Structural Engineers Association of BC | Certificate in Structural Engineering Program

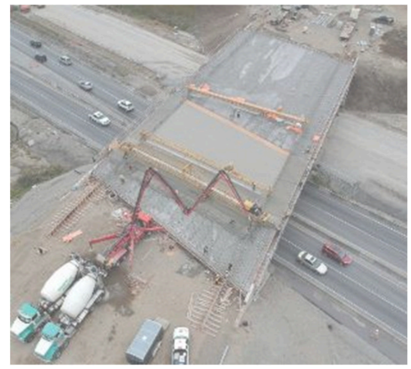
C56 Practical Topics in Bridge Engineering

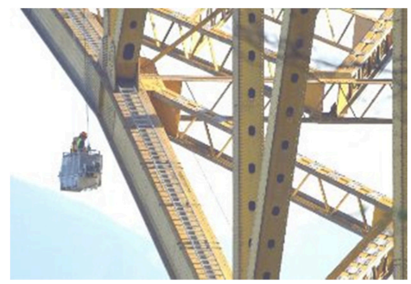
Asset Management & Supplemental Topics

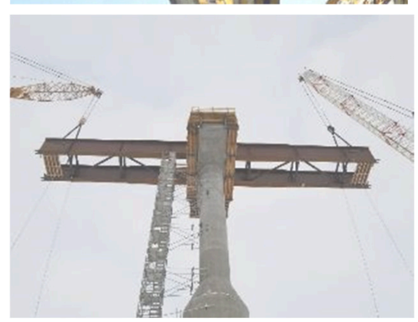
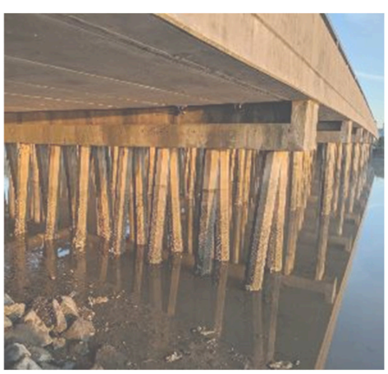
COURSE DESCRIPTION

REVISION B (OCTOBER 31, 2021)





REVISION HISTORY

FIRST DRAFT

Date: 2021-Sep-27	**Revision:** A	
Prepared by	**Assembled and Reviewed by**	
Instructor content prepared by corresponding instructor	Keith Holmes, M.Eng., P.Eng. Manager, Bridges (BC & Yukon) WSP Canada Inc.	

ISSUED FOR STUDENT REGISTRATION

Date: 2021-Oct-31	**Revision:** B	
Prepared by	**Assembled and Reviewed by**	**Reviewed by**
Instructor content prepared by corresponding instructor	Keith Holmes, M.Eng., P.Eng. Manager, Bridges (BC & Yukon) WSP Canada Inc.	Darrel Gagnon, M.Sc., P.Eng. Vice-President and Technical Director COWI Bridge

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INTRODUCTION

OVERVIEW

1. Program Background
The Structural Engineers Association of British Columbia (SEABC) is an association that promotes the interests of structural engineers in British Columbia. A key offering of the SEABC is the Certificate in Structural Engineering Program (CSEP). The goal of the CSEP program is to "*provide additional knowledge and skills in structural engineering to permit the candidate to be more effective in an engineering firm.*" Please see www.seabc.ca for more details.

2. Course Context
The CSEP program already covers several major bridge topics including loading (C50), analysis (C51), conceptual design (C52), and seismic (C54). A gap was identified for smaller bridge topics (i.e. joints, bearings, etc.), none of which were suited to a course on their own but useful when combined. An industry survey was completed in January 2021 to gauge interest in potential topics. From this survey, two courses "Practical Topics in Bridge Engineering" were developed:

I. Core Bridge Topics (C55)
II. Asset Management & Supplemental Topics (C56)

While the two courses were developed together, this Course Description covers **C56 "Asset Management & Supplemental Topics"**. Also, please note that one course is not a prerequisite for the other.

3. Course Objective
The objective is to enhance the knowledge base of BC bridge engineers on relevant bridge topics not typically covered by university programs or other full-length SEABC courses.

4. Intended Audience
The intended course audience are BC bridge engineers with 1-5 years working experience. However, many aspects of the course will be relevant to bridge engineers of different experience levels and from across Canada.

5. Timing
Each course is 13 weeks long (total of 26 weeks) and includes one 2-hour class per week. The first offering of Course C55 is expected to run Jan-March 2022. The first offering of Course C56 is expected to run April-June 2022.

6. Instructors
Each class is led by a different instructor, a local specialist on that class topic.

7. Delivery
Each class will be delivered both in-person and webcast. In-person classes will be held at UBC Robson, Room C485 - 800 Robson Street, Vancouver, BC. A site-visit to the Oak Street Bridge is planned as part of Class II.7.

8. Communication
Notices to students and questions outside of class will be handled strictly through Classbit and e-mail.

9. Evaluation
Evaluation is a requirement of the CSEP program. Students mush achieve an overall grade of 68% to pass the course. Evaluation will vary from week to week but will typically include a weekly assignment or quiz. There will be no final exam or major course project.

ROLES

Course Coordinators

– Keith Holmes, M.Eng., P.Eng.
WSP Canada
keith.holmes@wsp.com
604-812-4183

– Darrel Gagnon, M.Sc., P.Eng.
COWI Bridge
dpg@cowi.com
604-961-7339

Instructors: See following pages
Markers: TBD
CSEP Board of Directors

– John Pao, M.Eng., P.Eng. Struct.Eng.
CSEP Chair
cse-chair@seabc.ca

– Shannon Remillong
CSEP Coordinator
courses@seabc.ca

(see https://www.seabc.ca/certificate-program/overview/ for full list)

MATERIALS AND COPYRIGHT

Students will be provided with a PDF copy of the class materials (typically a PowerPoint presentation). Instructors will identify but not provide reference materials for their respective topics. Students are expected to have access to key course materials including CSA S6:19 Canadian Highway Bridge Design Code through their own means.

Note that any shared class materials will abide by the requirements of its publishers. For this course, SEABC has obtained authorization from CSA to share only limited excerpts of S6:19, embedded within the presentation materials.

WEEK II.1 | DURABILITY AND SERVICE LIFE

OBJECTIVES

By the end of the class, students will understand:

1. The definition and overall framework for service life design of highway bridges
2. The methodology for service life design typically used for concrete and steel structures (students will learn about key references they can use in the future)

KEY TOPICS

1. Introduction
    a. Definition of service life
    b. Objective of service life design
    c. History on the topic and key references that will be used throughout the course
2. Framework for service life design
3. Service life design for concrete structures
4. Service life design for steel structures
5. Various topics for the practicing engineer (how to require service life design on a project, common problems and challenges encountered during design and construction and strategies to avoid them)
6. Overview of life-cycle costs
7. Summary + Questions

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC • BC MoTI Supplement to CHBDC • AASHTO Guide Specification for Service Life Design of Highway Bridges • SHRP2 R19A documents, fib Bulletin 34
Eval. Format:	Open book quiz and take home assignment

LEAD INSTRUCTOR

COWI **ANNE-MARIE LANGLOIS, M.Sc., P.Eng., PE**
Associate Technical Director & Head Section

Anne-Marie has 10-years of bridge engineering experience and is registered as a Professional Engineer in British Columbia, Quebec, and Washington State. She specializes in durability assessments and service life design of structures. Most of her experience is with alternative delivery projects such as Design-Build and Public-Private Partnerships (P3) in Canada and the USA, including multiple major bridges and signatures structures.

She actively contributes to the development of service life design knowledge in North America. Since 2016, she has been a member of the sub-committee for Section 2 – Durability of the Canadian Highway Bridge Design Code (CSA S6). She was a subject matter expert for national projects in the USA (SHRP2 R19A and NCHRP 12-108) for which the objectives were to develop guidelines for service life design of bridge structures. Anne-Marie is also an author of the new Design Guidelines for Service Life Design of Highway Bridges adopted by the American Association of State Highway and Transportation Officials (AASHTO).

WEEK II.2 | INSPECTIONS

OBJECTIVES

By the end of the class, students will understand:

1. A practical and qualitative approach to how inspections are carried out.
2. The practical application of fundamental engineering principals for field assessment of structures and identification of structural issues rather than how to fill out a spreadsheet.

KEY TOPICS

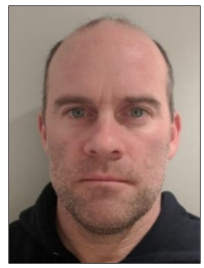
1. Introduction and Rationale
2. Reasons and Uses of Inspections
3. Types and Common Formats
4. Inspection Rationale for Engineers
5. Access / Alternatives
6. Planning and Safety
7. Foundations and Waterways
8. Considerations and Common / Specific Detects
    a. Concrete Bridges
    b. Steel Bridge
    c. Timber Bridges
9. PT and Stay Cables
10. Bridge Decks
    a. Field Assessment(s)
    b. Detailed Assessment(s) (time permitting)
11. NDT Investigations
    a. Ultrasonic Testing
    b. Mag Particle
    c. Laser Vibrometry

REFERENCES & EVALUATIONS

Key References:	• AASHTO – Guidelines for Inspecting Complex Components of Bridges • OSIM Field Inspection Guide
Eval. Format:	Take home assignment – short answer questions

LEAD INSTRUCTOR

CHARLES CHATAWAY, P.Eng.
Lead Engineer, Bridges (BC & Yukon)



Charles Chataway is a Lead Bridge Engineer for WSP with 17-years of experience in bridge inspection, evaluation, and construction. His experience extends to structural and bridge design, rehabilitation design, and infrastructure management system development. Clients include the BC MOTI, TransLink and SkyTrain, and the Government of Canada.

Charles has extensive experience with specification, selection and application of practical design and rehabilitation solutions for projects of all levels and values for numerous federal, municipal, private, provincial, territorial, private, and international clients.

WEEK II.3 | EVALUATION AND LOAD RATING

OBJECTIVES

By the end of the class, students will understand:

1. Background philosophy and key components of CHBDC S6-19 Section 14 - Evaluation

KEY TOPICS

1. Introduction to Section 14
2. Life safety philosophy basis for evaluation and why it differs from design
3. Basic derivation of limit states design to achieve target life safety
4. Evaluation load factors and load combinations
5. Permanent Loads
6. Non-permit Loads and Permit Loads
7. Resistance Adjustment Factors
8. Other Loads

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC Section 14
Eval. Format:	Take home assignment - short answer questions and simple load rating

LEAD INSTRUCTOR

DARREL GAGNON, M.Sc., P.Eng.
Vice-President and Technical Director

Darrel Gagnon is the Vice President and Technical Director for COWI North America Ltd. with over 34-years of experience on small to major bridge projects throughout North America and overseas. Darrel has served key roles on many of western Canada’s largest bridge projects including Golden Ears, Lions' Gate, Port Mann, Pattullo, and Walterdale.

Since 2010 he's led the management, inspection, evaluation, rehabilitation design and new design of Parks Canada's western inventory of 200+ bridges. Darrel is an ongoing member of S6 (CHBDC) Technical Committee and multiple Sub-Committees including Section 3 – Loads (Chairman), Section 14 – Evaluation (Chairman) and Section 15 – Rehabilitation. In addition, he's been a key member of CSA's recent Climate Change Study for Bridges.

Darrel has served on the SEABC educational board for over seven years and is the instructor for SEABC course C50 – Bridge Loadings and Load Ratings.

WEEK II.4 | REPAIR / REHAB / STRENGTHENING

OBJECTIVES

By the end of the class, students will understand:

1. Decision making in rehabilitation
2. Common rehabilitation methods

KEY TOPICS

1. Steps in rehabilitation decision making overview
   a. Inspection (Refer to II.02)
   b. Evaluation (Refer to II.03)
   c. Options Evaluation | Scoping Studies
   d. Rehabilitation Design and Construction
2. Scoping Studies
   a. What to get out of an inspection and evaluations
   b. How to develop alternatives / what are key considerations
   c. Synergies with other objectives (functionality, seismic retrofit)
   d. The role of the Owner
   e. Option comparison and life-cycle costing
   f. Recommendations
3. Common Rehabilitation Technique Design
   a. Concrete repairs
   b. Deck rehabilitation (comment on different levels of rehab, different reinforcing, overlay materials, etc.)
   c. Re-articulation, joints, and bearings
   d. Steel repairs (fatigue and deterioration)
   e. Drainage and approaches

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC • Conference Papers on Rehab (Alexandra, etc.)
Eval. Format:	Take home assignment - provide deterioration photos and ask short questions about them

LEAD INSTRUCTOR

KATRIN HABEL, Dr.sc.techn., P.Eng.
Manager, Transportation Structures

Katrin Habel is the Manager for Transportation Structures for Associated Engineering located in Vancouver, BC. Her experience includes new design, rehabilitation and strengthening, assessments, and load ratings of bridges, retaining walls, culverts and related structures, and project management with a focus on reinforced concrete, ultra-high performance concrete (UHPC) and rehabilitation.

She has been involved with the assessment of multiple dapped end connections in bridges, and has led major bridge rehabilitations such as the Alexandra Bridge on Hwy 1 in the Fraser Canyon, and the Granville Cambie Street Bridges in Vancouver.

For the Canadian Highway Bridge Design Code, Katrin is a member of several committees and subcommittees, notably Vice-Chair of the Technical Subcommittee 15 – Rehabilitation, Member of Technical Subcommittee 8 – Concrete, and Chair of the task force on fibre reinforced concrete. Katrin is also an active member of several committees of the American Concrete Institute, including the committees on strut-and-tie modeling and UHPC.

WEEK II.5 | REPAIR / REHAB / STRENGTHENING OF TIMBER

OBJECTIVES

By the end of the class, students will understand:

1. Timber bridge types, design features, materials, details, and vulnerabilities.
2. Basics of inspection, assessment, repair, and rehabilitation of typical timber bridges and timber bridge components currently in use in B.C.

KEY TOPICS

1. Introduction to timber bridges:
   a. Timber bridge types
   b. Timber bridges in B.C.
2. Timber as a bridge material:
   a. Species, grades, engineered wood
   b. Sizes and availability
   c. Pressure treatment
3. Timber bridge inspection basics (refer also to II.02)
4. Timber in the bridge code
5. Typical deterioration, defects and mitigation methods
6. Timber decks: designs, load distribution, assessment, and replacement
7. Timber bridge rehabilitation
8. Strengthening techniques

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC • BC MoTI Supplement to CHBDC
Eval. Format:	Take home assignment

LEAD INSTRUCTOR

Stantec

MURRAY JOHNSON, P.Eng. PE
Principal, Transportation

Murray Johnson is a Principal at Stantec, leading the Bridge Engineering group for the Transportation practice in B.C. He has over 41 years of experience covering virtually all aspects of bridge engineering: design at concept, preliminary, pre-bid and detailed stages; construction and erection engineering, inspection, assessment, repair, and rehabilitation. His work has included bridges from small to large, throughout the world, but with a focus on B.C.

Early in his career Murray began to gain experience in timber bridges as well as similar structures such as trestles and wharves, beginning with inspection and capacity assessment projects for many of these structures throughout B.C. This experience has expanded to include repairs, rehabilitation, new design, and construction support for many timber bridges. To date he has been involved in work on well over 100 timber bridges.

Murray has contributed to guidelines for timber inspection, has taught timber bridge inspection, and has presented papers several times at the International Conference on Timber Bridges.

WEEK II.6 | SEISMIC EVAL. AND RETROFIT 1

OBJECTIVES

By the end of the class, students will understand:

1. Historic and modern bridge systems and impact on seismic performance
2. Framework for seismic assessment and retrofit design of existing bridges
3. Seismic retrofit strategies and options

KEY TOPICS

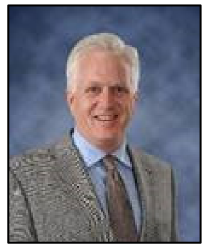
1. Bridge lateral-load resisting systems – historic and modern
2. Seismic hazard and demands on existing bridges
3. Seismic vulnerabilities in BC bridges
4. Framework for seismic assessment
5. Importance of soils on seismic behaviour
6. Seismic retrofit strategies and options

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC • EGBC Design Guidelines for Performance-Based Seismic Design of Bridges • BC MoTI Supplement to CHBDC
Eval. Format:	Take home assignment - short answer questions regarding bridge seismic lateral load-resisting systems, force vs displacement-based design, discuss (qualitative) seismic vulnerabilities in a sample bridge.

LEAD INSTRUCTOR

DON KENNEDY, M.A.Sc., P.Eng.
Technical Vice President, Transportation Structures



Don has 35 years of seismic and bridge experience in seismic criteria, design, performance assessment, retrofit design and construction. He has worked on bridge seismic projects in British Columbia, New Zealand, Ontario and Quebec. He is a ~20-year member of the seismic section of the Canadian Highway Bridge Design Code, and is current chair of that sub-committee. He has authored and presented papers and seminars on seismic retrofit and rehabilitation, seismic criteria and assessment, new bridge design, and performance-based seismic design. Don was a member of the Canadian reconnaissance team for the 1994 Northridge earthquake, is a Director of the Canadian Association of Earthquake Engineers, Chairman of the Seismic chapter for the Canadian bridge code and was Technical Co-Chair of the 2015 11th Canadian Conference on Earthquake Engineering. He was a co-author of the 2018 EGBC design practice guideline for performance-based seismic bridge design in BC and has co-authored the BC MoTI criteria and Supplement to the CHBDC for seismic retrofit and design since 2005.

WEEK II.7 | SEISMIC EVAL. AND RETROFIT 2 – SITE VISIT

OBJECTIVES

By the end of the class, students will understand:

1. Application of various seismic retrofit strategies
2. Participated in a site visit to the Oak Street Bridge in Vancouver/Richmond, BC

KEY TOPICS

1. Safety Briefing and PPE (vest only)
2. Visit south bank to view retrofits to steel spans
3. Visit south approach to view retrofits to concrete spans

REFERENCES & EVALUATIONS

Key References:	• Past Conference Papers on Testing and Retrofits
Eval. Format:	No evaluation

NOTES

This session is different from other classes in that it will be held entirely at the Oak Street Bridge (Richmond side). The Oak Street Bridge is one of BC's earliest examples of seismic retrofits to modern standards and displacement-based methods. A recent expanded seismic assessment confirmed the effectiveness of the retrofit schemes for a higher level of seismic hazard. The bridge is an excellent presentation of a wide variety of seismic retrofits and design methods for both structural and geotechnical issues. Many of these retrofits are readily viewable from under the south spans. Bruce Hamersley and Don Kennedy will lead the site tour, drawing on their past detailed retrofit design experience of the bridge.

Please note the following (with further details to come):

- A webcast will be attempted but will not be a replacement for an in-person visit.
- Transportation / muster point details are still under consideration.
- The visit will include active walking around and under the bridge. The bridge will not be toured from the deck level.
- Participants to dress for the forecasted weather.
- This is not active construction site but participants may be required to cross local streets or be adjacent to local traffic. A reflective vest will be required.
- Binoculars may be beneficial.

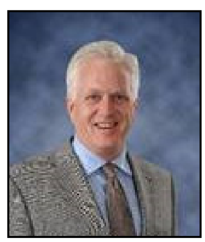
LEAD INSTRUCTOR

BRUCE HAMERSLEY, P.Eng., FEC
President, Principal Engineer

Bruce has 33-years of engineering experience with a focus on bridge design, soil-structure interaction, and construction engineering. His diverse design background includes project management of large transportation projects, highway and railway bridge designs, seismic retrofit and rehabilitation of major bridges, and construction engineering for bridge erection. He was a designer and /or project manager for the seismic retrofit of several major bridges in the BC lower mainland including the Oak Street, Knight Street, Mission, Agassiz Rosedale, and Lions Gate Bridges. Bruce has published and presented a number of papers on design and rehabilitation of major bridges.

LEAD INSTRUCTOR

DON KENNEDY, M.A.Sc., P.Eng.
Technical Vice President, Transportation Structures



Don has 35 years of seismic and bridge experience in seismic criteria, design, performance assessment, retrofit design and construction. He has worked on bridge seismic projects in British Columbia, New Zealand, Ontario and Quebec. He is the current chair of the CHBDC seismic design sub-committee. He has authored and presented papers and seminars on seismic retrofit and rehabilitation, seismic criteria and assessment and performance-based seismic design. Don was a member of the Canadian reconnaissance team for the 1994 Northridge earthquake, is a Director of the Canadian Association of Earthquake Engineers. Don led the seismic, assessment and strategy and the first design / construction phase of the Oak St Bridge retrofits.

WEEK II.8 | RETAINING WALL TYPES AND DESIGN

OBJECTIVES

By the end of the class, students will understand:

1. How to communicate with geotechnical engineers on a project
2. Wall types
3. Design responsibility considerations

KEY TOPICS

1. Earth Pressures
    a. At-rest, active and passive earth pressures
    b. Lateral earth pressure diagrams
2. Wall types
    a. CIP cantilever concrete
    b. Anchored CIP concrete
    c. Embedded (soldier, secant, and sheet piles)
    d. Shotcrete and anchors
    e. GRS
    f. MSE
    g. Composite walls
3. Design Responsibility
    a. Simplified design methods
    b. Complex design methods
    c. Proprietary suppliers

REFERENCES & EVALUATIONS

Key References:	• CDN Foundation Engineering Manual • CSA S6:19 CHBDC • BC MoTI Supplement to CHBDC
Eval. Format:	Google Quiz (take-home multiple choice, including simple calculations using geotechnical inputs)

LEAD INSTRUCTOR

PAUL WILSON, M.Eng., P.Eng.
Principal

Paul Wilson is a Principal with Thurber Engineering located in Vancouver, BC. He has over 20-years of experience on major projects in BC, which includes the LNG Canada Plant Site, G3 Grain Export Terminal, BC Place Roof Replacement, Richmond Speed Skating Oval, Sea-to-Sky Highway, Port Mann / Highway 1, Highway 91/17 Interchange, and the Kicking Horse Canyon Phase 4.

Paul is actively involved in design guideline and code development including Section of the Canadian Highway Bridge Design Code (CHBDC) and EGBC Guidelines for school retrofits, site response analysis and seismic design of dikes. Code (CHBDC) and EGBC Guidelines for school retrofits, site response analysis and seismic design of dikes.

WEEK II.9 | BRIDGE HYDRAULICS

OBJECTIVES

By the end of the class, students will understand:

1. The basics of stream hydraulics and its affect on bridge design
2. How to better engage technically with hydrotechnical engineers on a variety of projects

KEY TOPICS

1. Introduction
2. Streamflow estimates for different aspects of bridge design
3. The basics of channel type and why it matters
4. Water levels relevant to bridge design
5. Aggradation, degradation, artificial deepening, scour and erosion
6. Different types of scour and how they apply to foundation design
7. Erosion and scour protection
8. Ice and debris loading

REFERENCES & EVALUATIONS

Key References:	• TAC Guide to Bridge Hydraulics • CSA S6:19 CHBDC BC MoTI Supplement to CHBDC
Eval. Format:	Take home assignment

LEAD INSTRUCTOR

DES GOOLD, M.Eng., P.Eng.
Principal

Des Goold has 24-years' experience as a hydrotechnical engineer and project manager with NHC. He has a technical background in engineering hydrology, numerical modeling of streams, assessments of stream behaviour and the design of erosion and scour counter-measures for bridge, culvert, and pipeline crossings.

He has played a key role in the development of a bridge scour evaluation program for the BC Ministry of Transportation and Infrastructure (MoTI) and managed scour assessments for nearly 1,000 bridges as part of that program. Des' major project experience in BC includes the Inland Island Highway, the Sea-to-Sky Highway Improvements, and the Highway 29 Realignment Project.

WEEK II.10 | INFRASTRUCTURE DELIVERY/SPECIFICATIONS

OBJECTIVES

By the end of the class, students will understand:

1. Key aspects of different infrastructure delivery models
2. Requirements and issues for project specs and special provisions

KEY TOPICS

1. Overview of various infrastructure delivery models
2. Who Pays for Projects / Mobility Pricing
3. DBBs vs DB/P3
4. Kahoot: Major Infrastructure Delivery Examples in BC
5. Basics of a construction contract (BC MoTI focused)
6. Overview of the Standard Specifications for Highway Construction
7. Overview of the Special Provisions and common pitfalls
8. Kahoot: Spot the problem

REFERENCES & EVALUATIONS

Key References:	• Infrastructure BC Website • BC MoTI Resources
Eval. Format:	Take home assignment

LEAD INSTRUCTOR

KEITH HOLMES, M.Eng., P.Eng.
Manager, Bridges (BC & Yukon)

Keith Holmes is the Bridge Group Manager for WSP in British Columbia and Yukon with over 20 years of experience on major infrastructure works in BC and overseas. Keith has served a key role on many of BC's largest projects including Sea-to-Sky Highway, Port Mann / Highway 1, and Kicking Horse Canyon Phase 4.

Keith authored the 2010 TAC Guide to Bridge Traffic and Combination Barriers and led full-day workshops to support the TAC Guide in major cities across Canada. Keith presently serves on the Section 12 Sub-Committee for the Canadian Highway Bridge Design Code (CHBDC) and has provided barrier related updates to the BC MoTI's 2016 and 2021 Supplement to the CHBDC.

LEAD INSTRUCTOR

DAVID WOOLFORD, P.Eng.
Associate Project Director

David Woolford is an Associate Project Director for COWI and has over 20-years of diverse bridge and transportation structure experience as both an owner and a consultant including inspection, assessment, load rating, rehabilitation design, and new design. In addition, he has significant experience with project and program management, asset management and development of standards and specifications. David has worked on projects raging from small, remote low-volume road bridges to major lifeline structures such as the Pattullo and Knight Street Bridges.

David has made key contributions to the numerous BC Ministry of Transportation and Infrastructure standards and guidelines including the Standard Specifications for Highway Construction, the Special Provision Template, and the Bridge Design and Construction Standards Manuals. He currently serves on the Technical Committee for the Canadian Highway Bridge Design Code (CHBDC), as well as the Sub-Committees for Section 3 – Loads and Section 10 – Steel Structures.

WEEK II.11 | ACCELERATED BRIDGE CONSTRUCTION (ABC)

OBJECTIVES

By the end of the class, students will understand:

1. What ABC is, why use ABC, advantages and disadvantages, incorporating ABC into projects, roles and responsibilities
2. Types of ABC, ABC design implications, and ABC construction techniques

KEY TOPICS

1. Introduction to ABC, what it means, history, why we would use it, advantages and disadvantages
2. ABC in projects: procurement types, contract provisions, roles and responsibilities, owner acceptance
3. ABC techniques and technologies overview
4. Prefabricated Bridge Elements and Systems (PBES):
   a. Substructures
   b. Superstructures
   c. Decks
5. Structural placement methods: SPMT's, lateral sliding, launching, heavy-lift, gantries, and other methods
6. Temporary works associated with ABC
7. Resources available

REFERENCES & EVALUATIONS

Key References:	• CSA S6:19 CHBDC • BC MoTI Supplement to CHBDC
Eval. Format:	Take home assignment

LEAD INSTRUCTOR

Stantec

MURRAY JOHNSON, P.Eng. PE
Principal, Transportation

Murray Johnson is a Principal at Stantec, leading the Bridge Engineering group for the Transportation practice in B.C. He has over 41 years of experience covering virtually all aspects of bridge engineering: design at concept, preliminary, pre-bid and detailed stages; construction and erection engineering, inspection, assessment, repair, and rehabilitation. His work has included bridges from small to large, throughout the world, but with a focus on B.C.

In addition to bridge projects undertaken directly for the owner, Murray's career has had an extensive focus on working for contractors, in both permanent design and construction/erection engineering roles. He has expertise in a wide variety of bridge construction engineering methods and techniques, such as erection analysis and procedures, span heavy lifting, span float-in, lateral sliding, launching, jacking, falsework, cantilever and tied-back construction, gantry cranes, heavy lift, general steel erection, and other methods. He has considerable experience in maintaining uninterrupted traffic on busy roads or railroads while replacing or rehabilitating bridges, and on Accelerated Bridge Construction (ABC), and has led award-winning ABC projects. He is a member of the TRB ABC Joint Subcommittee, and has presented at ABC conferences.

WEEK II.12 | BIM AND DESIGN AUTOMATION

OBJECTIVES

By the end of the class, students will understand:

1. Motivations for BIM in the design, construction and management of bridges
2. Opportunities for design automation, and practical strategies for applying to day-to-day bridge design practice

KEY TOPICS

1. What is BIM?
2. BIM on infrastructure projects
3. BIM across the bridge life-cycle
4. BIM motivating design automation
5. Design automation case studies
6. Design automation patterns and anti-patterns
7. Implications for bridge engineering practice

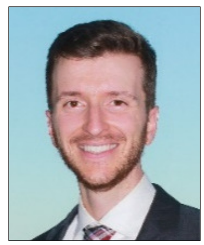
REFERENCES & EVALUATIONS

Key References:	• Grasshopper Primer, 3rd ed. • Karamba3d Manual
Eval. Format:	Take home assignment - parametric structural analysis of pedestrian bridge concept using Rhino/Grasshopper & Karamba3d (temporary licenses available)

LEAD INSTRUCTOR

M M MOTT MACDONALD

JAMIE McINTYRE, M.ASc., P.Eng.
Principal Project Engineer & Canada Digital Lead



Jamie McIntyre is a structural engineer and digital delivery professional specializing in design computation and smart infrastructure systems. He has 14-years of design, construction and management experience on a diverse range of bridge and civil infrastructure projects in BC and across North America. Over this time, Jamie has developed a keen ability with BIM and design automation, using these tools to improve practical outcomes on his projects.

Jamie now serves as Mott MacDonald's Digital Delivery Lead for Canada, where he guides the deployment of digital technologies in support of creative, innovative, and integrated solutions to real-world infrastructure challenges. He is also currently a member of the ACEC-BC MoTI Bridge BIM Working Group.

WEEK II.13 | PEDESTRIAN BRIDGES & AESTHETICS

OBJECTIVES

By the end of the class, students will understand:

1. The fundamental issues associated with Pedestrian Bridge Design
2. The value that bridge aesthetics can bring to any design

KEY TOPICS

1. Pedestrian Bridge Typical Configurations (including material selection)
2. Pedestrian Bridge Conceptual Design
3. Pedestrian Induced Dynamics
4. Non-Structural Considerations (including lighting, railings and drainage)
5. Architectural Form in Bridge Design
6. Architectural Detailing
7. Signature Bridges and Working with Architects
8. Aesthetic and Architectural Discussion

REFERENCES & EVALUATIONS

Key References:	• FIB Guidelines for the Design of Footbridges
Eval. Format:	Take home assignment - pedestrian induced dynamics assignment

LEAD INSTRUCTOR

MOTT MACDONALD

TOM SURTEES, M.Eng., P.Eng.
Principal Project Engineer

Tom Surtees is a Structural Engineer with nearly 20-years of experience working on both bridge and building projects around the world. In particular, Tom spent six years in Switzerland working with Santiago Calatrava where he was part of an integrated architectural and engineering team. During this time he completed a number of lightweight steel and concrete designs requiring assessment of pedestrian induced dynamics. He has also gained significant experience working on the erection engineering of signature structures where detailed staged construction analytical modelling was required. Tom currently works as a principal project engineer at Mott MacDonald.