ACEC/Maine DOT Bridge Design Subcommittee

MEETING AGENDA

September 16, 2014

Location
MaineDOT, Room # 227A/B

Time
10:00 AM to 11:30 AM

Purpose of Meeting
Third Quarter meeting 2014

Invitees

- ☐ Leanne Timberlake, MaineDOT
- ☐ Wayne Frankhauser, MaineDOT
- ☐ Craig Weaver, Kleinfelder
- ☐ Christopher Snow, GZA
- ☐ Tom Kendrick, MJ
- ☐ Mike Wight, MaineDOT
- ☐ Laura Krusinski, MaineDOT
- ☐ Marie Malloy, MaineDOT
- ☐ Ben Foster, MaineDOT
- ☐ Keith Donington, PB
- ☐ Steve Hodgdon, VHB

AGENDA ITEMS

1. Introductions
2. Information Dissemination by MaineDOT
    a. Contracting / GCA
    b. Workload / Staffing
3. Summary of Designer Meetings
4. Discussion Topics
    a. Bridge Rating Policies and Procedure Updates (Ben Foster)
    b. Questions from Consultant Community (Protocol on structural deficiency discovery during inspections – Maine contacts…primary, secondary, etc.)
    c. Training Areas (Hydraulics and HEC-RAS, Prestressed Concrete, CADD and Plan Development, NBIS training, Other?)
    d. Other
5. Subcommittee Rotation for Consultants (2-yr rotations for new members joining 2014 and later)

a.	Craig Weaver:	Q4 2011 thru Q1 2015
b.	Steve Hodgdon	Q1 2013 thru Q4 2015
c.	Chris Snow	Q1 2013 thru Q4 2015
d.	Keith Donington	Q4 2013 thru Q3 2016
e.	Tom Kendrick	Q3 2014 thru Q2 2016
f.	Jack Burgess	Q2 2015 thru Q1 2017
g.	Tim Merritt	Q1 2016 thru Q4 2017
h.	Geotechnical Rep TBD	Q1 2016 thru Q4 2017
i.	Vacant	Q4 2016 thru Q3 2018

6. Set Next Meeting

ACEC/MaineDOT Bridge Design Subcommittee

MEETING MINUTES

September 16, 2014

Attendees:		**Location:** MDOT Conference Rm. #227 A/B
Leanne Timberlake	MaineDOT	
Wayne Frankhauser	MaineDOT	
Mike Wight	MaineDOT	
Jeff Folsom	MaineDOT	
Laura Krusinski	MaineDOT	
Ben Foster	MaineDOT	
Steve Hodgdon	VHB	
Keith Donington	PB	
Tom Kendrick	MJ	
Christopher Snow	GZA	
Craig Weaver	Kleinfelder	**Notes Taken By:** Keith Donington

This was the third quarter ACEC/MaineDOT Bridge Design Subcommittee meeting for this year.

- **Information from ACEC Subcommittee**

  - Steve H. introduced Tom Kendrick from MJ. This was Tom's first committee meeting.
  - June 3rd Meeting Minutes accepted
  - There is currently a high demand and a waiting list for consultants to join the Bridge Subcommittee. Alternatives were discussed to allow more involvement. (As discussed in the previous meeting, the group felt the best solution was to reduce individual terms from 3 years to 2 years. A new member would be replaced every 6 months. Wayne F. suggested the current schedule of consultant members be maintained and begin 2-year terms for newly introduced members.)
  - Steve said the committee is looking for a geotech and one other spot. Needs to be first come/served basis – apply by website
  - Laura K. has spread the word to contact Steve for geotech nominations.

- **Information from MaineDOT**

Wayne F update:

  - Work Plan- A 3 year work plan has been developed, for 2015, 2016 and 2017, with a budget of $53M. The plan is reevaluated every year. There will be more of a focus made on bridge preservation rather than bridge replacement.

- Bridge Program - Rich Myers promoted to lead Team South, which is interviewing for several new positions including an AE-Geotechnical Engineer, Fabrication Engineer, and Utility coordinator/assistant
- Looking at finalizing the 2015 schedule for projects with lock-down at end of the year. ROW is taking between 6 to 8 months to process and need to find ways to expedite.
- Kittery Overpass ABC project was very successful. Leanne T. was the PM and MJ were the designers.

Jeff F. explained that GCA quals are due Oct 2. Clarifications had been received for Geotech which would be posted on the web. No clarifications received as yet for Structures

Ben Foster update:

- Wayne, Mike and Ben attended NE Peer exchange to discuss problems with LRFR load rating. RI and Maine are the only states going with LRFR method for all bridges. Other New England states are waiting until a new bridge is built to rate by LRFR.
- Have received clarifications from Mr. Lubin Gao Ph.D, the load rating guru from FHWA.
- Some changes will be coming (e.g. condition factors, cracking in tension zones for RC concrete)
- Maine Load Rating Guide revisions are in progress, including changes to posting load requirements
- MBE is calibrated very conservatively. Posting Committee meets to makes final judgments for posting loads taking into account degree of conservatism and long term performance of each bridge
- Three consultants met with the Department to discuss use of 75% composite action assumption with no shear connectors for steel stringer/concrete decks. University of Maine load testing has shown under good conditions that 75% is realistic. Concrete curbs and bridge rail curbs also provide stiffening and additional load carrying capacity.
- In 2015, there will be fewer load rating contracts issued to consultants as so many were done in 2014. New rating assignments will be coming out soon after January. However, several RFPs will be coming out for big bridge inspections.
- In 2015 there will be additional load testing carried out including running a test truck over a concrete bridge. Some States rate concrete bridges by just by visual inspection.
- In response to a question submitted to the committee, the Protocol for consultants to report Bridge Inspection Emergencies found both during NBIS bridge inspections as well as during inspections for load rating purposes was discussed.
- Ben is to be notified or the MaineDOT PM/Lead for the consultant’s contract. MaineDOT should be notified immediately by the inspector on site if a

previous condition rating has deteriorated to a 2 (i.e. Critical rating) .The Bridge Inspection Guide provides guidance, and Ben typically includes guidance in RFP's for consultant services.

- NBIS Bridge Inspection Training
- 2 week training course
- FCM training done a couple of years ago.
- Refresher course – required every 5 years by Maine DOT
- FAA has shutdown the idea of using drones for bridge inspection.

Mike Wight discussed Designer Meetings (see attached Designer Meeting Minutes for more details about the topics listed below):

A. Designers' Meeting July 19, 2014
   1. Enhance PMT Concrete Additive – basically new product found not to be effective.
   2. Finger Joint Changes – Fairfield - Due to a joint failure, Maine DOT on new projects is increasing the number of headed studs, and will be revising the detail soon in the Design Guide. NHDOT has a stronger detail.
   3. Project Candidates for FRP Bridge Drains
   4. Rail Test Level for Temporary Detour Bridge Railing Design for updated 510 Standard Specification – 510 specs refers to old LFD technology, and MaineDOT may change to crash test requirements on detour bridges
   5. New Guardrail Standard Height

B. Designers' Meeting August 20, 2014
   1. Future Designer Training
   2. Upcoming Revisions to AASHTO LRFD Design Specifications
      Wayne and Mike attended AASHTO meeting in June. Proposed committee changes should be included in 2015 LRFD update. Changes include:
      -MBE section on fatigue is being completely revised
      - New section on micro-piles, and composite action filled steel tubes
      -Rebar development lengths being made longer
      - Seismic design handout (see attached). Clarification is to be issued. Always has been a minimum connection required between super and substructure but it was never the intent to carry the connection design force into the design of the substructure.
      - MaineDOT will approve changes in conflict with their Design Guide on a project by project basis until they have had a chance to try out the new code.

3. Deck formwork/falsework design procedure - run through Maine DOT fabrication group if any questions
4. Discontinuing LUSAS – license dropped as program not being used. MaineDOT typically uses STADD instead
5. Bangor ASR trip

C. Designers' Meeting September 3, 2014

1. Maintenance of Traffic on Box Culvert Projects – Contractors have asked for option for using detours instead of staged construction but it generally takes 6 weeks to acquire ROW. Hence, on future projects acquiring additional ROW will be a consideration made during the design phase (especially in rural areas where no houses are involved) to provide contractors with both options.
2. NHI Training Options (see attached)

- **Possible Future Training**
  - See list of NHI bridge training courses (attached) provided by Mike.
  - Training areas to be discussed at next meeting and selections and preferences determined.

- **Next Meeting Date**
  - December 16, 2014 at 1:00PM to 2:30PM in room 317A/B

Attachments: Designer Meeting Minutes from July 9th, August 20th and September 3rd, 2014

I have attempted to summarize discussions held during this meeting as accurately as possible. If there are any items discussed herein that are misrepresented in any way, please contact me within ten working days. In the absence of any corrections or clarifications, it will be understood that these minutes accurately summarize the discussions at the meeting.

Respectfully Submitted,

Keith Donington, P.E.

Designers Meeting Agenda

Wednesday July 9th, 2014

Conference Room 317 A&B

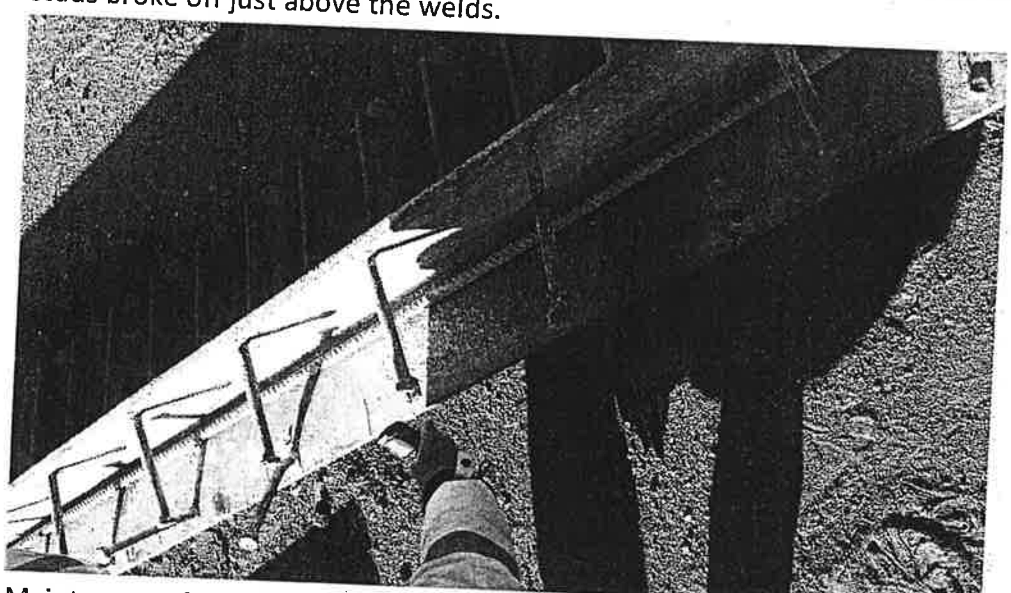
1:00-2:30 PM

1. **Enhance PMT Concrete Additive**
   Joe Stilwell
   5 minutes

   Enhance PMT is a concrete densifier similar to Xypex. The Concrete and Bridge Evaluation Committee wanted to know if there was any interest in testing Enhance PMT. The Bridge Designers were open to trying Enhance PMT as long as it is provided at no cost to the Department.

2. **Finger Joint Changes-Fairfield**
   Wayne Frankhauser/Bill Doukas
   20 minutes

   The finger joints on pier 5 at Fairfield/ Benton failed shortly after being installed. The studs broke off just above the welds.



Maintenance fixed the joint by welding more studs on it. There were several purposed long term fixes ranging from require fabricators to use stud guns to changing the Standard Detail to match New Hampshire's or add more studs. The recommended solution is to add more studs to the larger finger joints and step up QA inspection during the joint fabrication. Devon Eaton and Ed were assigned to come up with the amount of studs that need to be added.

3. **Project Candidates for FRP Bridge Drains**
   Michael Wight
   5 minutes

   Mike is looking for a medium sized bridge to use FRP drains. More details to follow from him.

4. **Rail test level for Temporary Detour Bridge railing design for updated 510 standard specification**
   Michael Wight
   15 minutes

   Mike wanted to know if the Section 510- Special Detours Special should be updated to require a LRFD test level for temporary detours. Any change would affect Mabey Bridges used for detours. Rodger Naous is going to check for any design load ratings for Mabey Bridges.

5. **New Guardrail Standard Height**
   Michael Wight

   The new standard height for guardrail changed to 30" from 27.75". Jeff Folsom is going to FHWA for permission to raise the bridge transition heights to match the new guardrail height. We will potentially adopt the New Hampshire bridge transition detail.

Designers Meeting Minutes

Wednesday, August 20th 2014

Conference Room 317 A&B

1:00-2:30 PM

1. **Future designer training**
   10 minutes
   Michael Wight
   Does anyone have ideas for the next training?

   NHI- Hydraulics was suggested

2. **Upcoming revisions to AASHTO LRFD Bridge Design Specifications**
   30 minutes
   Michael Wight

   Multiple changes accepted at the AASHTO Meeting
   MBE Load Rating updates including a section for fatigue life and changes to gusset plates
   New micro pile section
   New Designs for composite concrete filled steel tubes
   Adding coding for rolling direction for splice plates
   New guidelines for steel girder erection and coatings
   New LRFD for Highway signs and traffic signals
   More research completed on rebar development lengths- the development lengths will get longer
   Seismic code change- don't carry loads through the substructure

3. **Deck formwork/false work design procedure**
   15 minutes
   Michael Wight

   PE stamp required for form and false work plans
   Needs to be enforced and the plans need to be sent to the Fab Group

4. **Discontinuing LUSAS**
   5 minutes
   Garrett Gustafson

   Not renewing the LUSAS license

5. **Bangor ASR Trip**
   5 minutes
   Tyler Hjelm

   Follow up trip to the FHWA study to test and monitor ASR
   The test were a 3-pin set up to measure movement horizontally and vertically and caped drilled holes to measure moisture
   The trip was the first one since the DOT took over monitoring the ASR
   The FHWA report will coming in the near future

Designers Meeting Minutes

Wednesday, September 3, 2014

Conference Room 317 A&B

1:00-1:45 PM

Attendees: Mike Wight, Rich Myers, Joel Veilleux, Laura Krusinski, Joe Stilwell, Tyler Hjelm, Brian Nichols, Joel Kittredge, Josh Hasbrouck, Mark Parlin

1. **Maintenince of Traffic on Box Culvert Projects**
   Mike Wight

   For projects with staged construction some contractors want a temporary detour option. Specifically for culvert replacement projects under a lot of fill, the temporary detour option could be cheaper. It would require more right of way on projects that have this option. Currently the Contractor can VE the project and build a temporary detour but the DOT still needs to acquire the right of way (6-8 weeks), which may not leave the contractor enough time. Mike is going to follow up with Rodger to get expected costs of increasing the right of way. For now it will be a case by case whether to allow the option of a temporary detour.

2. **Training Options**
   Rich Myers

   Rich looked into the available FWHA and NHI training options. Attached are the summaries of each course. Everyone is encouraged to look at the courses and recommend their preferred option.

2014 AASHTO BRIDGE COMMITTEE AGENDA ITEM: 43 (REVISION 1)

SUBJECT: Guide Specifications for LRFD Seismic Bridge Design: Section 1, Article 1.3, and Section 4, Article 4.6

TECHNICAL COMMITTEE: T-3 Seismic

☒ **REVISION** ☒ **ADDITION** ☐ **NEW DOCUMENT**

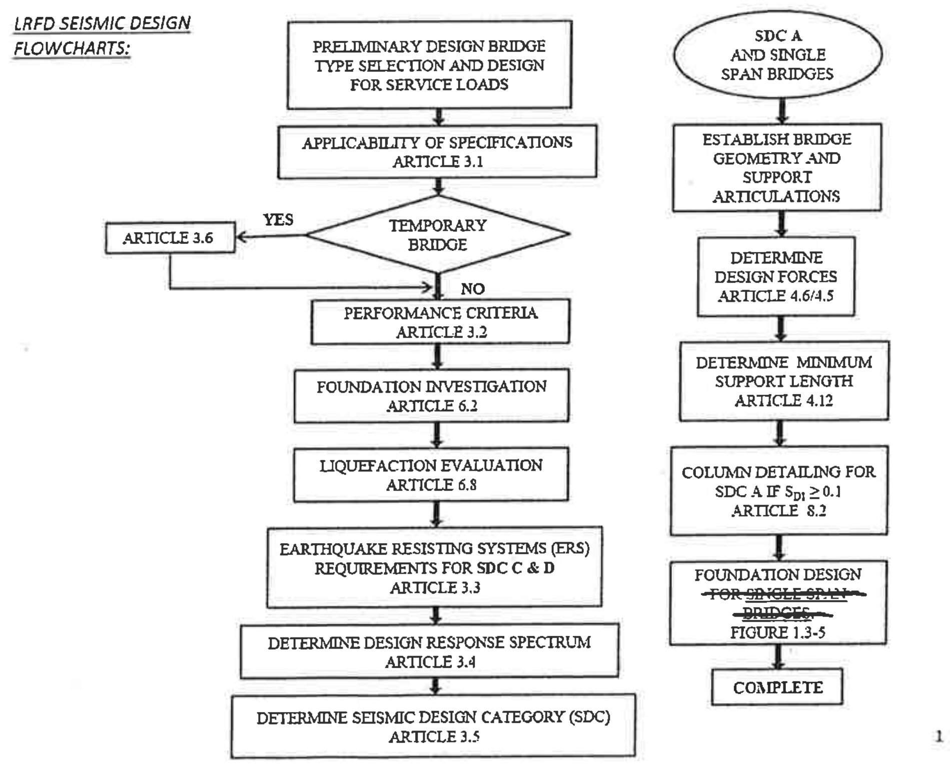
☐ **DESIGN SPEC** ☐ **CONSTRUCTION SPEC** ☐ **MOVABLE SPEC**
☐ **MANUAL FOR BRIDGE EVALUATION** ☒ **SEISMIC GUIDE SPEC** ☐ **COASTAL GUIDE SPEC**
☐ **OTHER**

DATE PREPARED: 1/10/14
DATE REVISED: 6/24/14

AGENDA ITEM:

<u>Item#1</u>

In Article 1.3, change the term "SDC A" to "single-span bridges" in the foundation design box of the "SDC A and Single Span Bridges" flowchart in Figure 1.3-1.



Item #2

Delete the third paragraph of Article 4.6.

Item #3

Revise the first paragraph of Article C4.6 as follows:

These provisions arise because, as specified in Articles 4.1 and 4.2, seismic analysis for bridges in SDC A is not generally required. ~~These default values are used as~~ The minimum connection design forces of this Article are used in lieu of determining such forces through rigorous analysis. The division of SDC A at an acceleration coefficient of 0.05 recognizes that, in parts of the country with very low seismicity, seismic forces on connections are ~~very~~ relatively small. However as outlined below, the intent of this Article is to prevent connections from becoming unintended weak links in the seismic lateral load path. Accordingly, the minimum connection forces specified in this Article are intended to be sufficiently conservative to prevent premature failure and are not intended to precisely reflect the expected dynamic seismic forces. Connections that transfer forces from one part of a structure to another include, but are not limited to, fixed bearings, expansion bearings with restrainer devices, STUs or dampers and shear keys. Note that a connection, as considered in this Article, may be an element that simply restrains a member and may not physically connect to that member, such as transverse shear keys. Additionally, anchorage detailing for connections should be extended far enough into the adjacent member to ensure that premature or unintentional local failure is prevented. Similarly, the design of a girder support pedestal should consider the connection forces specified in this Article, since failure of a pedestal located above the ~~main~~ pier cap could potentially lead to loss of span support.

Item #4

Insert a new second paragraph and additional paragraphs to Article C4.6 as follows:

In SDC A, the prevention of superstructure collapse due to unseating of spans is the primary objective behind the provisions for minimum connection forces in restrained directions, as covered by this Article, and for minimum support lengths for unrestrained directions (e.g. expansion bearings), as covered by Article 4.12. The minimum connection forces specified in this Article are not intended to be minimum design forces for the substructure or foundation because the main elements of a bridge in SDC A should generally be capable of resisting the expected lateral seismic forces by virtue of satisfying the nonseismic design requirements. However, this presumed structural resistance is predicated on providing sufficient integrity and connectivity within the structure to mobilize the lateral resistance of the main structural elements (e.g. columns, pier caps, superstructure, abutments and foundations).

Accordingly, the design forces for connections need only be considered for those elements that directly prevent loss of span support or prevent system instability. Connections that fall into this category include, but are not limited to, those elements restraining the superstructure at in-span hinges and at substructure support locations. Other connections in this category include connections between substructure elements if failure of such connections could lead to loss of span support. For example, failure of the connections between steel piles and a precast concrete bent cap could lead to loss of support for both the cap and superstructure, and therefore such connections should meet the requirements of this Article.

If the minimum connection forces are deemed unreasonably large, the design may be completed using the requirements of a higher seismic zone. The minimum requirements of this Article require adequate connection strength for restrained directions and adequate support length in unrestrained directions. In many cases, it is feasible, conservative and economical to provide both sufficient connection force capacity and support length and should be considered. In situations where load sharing of connections may be uncertain, adequate support length, in addition to the required connection force capacity, should be considered. An example is the case of bearings that may not take up load equally, thus leading to the possibility of "unzipping" of the lateral restraint elements. In cases where support length is needed in the transverse direction, the designer is cautioned that the minimum support length equations for N were developed empirically considering longitudinal response. Thus adequate support in the transverse direction should be based on engineering judgment to prevent loss of superstructure support.

NHI Training Courses – Bridge Topics

Structural Courses

Course Number: FHWA –NHI-130092

Course Title: The Fundaments of LRFR and Applications of LRFR for Bridge Superstructures

Fee: $1250 per person   Length: 4 days

Course Number: FHWA –NHI-130095A

Course Title: Fundamental and Structural Analysis for Curved and Skewed Steel Bridges

Fee: $850 per person   Length: 2.5 days

Course Number: FHWA –NHI-134062A

Course Title: Bridge Evaluation for Rehabilitation Design Considerations

Fee: $920 per person   Length: 5 days

Hydraulic Courses

Course Number: FHWA –NHI-135090

Course Title: Hydraulic Design of Safe Bridges

Fee: $750 per person   Length: 3 days

Course Number: FHWA –NHI-135046

Course Title: Stream Stability and Scour at Highway Bridges

Fee: $750 per person   Length: 3 days

Course Number: FHWA –NHI-135041

Course Title: HEC-RAS, River Analysis System

Fee: $750 per person   Length: 3 days

Course Number: FHWA –NHI-135041A

Course Title: HEC-RAS, River Analysis System

Fee: $800 per person Length: 3.5 days

Course Number: FHWA –NHI-135082

Course Title: Highways in the Coastal Environment

Fee: $750 per person Length: 3.5 days

Course Number

FHWA-NHI-130092

Course Title

Fundamentals of LRFR and Applications of LRFR for Bridge Superstructures

This course provides novice and experienced bridge engineers with the fundamental knowledge necessary to apply the most recent AASHTO LRFR Specifications to bridge ratings. This course introduces participants to applications of LRFR specifications that can be used to enhance bridge safety and to identify and discuss the steps to ensure successful transition to this new state-of-the art methodology.

Load Rating of Concrete and Steel Superstructure Bridges will provide participants with in-depth training in evaluating reinforced and prestressed concrete bridges and steel bridges using LRFR methodology. This course will illustrate the use of the current AASHTO evaluation specifications and state-of-the art evaluation methods with step-by-step examples.

Outcomes

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

- Describe the purpose of performing a load rating
- Identify the benefits of the LRFR methodology
- Demonstrate the LRFR process and the general load rating equations
- Explain legal loads and their use in load rating
- Determine distribution factors for load rating
- State the LRFR limit states
- Select evaluation factors for rating
- Describe the process for load posting and importance of load posting
- Describe the procedure for checking overload permits
- Demonstrate the application of LRFR requirements by completing load rating exercises
- Identify material deteriorations that affect load capacity of bridge components
- Calculate the flexural resistances of a prestressed concrete girder for load rating
- Calculate the shear resistance of a prestressed concrete girder for load rating
- Apply the load rating procedures for concrete slab bridges
- Calculate the flexural and shear resistance of a steel I-girder bridge for load rating
- Evaluate fatigue for load rating a steel girder bridge
- Apply LRFR requirements by completing load rating exercises

Target Audience

Bridge engineers with 0-20 years of experience.

Training Level: Basic

Fee: 2014: $1250 Per Person; 2015: $1250 Per Person

Length: 4 DAYS (CEU: 2.4 UNITS)

Class Size: MINIMUM: 20; MAXIMUM: 40

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-130092A

COURSE TITLE

Load and Resistance Factor Rating for Highway Bridges

This course provides novice and experienced bridge engineers with the fundamental knowledge necessary to apply the most recent AASHTO Load and Resistance Factor Rating (LRFR) Specifications to bridge load rating.

OUTCOMES

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

- Describe the purpose of performing a load rating
- Identify the benefits of the LRFR methodology
- Demonstrate the LRFR process and the general load rating equations
- Explain legal loads and their use in load rating
- Determine distribution factors for load rating
- State the LRFR limit states
- Select evaluation factors for rating
- Describe the process for load posting and importance of load posting
- Describe the procedure for checking overload permits
- Demonstrate the application of LRFR requirements by completing load rating exercises

TARGET AUDIENCE

Bridge engineers with 0-20 years of experience.

TRAINING LEVEL: Basic

FEE: 2014: $850 Per Person; 2015: $875 Per Person

LENGTH: 2 DAYS (CEU: 1.2 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 40

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

Course Number

FHWA-NHI-130095

Updated

Course Title

LRFD and Analysis of Curved Steel Highway Bridges

This five-day course expands the suite of FHWA services to assist State and local governments in a successful implementation of Load and Resistance Factor Design (LRFD). This course applies the principles of LRFD to the analysis and design of skewed and horizontally curved steel bridges. For structural applications, the curriculum follows the AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010 (AASHTO LRFD Specifications). The training course focuses primarily on the analysis and design of skewed and horizontally curved steel I-girder bridges. However, the accompanying Reference Manual also includes design examples for horizontally curved steel box-girder bridges.

This course provides a combination of instructor-led discussions and workshop exercises. It includes LRFD theory applied to design examples, and it illustrates step-by-step LRFD design procedures for skewed and curved steel bridges. The course includes participant exercises in which students apply the LRFD principles to specific applications, guided walk-throughs in which the instructor guides the participants through design examples, case studies in which real-life examples are used to illustrate the principles being learned, as well as models to help participants observe firsthand the behavior of skewed and curved bridges.

The curriculum materials are comprised of a comprehensive Reference Manual, lecture and workshop exercises intended to promote and enhance a working knowledge of the AASHTO LRFD Specifications as they apply to skewed and curved steel bridges, and a Participant Workbook containing slides, design examples, exercises, narrative descriptions and room for participant notes.

The curriculum material contains the following major topics:

1. General introduction (course introduction and overview)
2. Fundamentals (system behavior, torsion and live load force effects)
3. Structural analysis (general analysis considerations, bearing constraints, approximate methods, 2D refined methods, 3D refined methods and recommended level of analysis)
4. Design (preliminary design decisions, girder design verifications and design detail items)
5. Fabrication and construction

Outcomes

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

- Describe the bridge superstructure analysis, design, fabrication and construction process for skewed or horizontally curved steel I-girder superstructures and for horizontally curved steel box-girder superstructures in accordance with the AASHTO LRFD Specifications
- Illustrate the application of the AASHTO LRFD Specifications to the analysis and design process for skewed and curved steel-bridge superstructures, taking into account erection and construction considerations
- Demonstrate understanding of analysis and design specification requirements for skewed and curved steel girder bridges through the completion of participant exercises and guided walk-throughs and the review of design examples

Target Audience

This course has been developed for the needs of practicing public and private sector structural and bridge engineers with 0 to approximately 20 years of experience. The primary audience is Host Agency and consultant structural designers. Pre-training Competencies: Individuals attending this course should have a minimum BSCE degree and have a working knowledge of the current AASHTO LRFD Specifications or the AASHTO Standard Specifications for Highway Bridges. They should also have relevant design experience using either of these specifications on at least one bridge superstructure.

TRAINING LEVEL: Basic

FEE: 2014: $1250 Per Person; 2015: N/A

LENGTH: 5 DAYS (CEU: 3.1 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

Course Number

FHWA-NHI-130095A

Course Title

Fundamental and Structural Analysis for Curved and Skewed Steel Bridges

This 2½-day course presents the first half of the five-day course (Course No. FHWA-NHI-130095). It expands the suite of FHWA services to assist State and local governments in a successful implementation of Load and Resistance Factor Design (LRFD). This course applies the principles of LRFD to the analysis of skewed and horizontally curved steel bridges. For structural applications, the curriculum follows the AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010 (AASHTO LRFD Specifications). The training course focuses primarily on the analysis of skewed and horizontally curved steel I-girder bridges. However, the accompanying Reference Manual also includes design examples for horizontally curved steel box-girder bridges.

This course provides a combination of instructor-led discussions and workshop exercises. It includes LRFD theory applied to analysis examples, and it illustrates step-by-step LRFD analysis procedures for skewed and curved steel bridges. The course includes participant exercises in which students apply the LRFD principles to specific applications, guided walk-throughs in which the instructor guides the participants through analysis examples, case studies in which real-life examples are used to illustrate the principles being learned, as well as models to help participants observe firsthand the behavior of skewed and curved bridges.

The curriculum materials are comprised of a comprehensive Reference Manual, lecture and workshop exercises intended to promote and enhance a working knowledge of the AASHTO LRFD Specifications as they apply to skewed and curved steel bridges, and a Participant Workbook containing slides, analysis examples, exercises, narrative descriptions and room for participant notes.

The curriculum material contains the following major topics:

1. General introduction (course introduction and overview)
2. Fundamentals (system behavior, torsion and live load force effects)
3. Structural analysis (general analysis considerations, bearing constraints, approximate methods, 2D refined methods, 3D refined methods and recommended level of analysis)

Outcomes

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

- Describe the bridge superstructure analysis process for skewed or horizontally curved steel I-girder superstructures and for horizontally curved steel box-girder superstructures in accordance with the AASHTO LRFD Specifications
- Illustrate the application of the AASHTO LRFD Specifications to the analysis process for skewed and curved steel-bridge superstructures
- Demonstrate understanding of analysis specification requirements for skewed and curved steel girder bridges through the completion of participant exercises and guided walk-throughs and the review of analysis examples

Target Audience

This course has been developed for the needs of practicing public and private sector structural and bridge engineers with 0 to approximately 20 years of experience. The primary audience is Host Agency and consultant structural designers. Pre-training Competencies: Individuals attending this course should have a minimum BSCE degree and have a working knowledge of the current AASHTO LRFD Specifications or the AASHTO Standard Specifications for Highway Bridges. They should also have relevant design experience using either of these specifications on at least one bridge superstructure.

Training Level: Basic

Fee: 2014: $850 Per Person; 2015: $850 Per Person

Length: 2.5 DAYS (CEU: 1.6 UNITS)

Class Size: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-134062A

COURSE TITLE

Bridge Evaluation for Rehabilitation Design Considerations 5-Day

The ultimate goal of this effort is the development of a nationally accepted program that will serve to improve quality, ensure uniformity, and establish a minimum standard for bridge rehabilitation. The course will present innovative and state-of-the-art bridge rehabilitation technologies and procedures for a broad array of structural elements including bridge decks, girders, piers, and abutments.

The 5-day version of this course includes two additional modules on the rehabilitation of timber and masonry structures.

OUTCOMES

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

- Describe conditions that suggest the need for rehabilitation
- Identify the need for, and capacity of, destructive and/or non destructive testing (NDT) for assessment of existing conditions
- Prescribe analysis and load testing to determine the effect of existing conditions on the structure
- Distinguish root causes of distress and deterioration
- Formulate appropriate rehabilitation strategies
- Select procedures and materials for rehabilitation
- Develop effective rehabilitation construction documents
- Prepare and implement quality assurance for construction
- Monitor and resolve construction and material problems

TARGET AUDIENCE

The target audience includes design engineers, field engineers, resident engineers, structural engineers, materials engineers, and other technical personnel involved in the construction and rehabilitation design of bridges. Participants with an engineering background are expected to constitute the target audience. People knowledgeable in new bridge design, but not necessarily bridge rehabilitation should attend.

TRAINING LEVEL: Intermediate

FEE: 2014: $920 Per Person; 2015: $1225 Per Person

LENGTH: 5 DAYS (CEU: 3 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-135090

New

COURSE TITLE

Hydraulic Design of Safe Bridges

The National Highway Institute's (NHI) 3-day 135090 Hydraulic Design of Safe Bridges course provides participants with an intensive training on the hydraulic analysis and design of bridges. The goal of this course is to provide information needed to safely build bridges, while optimizing costs and limiting the impact to property and the environment.

This engaging course includes 12 mandatory lessons that are standard to the course and 3 optional lessons that allow the host agency to customize the course to their particular needs. The optional lessons are: a lesson intended for coastal states with bridges crossing tidal waterways; a lesson that supplements the Unsteady Flow Modeling Concepts lesson and provides additional knowledge of the requirements for one-dimensional unsteady flow modeling; and a lesson that supplements the Scour and Stream Instability Concepts lesson, which enables participants to identify situations requiring sediment transport computations as part of the bridge hydraulics analysis. The host agency will select two optional lessons for the delivery of this course.

Material for this 3-day course is primarily derived from the Hydraulic Design Series No. 7 (HDS 7), Hydraulic Design of Safe Bridges, which is provided to course participants. The course covers significant aspects of bridge hydraulic design including: regulatory topics, specific approaches for bridge hydraulic modeling, hydraulic model selection, bridge design impacts on scour and stream instability, and sediment transport.

Prior to the beginning of the course, participants are strongly encouraged to enroll in the Web-based training (WBT) entitled, 135091 Basic Hydraulic Principles Review. Mastery of the concepts covered in this WBT is important to successful completion of this course.

OUTCOMES

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

- Describe the ways hydraulic design affects bridge performance and public safety
- Describe hydraulic conditions that occur in the vicinity of bridges
- Identify regulatory requirements and design constraints important to bridge projects
- Describe the input requirements for one-dimensional models
- Identify conditions when one-dimensional modeling is adequate to develop accurate hydraulic results for safe bridge design
- Describe the effects of atypical bridge hydraulic conditions on bridge design
- Perform a qualitative risk assessment for a bridge replacement project
- Describe the properties and input requirements for two-dimensional models
- Distinguish conditions requiring two-dimensional modeling to develop accurate hydraulic results for safe bridge design
- Define the types of scour and stream instability that affect bridge design
- Identify how hydraulic variables are obtained from one- and two-dimensional models
- Assess whether a replacement bridge design alternative will have adequate hydraulic capacity to meet design criteria
- Distinguish conditions requiring unsteady flow modeling to develop accurate hydraulic results for safe bridge design
- Describe additional analyses that contribute to the hydraulic aspects of safe bridge design
- Determine the minimum required foundation depth based on scour conditions
- Assess the likelihood of a bridge project causing adverse hydraulic impacts downstream
- Demonstrate strategies for communicating hydraulic recommendations to various stakeholders

TARGET AUDIENCE

The target audience for 135090 Hydraulic Design of Safe Bridges is primarily members of Federal or State departments of transportation. This typically includes hydraulic engineers with a wide range of experience; however, structural and geotechnical engineers would benefit from an understanding of many of the topics in this course. The complexity of some of the engineering decisions made can have significant impacts on structural and geotechnical designs. Additionally, many other segments of the national and international engineering community may find this course valuable. Federal, State, and local highway hydraulic engineers responsible for maintaining the integrity of highway bridges against possible hydraulic related problems will rely on this course and HDS 7 for guidance. Consultants who perform bridge engineering work are also encouraged to attend.

TRAINING LEVEL: Intermediate

FEE: 2014: $750 Per Person; 2015: N/A

LENGTH: 3 DAYS (CEU: 1.8 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-135041

COURSE TITLE

HEC-RAS, River Analysis System (3-Day)

The host is responsible for providing 15 computers with the following minimum configuration: 850 MHz Intel Pentium III Processor or equivalent with 128 MB RAM, Windows NT 4.0 with Service Pack 6a or 98 Second Edition or 95 (SR-1), 100 MB available disk space, CD-ROM drive, and 1024 x 768 color video display.

HEC-RAS is a computer program designed as the successor to the U.S. Army Corps of Engineers' Hydraulic Engineering Circular HEC-2, Water Surface Profiles program (WSPRO). The program incorporates the Standard Step Method for Water Surface Profile computations, bridge hydraulics, including the method presented in WSPRO, culvert hydraulics, flood encroachments, design of open channel flow, analyzing split flow options and sub- and supercritical flow computations. The program can be used to compute bridge pier and abutment scour following the HEC-18 guidelines. The program is Windows-based and uses a graphical user interface for file management, data entry and editing, program execution and output display. It provides easy conversion from English to metric units and vice versa.

Both courses provide an overview and hands-on experience with the computer program, including modeling of bridges, but the 3.5-day version adds coverage of culvert modeling or multiple-opening bridges. A representative from the host agency is encouraged to contact the instructor when setting up the course to determine which length course would best suit the needs of the course participants and if the 3.5-day version is requested whether coverage of culverts or multiple-opening bridges is preferred. Each participant will receive a notebook containing the course notes, and a CD containing user documentation, HEC-RAS software, and example computer workshops.

Prior to the beginning of the course, participants are strongly encouraged to enroll in the Web-based training entitled, 135091 basic Hydraulic Principles Review. Mastery of the concepts covered in this WBT is important to successful completion of the Instructor-led training.

OUTCOMES

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

- Apply the conservation of mass, energy and momentum to computations of water surface profiles, hydraulics of bridges, and the hydraulics of culverts
- Create cross section, bridge, and culvert data files
- Create flow files
- Run the HEC-RAS computer program to solve all applications as presented in this course
- Troubleshoot the output data to determine the validity of the results

TARGET AUDIENCE

Federal, State, and local hydraulic engineers who have responsibility for the design and analysis of river systems and stream crossings. Participants should have experience in using the Windows environment and knowledge of the fundamentals of open channel flow, including basic understanding of HEC-2 or WSPRO.

TRAINING LEVEL: Intermediate

FEE: 2014: $750 Per Person; 2015: N/A

LENGTH: 3 DAYS (CEU: 3 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-135041A

COURSE TITLE

HEC-RAS, River Analysis System (3.5-Day)

The host is responsible for providing 15 computers with the following minimum configuration: 850 MHz Intel Pentium III Processor or equivalent with 128 MB RAM, Windows XP or Windows NT 4.0 with Service Pack 6a or 98 Second Edition or 95 (SR-1), 100 MB available disk space, CD-ROM drive, and 1024 x 768 color video display. Note: Software is not yet compatible with Windows 2007 (Vista).

HEC-RAS is a computer program designed as the successor to the U.S. Army Corps of Engineers' Hydraulic Engineering Circular HEC-2, Water Surface Profiles program (WSPRO). The program incorporates the Standard Step Method for Water Surface Profile computations, bridge hydraulics, including the method presented in WSPRO, culvert hydraulics, flood encroachments, design of open channel flow, analyzing split flow options and sub- and supercritical flow computations. The program can be used to compute bridge pier and abutment scour following the HEC-18 guidelines. The program is Windows-based and uses a graphical user interface for file management, data entry and editing, program execution and output display. It provides easy conversion from English to metric units and vice versa.

Both courses provide an overview and hands-on experience with the computer program, including modeling of bridges, but the 3.5-day version adds coverage of culvert modeling or multiple-opening bridges. A representative from the host agency is encouraged to contact the instructor when setting up the course to determine which length course would best suit the needs of the course participants and if the 3.5-day version is requested whether coverage of culverts or multiple-opening bridges is preferred. Each participant will receive a notebook containing the course notes, and a CD containing user documentation, HEC-RAS software, and example computer workshops.

Prior to the beginning of the course, participants are strongly encouraged to enroll in the Web-based training entitled, 135091 basic Hydraulic Principles Review. Mastery of the concepts covered in this WBT is important to successful completion of the Instructor-led training.

OUTCOMES

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

- Apply the conservation of mass, energy and momentum to computations of water surface profiles, hydraulics of bridges, and the hydraulics of culverts
- Create cross section, bridge, and culvert data files
- Create flow files
- Run the HEC-RAS computer program to solve all applications as presented in this course
- Troubleshoot the output data to determine the validity of the results

TARGET AUDIENCE

Federal, State, and local hydraulic engineers who have responsibility for the design and analysis of river systems and stream crossings. Participants should have experience in using the Windows environment and knowledge of the fundamentals of open channel flow, including basic understanding of HEC-2 or WSPRO.

TRAINING LEVEL: Intermediate

FEE: 2014: $800 Per Person; 2015: N/A

LENGTH: 3.5 DAYS (CEU: 2.1 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

COURSE NUMBER

FHWA-NHI-135046

COURSE TITLE

Stream Stability and Scour at Highway Bridges

The National Highway Institute's (NHI) 3-day Stream Stability and Scour at Highway Bridges course provides participants with comprehensive training in the prevention of hydraulic-related bridge failures. Course participants will receive training in conducting a stream stability classification and qualitative analysis of stream response and make estimates of scour at a bridge opening.

Material for the course comes primarily from two Hydraulic Engineering Circulars (HEC), "Evaluating Scour at Bridges" (HEC-18), 5th Edition (2012), and "Stream Stability at Highway Structures" (HEC-20), 4th Edition (2012). The effects of stream instability, scour, erosion, and stream aggradation and degradation are covered. Quantitative techniques are provided for estimating long-term degradation and for calculating the magnitude of contraction scour in a bridge opening. Procedures for estimating local scour at bridge piers and abutments for simple and complex substructures are also provided. A comprehensive workshop integrates qualitative analysis and analytical techniques to determine the need for a Scour Plan of Action for correcting stream instability and scour problems. For this 3-day course, the host agency will need to select 3 optional topics (out of 8 possible topics). Course instructors will contact the host prior to the course to complete a pre-course questionnaire, determine optional topics to be taught, and discuss the course schedule.

This comprehensive training provides preventive techniques for identifying, analyzing, and calculating various hydraulic factors that impact bridge stability. Public and private sector engineers responsible for maintaining the integrity of highway bridges will find it invaluable.

Prior to the beginning of the course, participants are strongly encouraged to enroll in the following Web-based training (WBT) courses: 135091 Basic Hydraulic Principles Review, 135086 Stream Stability Factors and Concepts, and 135087 Scour at Highway Bridges: Concepts and Definitions. Mastery of the concepts covered in these WBTs will enhance participation in the Instructor-led training.

OUTCOMES

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

- Identify indicators of stream instability that can threaten bridges
- Identify stream types and their potential for instability problems
- Describe open-channel hydraulics concepts in bridge scour and stream instability analyses
- Define types of scour that can occur at bridge crossings
- Describe aggradation, degradation, and contraction scour
- Calculate contraction scour for live bed and clear water conditions
- Describe factors that influence scour at piers
- Calculate pier scour for three typical case studies
- Describe the factors that influence scour at abutments
- Describe how HEC-18, HEC-20, and HEC-23 provide analysis procedures for stream instability and bridge scour
- Perform Level I and II analyses
- Classify a stream using two different classification systems
- Conduct a qualitative analysis of stream responses
- Apply the HEC-18 scour equations to determine total scour at a bridge
- Determine the need for a Scour Plan of Action at a scour-critical bridge

TARGET AUDIENCE

Federal, State, and local highway hydraulic, structural, and geotechnical engineers as well as bridge inspectors responsible for maintaining the integrity of highway bridges against possible hydraulic-related problems. Consultants who perform bridge engineering work are encouraged to attend.

TRAINING LEVEL: Intermediate

FEE: 2014: $750 Per Person; 2015: N/A

LENGTH: 3 DAYS (CEU: 2 UNITS)

CLASS SIZE: MINIMUM: 20; MAXIMUM: 30

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov

Course Number

FHWA-NHI-135082

Course Title

Highways in the Coastal Environment

Over 60,000 miles of roads in the United States are occasionally exposed to coastal surge and waves. Due to these unique design conditions, many highways and bridges suffer damage during coastal storms, including hurricanes and El Nino events. The purpose of this course is to teach important concepts and terminology of coastal science and engineering to highway engineers for use in the planning and design of coastal roads. The course is based on the Hydraulic Engineering Circular (HEC) No. 25, "Highways in the Coastal Environment" (2nd Edition), which is also used in the course as a reference manual.

The course includes the use of a portable flume for demonstration of key concepts and for hands-on participant activities. In addition to the presentation of materials and the flume demonstrations, the course incorporates various workshops and exercises to reinforce key concepts. Topics covered in the course include:

1. Introduction to highways in the coastal environment
2. Waves
3. Tide and water levels
4. Revetment design for coastal embankments
5. Wave loads on bridge decks
6. Coastal geology and sediments
7. Shoreline change and stabilization
8. Road overwash
9. Tidal inlets and coastal bridges

Outcomes

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

- Describe coastal engineering design issues related to highways using standard terminology with an understanding of the physical processes unique to this design environment
- Identify appropriate planning, analysis, and design methods for highways and bridges exposed to coastal surge and waves
- Describe differing levels of complexity involving coastal engineering and appropriate qualifications of engineers and coastal engineering consultants to address this complexity in design.

Target Audience

Participants are adult learners with (1) a general civil engineering education and background who currently work in highway planning and design and (2) coastal engineers with some experience in transportation engineering.

Training Level: Intermediate

Fee: 2014: $750 Per Person; 2015: N/A

Length: 3 DAYS (CEU: 1.8 UNITS)

Class Size: MINIMUM: 14; MAXIMUM: 24

NHI Customer Service: (877) 558-6873 • nhicustomerservice@dot.gov