**Modeling Bridges with Unsteady Flow**
Workshop

1   Objective

This workshop will help students learn how to use HEC-RAS to model bridges using unsteady flow, and to review and understand pertinent bridge output. Sensitivity of simulation results to model changes will be reviewed.

2   Background

The stream for this example is a section of Beaver Creek located near Kentwood, Louisiana. The bridge crossing is located along State Highway 1049, near the middle of the river reach. The field data for this example was obtained from the USGS study "Backwater at Bridges and Densely Wooded Flood Plains, Beaver Creek Near Kentwood, Louisiana" by George J. Arcement, B.E. Colson, and C.O. Ming.
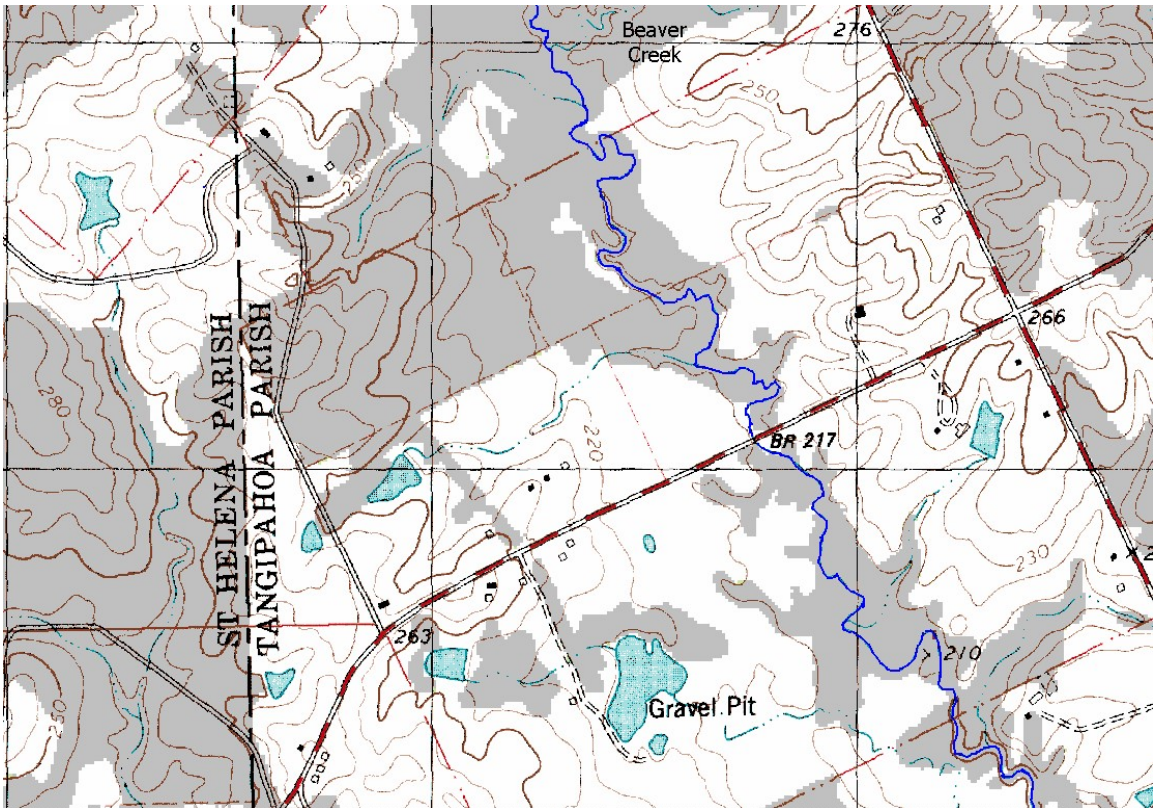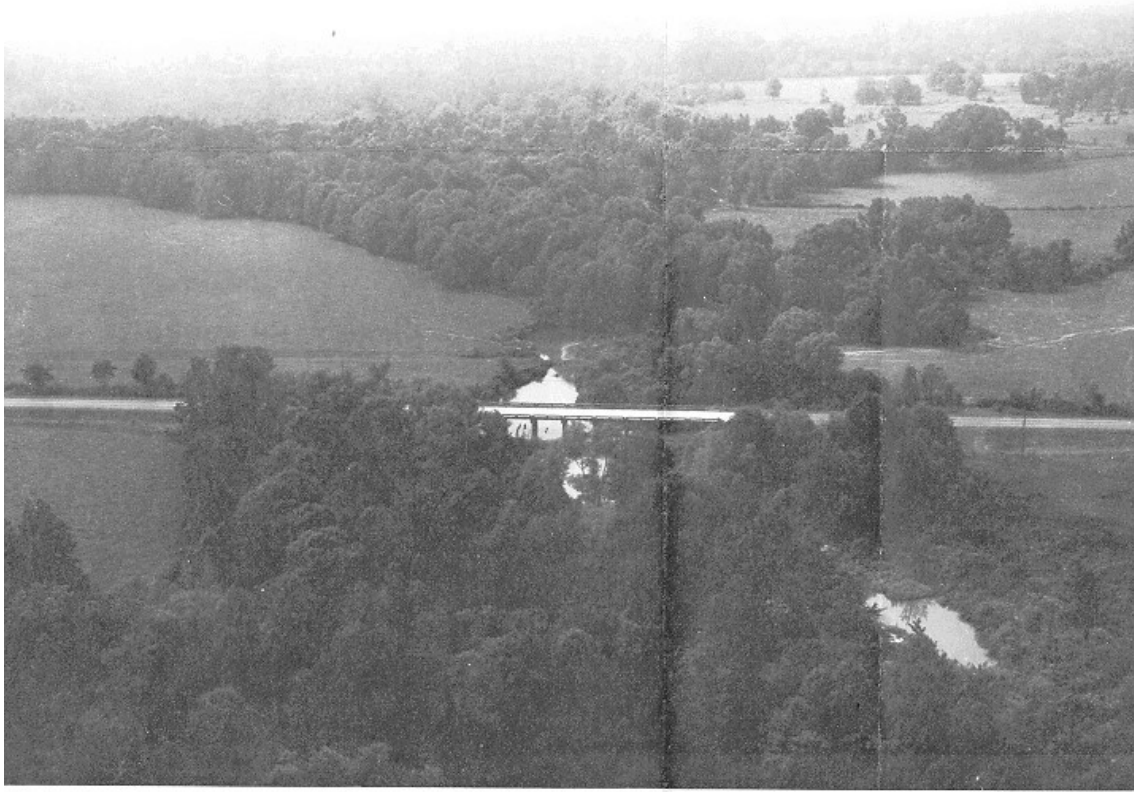
FIGURE 2—AERIAL VIEW LOOKING UPSTREAM AT BRIDGE
ON STATE HIGHWAY 1049 NEAR KENTWOOD, LOUISIANA

3   Enter Bridge Information

1. **Start HEC-RAS**.
2. **Open** the **"BridgeModeling"** dataset in the Bridge Workshop folder.
3. **Add** a new Bridge at **Station 5.4**.
4. Enter bridge information based on the following parameters, noting that the Bridge Design Editor can be used to enter the deck and pier data.

RS=5.4   Upstream (Bridge)
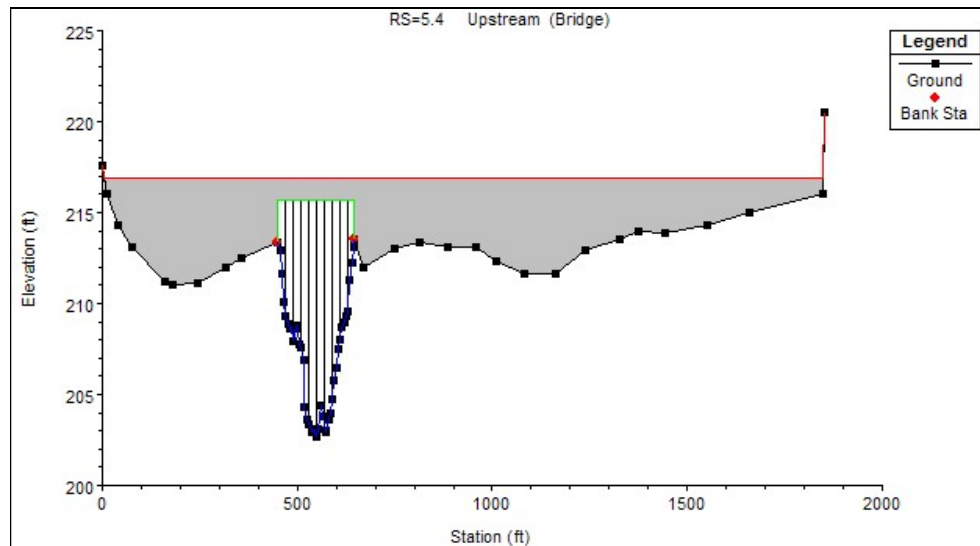
a. Road embankment is at a constant elevation of **216.93**ft.
b. The bridge low chord is at elevation of **215.7 ft**.
c. The bridge opening has vertical walls at cross section stationing **450** ft and **647** ft.
d. The bridge deck is **40** ft wide, and the upstream side of the bridge deck is **30** ft from cross section immediately upstream of the bridge (section 5.41). The upstream and downstream sides of the bridge are exactly the same.
e. The bridge has **9 piers**. The piers are **1.25** ft wide each and have a square nose. The piers are spaced **20** ft. apart on center, starting with the first pier at station **470** ft.

RS=5.4   Upstream (Bridge)
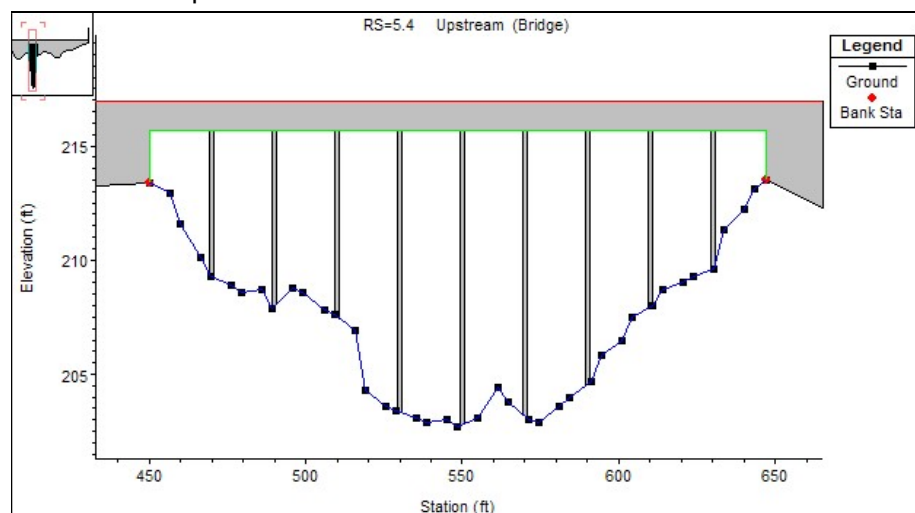
5. **Enter** the **Ineffective Flow Area** data for the bounding bridge cross sections

6. **Select** a **Bridge Modeling Approach**.
7. **Enter** the necessary **coefficients** for the modeling approach.

4 Compute Steady Flow Profiles

8. **Create** a **Steady Flow** plan using the flow file that has 3 flows for 5000, 10000, and 14000 cfs.
9. Give the plan **Title** and **ShortID**
10. **Compute** the simulation
11. **Review Results, verify, and make model adjustments**
    a. Are the ineffective flow areas turning off together?
    b. Is the computed weir flow consistent with the flow distribution upstream and downstream of the bridge?

5 Compare Computed Results with Observed Data

There are observed data for the 14000 cfs event that occurred 22 May 1974. The USGS observed high water marks are provided below.

Cross Section River Station	Observed WSE (ft)
5.99	220.0
5.76	218.4
5.61	218.1
5.44	217.8
5.41	*217.8
Bridge 5.4	
5.39	215.2*
5.3	214.9
5.13	213.6
5.0	211.8

*The observed high water mark at this location is questionable.

6 Set up an Unsteady Flow Simulation

12. **Adjust** the **HTAB settings** for the bridge
13. Load the flow file "**BridgeModeling.u01**" for the May 1974 Flood
14. Setup a **new Unsteady Flow Plan**. (Don't save over the Steady Flow plan.)
    a. Set the time step and any other parameters

7 Review Unsteady Flow Results

15. Review the unsteady flow bridge results
    a. HTAB plots
    b. Hydrograph plots – does the hydrograph transition smoothly
    c. Profile plots – max profile compararison with steady
    d. Cross sections plots – verify ineffective flow areas turn off together
    e. Various bridge tables – look for flow consistency with weir flow and conveyance of bounding cross sections

8 Questions

How do your steady-flow results compare to the observed data? What methods did you use?

What settings did you use for HTAB on bridge model processing?

What changes did you make to the unsteady flow model, after you were satisfied with the steady flow solution?

How did the unsteady-flow simulation compare to the steady-flow profile with 14,000 cfs?