LEARNING OUTCOMES

• Define scour

• List design considerations for piers and abutments

• Define live-bed and clear-water scour

• Define total scour and discuss each of its three components
PURPOSE OF HEC-18

Provide Guidelines for:

• Designing new/replacement bridges for scour

• Evaluating existing bridges for scour

• Inspecting bridges for scour
WHAT IS THE MOST COMMON CAUSE OF FAILURE IN BRIDGES?

- Scouring of material from bridge foundations
SCOUR DEFINITION

- Scour is the result of erosive action of running water, excavating and carrying away materials from the bed and bank of streams
BRIDGE SCOUR EVALUATION PROGRAM

- FHWA T5140.23 – Evaluating Scour at Bridges
- More than 484,000 bridges over water
- HEC-18 guide to evaluations
FOUNDATION DESIGN

100 Yr. Scour

This Section Must Provide Bearing & Lateral Support
SCOUR IS A SEDIMENT TRANSPORT PROBLEM

Change in Volume = Inflow - Outflow
- If negative, erosion will occur
- If positive, sedimentation will occur
STORM HYDROGRAPH

DISCHARGE

BED ELEVATION
CSU VIDEO

SCOUR AT BRIDGES
TYPES OF SCOUR

• Clear water – No transport of bed material from upstream or suspended material being carried through the crossing

• Live bed – Bed material from upstream is transported into the crossing
TOTAL SCOUR

- Aggradation/degradation
- General scour
- Local scour
- Stream migration
AGGRADATION/DEGRADATION

- Long-term elevation changes
- Results from natural or man induced causes
- Deposition causes aggradation
- Scouring causes degradation
GENERAL SCOUR - CONTRACTION

- Flow area is reduced
- Shear stress increased
- Stream bed scours
GENERAL SCOUR - OTHER

- Planform characteristics
- Variable downstream control
- Flow around a bend
LOCAL SCOUR

[Diagram showing the concept of local scour with labels for Horseshoe Vortex and Wake Vortex.]
GENERAL DESIGN PROCEDURE

- Select design flood event
- Develop water surface profiles
- Estimate total scour
- Plot and evaluate total scour
- Evaluate bridge TS&L
- Perform foundation analysis
- Repeat the process for the superflood (SF=1)
DESIGN CONSIDERATIONS (GENERAL)

- Raise superstructure
- Anchor superstructures
- Use continuous spans
- Check for overlapping scour holes
- Reevaluate foundation design
- Consider partial or total inundation
DESIGN CONSIDERATIONS
(PIERS)

• Floodplain piers same as channel?

• Align piers to flow direction

• Streamline piers

• Ice and debris hazards

• Piers near abutments
DESIGN CONSIDERATIONS (ABUTMENTS)

- Equations over predict scour
- Design for contraction and long-term degradation and provide protection
- Minimize adverse flow conditions
- Use spill-through abutments and protect slope
- Protect downstream side of abutment
SPECIFIC DESIGN APPROACH (STEP 3 OF GENERAL DESIGN PROCEDURE)

- Determine scour analysis variables
- Analyze long-term bed changes
- Compute general scour
- Compute pier scour
- Determine abutment foundation
- Plot and evaluate
LEARNING OUTCOMES

• Define scour

• List design considerations for piers and abutments

• Define live-bed and clear-water scour

• Define total scour and discuss each of its three components