



## COURSE NUMBER

FHWA-NHI-130102A

## COURSE TITLE

### Engineering for Structural Stability in Bridge Construction (3.5 day)

The objective of this course is to train participants on the behavior of steel and concrete girder bridges during construction and teach them to identify vulnerabilities and engineering methods to investigate the structure's strength and stability at each critical stage. This is done within the practical context of engineering, development, verification, and/or review of erection plans.

Starting with basic structural stability principles, course participants are introduced to stability analysis methods and how they should be applied to properly engineer a bridge erection plan. The role of both permanent and temporary bracing in achieving structural stability is covered, and methods for bracing design presented. Behavior and design considerations for construction phases are provided through presentation of case studies, demonstrations, design examples, and guided walk-throughs. The impacts of construction practices, means, and methods are explored and demonstrated.

During bridge erection, the member support conditions, loads, stresses, strength, and stability are affected by the erection practices such as lifting, installation of bracing, bearing conditions, temporary supports, and placing sequence. Deck placing equipment, overhang brackets and staging can also have significant effects on girder stability. Thus, this course presents information on construction practices as it relates to these considerations.

Engineering criteria for use in evaluating bridges during erection are presented. Loading criteria and load factors for analysis are provided along with discussion of their applicability. Equations for checking member conditions during erection are included. Participants learn how loads during construction differ from final design conditions and appropriate methods to compute and apply those loads. The required contents of erection engineering plans, procedures, and submittals are presented in the course. Check lists are included to assist both the erection engineer and submittal reviewer.

This extended Course 130102A (3.5 days) provides an additional 8 hours of hands-on practicum where participants are given opportunity to apply advanced stability analysis on real-world examples, using software executed on laptop computers. This provides a valuable "capstone" experience to solidify their understanding, relate curriculum to practice, apply the concepts presented, and engage in self-discovery.

## OUTCOMES

Upon completion of the course, participants will be able to:

- Explain the fundamentals of stability theory and how they affect bridge strength and performance during construction
- Describe the differences between local, girder, and system (global) stability limit states
- Employ lessons learned from past stability-related failures to avoid similar results
- Explain common techniques for evaluating the stability of bridge members and components
- Choose an appropriate advanced stability analysis for a critical construction stage where stability is in question
- Describe the role of bracing and shoring and how to use them to provide stability
- Select loads, load combinations, and factors that are appropriate for the construction plan verification
- Assess procedures and details for a construction plan that will be safe and economical
- Employ stability evaluation techniques to conduct an erection analysis for steel girder and concrete splice girder bridges (3 ½ day course)

## TARGET AUDIENCE

This course has been developed for the needs of practicing public and private sector structural engineers with zero to approximately twenty years of experience. The primary audience is Host Agency and consultant bridge structural engineers and project managers, particularly those who prepare and/or review erection plans and procedures. The course will also be of benefit to bridge contractors and erectors as well as those Agency staff overseeing bridge erection.

**TRAINING LEVEL:** Basic

**FEE:** 2017: \$1100 Per Person; 2018: N/A

**LENGTH:** 3.5 DAYS (CEU: 2.4 UNITS)

**CLASS SIZE:** MINIMUM: 0; MAXIMUM: 0

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