** form. A report will be generated as shown.

| | |
|--|-----------|
| Flood Control District of Maricopa County Drainage Design Management System PIER INFLUENCE ZONE SCOUR Project Reference: V680_PIER_INFLUENCE | |
| Page 1 | 5/18/2024 |
| ID: PIERINF01 | |
| Pier Scour Depth, Ys (ft) | 15.00 |
| Ratio of bottom width to depth of local pier scour, B | 1.00 |
| Angle of repose of the bed material in water, (degrees) | 44.00 |
| Top width of the scour hole from pier or footing, W (ft) | 30.53 |
| Distance from outside edge of pier, X (ft) | 10.00 |
| Scour hole depth from ground, Y (ft) | 15.00 |

- (b) To print a hard copy of the results, click the printer symbol ().
- (c) To export the results to a PDF file or to other file formats, click the export symbol ()

This concludes the tutorial for pier influence zone calculation.