NCHRP NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Arizona State University

University of Colorado Boulder

TRB TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

The National Academies of Sciences, Engineering, and Medicine

Training on Post-Award Contract Administration for Highway Projects Delivered using D-B and CM-GC

Based on NCHRP Research Report 939 Volumes 1, 2, and 3

Session 8 of 8: December 1, 2022

Agenda

- 10:00-10:10 am Welcome and reminders
- 10:10-10:15 am Witness and hold points
- 10:15-10:25 am Payment checklist
- 10:25-11:10 am Case study: culminating experience
- 11:10-11:35 am Peer Exchange: Overview on additional related resources
  - DOT ACM peer group (Erika Drury, Kentucky Transportation Cabinet)
  - Progressive design-build (Lisa Washington, DBIA)
  - CASE webtool (Dana Dietz, Idaho DOT)
  - Implementation guidance for a learning organization (Dr. Keith Molenaar, CU)
- 11:35-11:40 am Path forward
- 11:40-11:50 am Wrap-up and graduation photo
- 11:50-12:00 pm Course evaluation (anonymous) and open discussion

Note: All times are in Pacific Daylight Time (PDT)

Review: Last Session's Learning Objectives

- **Phases and strategies** – Introduce the *construction* phase and the *construction quality* and *construction efficiency* strategies
- **Tools** – Explain the following tools, illustrated with examples from DOTs:
  - Contractor-controlled quality control testing
  - Contractor involvement in establishing quality control standards
  - Incentive-disincentive program for superior quality
  - Real-time electronic quality management information
  - Dual construction engineering inspection roles
- **Peer exchange** – Discuss successful practices using tools for enhancing quality and efficiency in the construction phase

Review: Last Session's Takeaway Points

- **Contractor-controlled quality control testing** allows the contractor to perform their QC testing to keep project progress aligned with quality standards and at a reduced cost.
- **Contractor involvement in establishing quality control standards** enables innovative solutions by customizing QC standards.
- **Incentive-disincentive program for superior quality** creates motivation to achieve efficient performance and excellence in quality.
- **Real-time electronic quality management information** enables tracking project progress in real-time for quality management purposes.
- **Dual construction engineering inspection roles** enables contractor to hire their own construction engineering inspector (CEI) while the agency hires an oversight CEI; thus, more efficient use of time and quality construction.

Overall Learning Objectives

1. Navigate and interpret the information in the D-B and CM-GC Guidebooks that is relevant to your project.

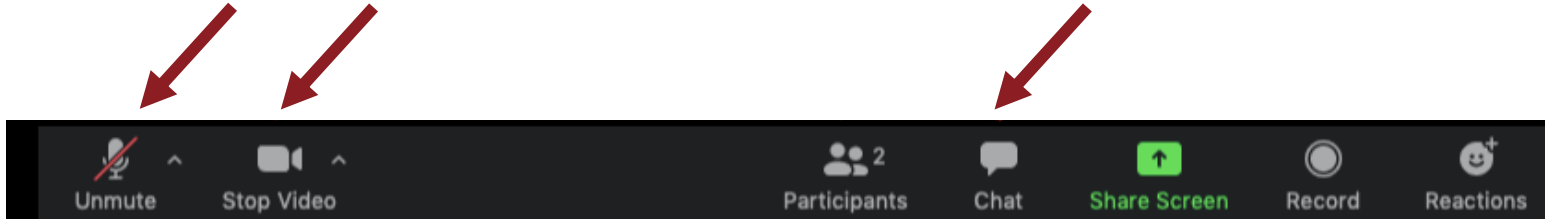
2. Select and implement appropriate tools for various types of D-B and CM-GC projects for all phases of contract administration.

Today's Learning Objectives

- **Phases and strategies** – Introduce the *closeout* phase
- **Tools** – Explain the following tools, illustrated with examples from DOTs:
  - Witness and hold points
  - Payment checklist
- **Case study** – Analyze a case study and suggest tools from your toolkit for enhancing post-award contract administration for a fictitious highway project
- **Peer exchange** – Share additional resources related to D-B and CM-GC

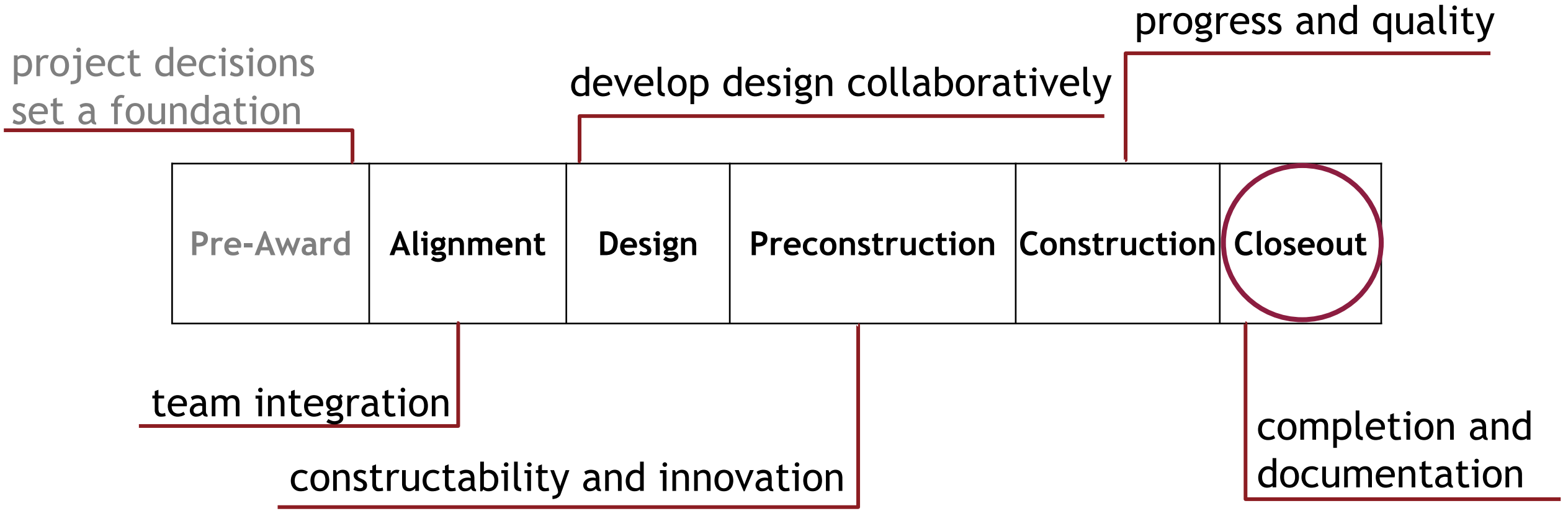
Logistics Reminders

- Please make sure you are registered (only once)
- Please make sure your name is correct on Zoom
- Download the *Guidebooks for Post-Award Contract Administration* *Vol. 1* and *2*
- No formal break; please take one if/as needed
- Actively engage and participate when prompted
- Use the chat feature as needed
- Ask for help



Contract Administration Phases

The guidebooks describe the following phases of D-B and CM-GC contract administration



Closeout Phase Administration

- Closeout is the final phase of a project, it ensures the project scope was completed and all activities were documented
- Key activities include
  - Conduct final inspection
  - Review invoice for final payment
  - Execute contractor release
  - Conduct contractor evaluation and lessons learned

Pre-Award	Alignment	Design	Preconstruction	Construction	Closeout

Closeout Phase Tools

	Contract administration phase					Project complexity			Project size		
Tools for D-B and CM-GC contract administration	Alignment	Design	Preconstruction (CM-GC only)	Construction	Closeout	**Non-complex**	**Moderately complex**	**Complex**	**≤ $10 M**	**$10 M - $50 M**	**> $50M**
CM-GC management fee table	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
ACM-specific partnering	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
Continuity of team members	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
FHWA involvement overview	✓	✓	✓	✓	✓	●	●	●	●	●	●
Permit commitment database	✓	✓	✓	✓	✓	◗	●	●	●	●	●
Public announcements		✓	✓	✓	✓	○	●	●	◗	●	●
Delegation of authority		✓	✓	✓	✓	●	●	●	●	●	●
Witness and hold points				✓		◗	●	●	◗	●	●
Payment checklist				✓	✓	●	●	●	●	●	●

● = Recommended; ◗ = Consider Case-by-Case; ○ = Not Recommended

Today's Learning Objectives

- **Phases and strategies** – Introduce the *closeout* phase
- **Tools** – Explain the following tools, illustrated with examples from DOTs:
  - Witness and hold points
  - Payment checklist
- **Case study** – Analyze a case study and suggest tools from your toolkit for enhancing post-award contract administration for a fictitious highway project
- **Peer exchange** – Share additional resources related to D-B and CM-GC

Witness and Hold Points

Witness and Hold Points

- What is it?
  - A hold point is linked to an activity that should be inspected before the work becomes inaccessible
  - A witness point is linked to a point in the work process where the agency may review, witness, inspect, or test any component, method, or process in the work
- Why use it?
  - Agency verifies work is proceeding per plan before it is covered or enclosed

27 D-B
31 CM-GC

CONSTRUCTION QUALITY
CONSTRUCTION EFFICIENCY

Witness and Hold Points

- When to use it?
  - During construction, before work is covered or enclosed

	Contract Administration Phase				Project Complexity			Project Size		
	Alignment	Design	**Construction**	Closeout	Noncomplex	**Moderately Complex**	**Complex**	≤ $10 million	**$10 million–$50 million**	**> $50 million**
27 Witness and Hold Points			✓		◗	●	●	◗	●	●

Note: ● = Recommended; ◗ = Consider case by case; ○ = Not recommended.

27 D-B
31 CM-GC

Witness and Hold Points

- How to use it?
  - Establish witness and hold points before construction begins
  - Agency and contractor work collaboratively to create inspection and testing procedures
  - Hold points established where quality is critical

27 D-B
31 CM-GC

Witness and Hold Points

- Synthesis of Examples
  - Used to align project team on quality goals even when speed is a priority
  - Include W & H points on the project schedule
- Guidebook example
  - D-B p.144-146, CM-GC p.167

27 D-B
31 CM-GC

Example: MnDOT, Winona Bridge CM-GC

- Rehab of historic bridge
- Significant public interest
- Fast-track with multiple work packages
- Hold points were a key driver in maintaining quality in materials and construction
- Upper management communicated the high expectations for quality, which helped align all team members to this goal

27 D-B
31 CM-GC

Example: WSDOT, I-405, NE 6th St. to I-5

- Widening and express toll lanes
- D-B Quality Mgmt Plan refers to “quality check points” (same as hold points)
- Review progress to date, including inspection reports, process and [QA] test reports, settlement data, pile driving records, string-line measurements, audits, and other pertinent data.
- Construction QA Manager meets with WSDOT daily to schedule quality check points for the following day.

27 D-B
31 CM-GC

Example: WSDOT, Quality Check Points

QCP's will be incorporated into the schedule for:

- Pre-Activity Meetings
- Temporary Erosion and Sediment Control
- Embankments
- Structures, retaining wall, noise wall
- Drainage, and In-water work
- Subgrade, surfacing, & pavement
- Electrical

27 D-B
31 CM-GC

Today's Learning Objectives

- **Phases and strategies** – Introduce the *closeout* phase
- **Tools** – Explain the following tools, illustrated with examples from DOTs:
  - Witness and hold points
  - Payment checklist
- **Case study** – Analyze a case study and suggest tools from your toolkit for enhancing post-award contract administration for a fictitious highway project
- **Peer exchange** – Share additional resources related to D-B and CM-GC

Payment Checklist

Payment Checklist

- What is it?
  - A list distinguishing contractor and agency tasks involved in payment for construction
- Why use it?
  - Helps ensure thorough preparation of invoices by the contractor which facilitates efficient review of invoices by the agency
  - Clear task definitions promote consistent review by agencies

28 D-B
32 CM-GC

CONSTRUCTION EFFICIENCY

Payment Checklist

- When to use it?
  - Throughout construction

	Contract Administration Phase				Project Complexity			Project Size		
	Alignment	Design	Construction	Closeout	Noncomplex	Moderately Complex	Complex	≤ $10 million	$10 million–$50 million	> $50 million
28 Payment Checklist			✓	✓	●	●	●	●	●	●

Note: ● = Recommended; ◗ = Consider case by case; ○ = Not recommended.

28 D-B
32 CM-GC

Payment Checklist

- How to use it?
  - Created based on agency requirements and payment requirements in the RFP
  - Contractor creates complete invoices based on the checklist
  - Agency provides consistent invoice reviews based on the checklist

28 D-B
32 CM-GC

Payment Checklist

- Synthesis of Examples
  - Clearly distinguish contractor and agency responsibilities in the payment checklist
  - D-B-B standard forms can be used or adapted
- Guidebook example
  - D-B p.171, CM-GC p.148-149

28 D-B
32 CM-GC

Payment Checklist for D-B (WSDOT)

Payment Checklist	RFP Section	✓
Design-Builder		
Invoice Cover Sheet w/ signatures of the Design and Construction QA Managers	1-09.9(1).2	
Progress Report including narrative and technical report	1-09.9(1).2	
Contract Schedule update per 1-08.3(7) including .xer Primavera file verified to match the invoice	1-09.9(1).2	
Certification by Design and Construction QA Managers	1-09.9(1).2	
Invoice Data Sheets and Supporting Documents based on the price loaded Contract schedule	1-09.9(1).2	
Design Exception Report	1-09.9(1).2	
Incentive Self-Assessment	1-08.11(1).1	
If HMA adjustment requested, **Calculations and Accounting documents** required to be submitted	1-09.9(2).1	

28 D-B
32 CM-GC

Payment Checklist for Agency (WSDOT)

WSDOT		
QV – verify and mutually agree with D-B on physical percentage of Work completed		
Check Schedule against Invoice amounts incl. Paid TTD; Paid this Period; Previous		
Review Monthly Contract Schedule Updates	1-08.3(7)	
Check to ensure Force Account sheets are signed		
Check to ensure all CO requested are executed		
QV – check materials per D-B payment request		
Input into CAPS and print Pre-Estimate for PE signature		
PE signed off on DB requested %		
Complete WSDOT comments form and transmit back to Design-Builder		
Advise D-B that payment is approved and total amount to be paid		
Once payment is made, email all information to Document Control for distribution		

28 D-B
32 CM-GC

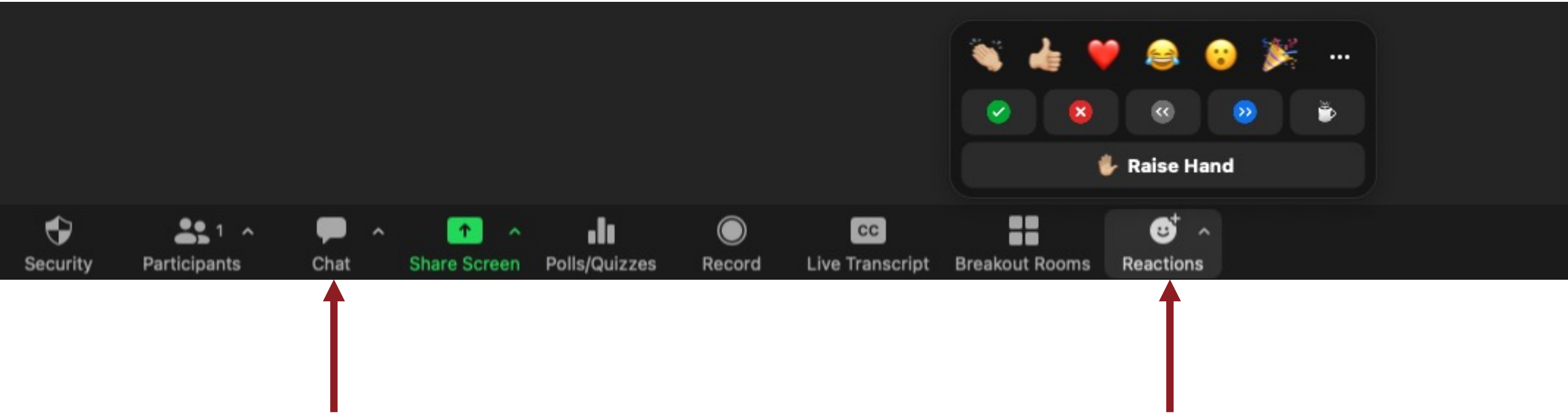
Let's compare practices: Select the items YOUR agency requires for construction invoices.

- ❑ Verify and mutually agree on percentage of work complete
- ❑ Check schedule against invoice amounts
- ❑ Review monthly contract schedule updates
- ❑ Check that force account sheets are signed
- ❑ Check that all contracting officer requests are executed
- ❑ Check materials per payment request
- ❑ PE signs-off on D-B request percent
- ❑ Complete comments form and transmit back to D-B
- ❑ Notify D-B of invoice approval and amount to be paid
- ❑ Distribute and save documentation

28 D-B
32 CM-GC

Q and A

- Chat or raise your hand



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Case Study

Case Study: Rapid River Bridge Replacement Project

Prior to NTP, your state highway agency wants you to plan your post-award contract administration approach for your upcoming project's design and construction phases, taking into account the training you recently received.

Case Study: Given Information

- *Project name:* Rapid River Bridge Crossing
- *Location:* Your state
- *Collaborating jurisdictions:* Green National Forest, State Parks, Forest County, State DOT, FHWA
- *Project delivery method:* D-B
- *Total project cost:* $4 million for design + $16 million for construction
- *Schedule:* 2 years
- *Objectives:* replace the existing bridge in a rural area over Rapid River, part of the National Wild and Scenic Rivers System and home to several threatened, endangered, and sensitive species

Case Study: Instructions

1. List some of the **advantages** of using D-B for this project.
2. List some contract administration tools for the **design phase** that apply to this project. Justify why you are choosing these tools for this particular project.
3. List some contract administration tools for the **construction phase** that apply to this project. Justify why you are choosing these tools for this particular project.
4. What are some typical **risks** for a project of this scope, and how do some of the chosen tools help manage that risk?
5. Which **strategies** will have been tackled with the chosen tools? And which strategies do you think are most salient for the success of this project? Discuss the thinking behind your answers.

Case Study: Appendixes A and B

Tools for D-B contract administration	Contract administration phase				Project complexity			Project size		
	Alignment	**Design**	Construction	Closeout	Non-complex	Moderately complex	Complex	≤ $10 M	$10 M - $50 M	> $50M
Phase 2: Administer Design of D-B Project										
5 Co-location of key personnel	✓	✓			○	◗	●	○	◗	●
6 Regulatory agency partnering	✓	✓			○	●	●	◗	●	●
7 External stakeholder coordination plan	✓	✓			◗	●	●	◗	●	●
8 D-B specific partnering	✓	✓	✓	✓	◗	●	●	◗	●	●
9 Continuity of team members	✓	✓	✓	✓	◗	●	●	◗	●	●
10 FHWA involvement overview	✓	✓	✓	✓	●	●	●	●	●	●
11 Permit commitment database	✓	✓	✓	✓	◗	●	●	●	●	●
12 Plan standards		✓			◗	◗	●	◗	●	●
13 Deviations from agency standards		✓			◗	●	●	◗	●	●
14 Discipline task force		✓			○	◗	●	◗	●	●
15 Independent party design review		✓			○	●	●	○	●	●
16 Cost savings matrix		✓			◗	●	●	◗	●	●
17 In-Progress design workshops		✓			◗	●	●	●	●	●
18 Over-the-shoulder reviews		✓			◗	●	●	●	●	●
19 Scope validation period	✓	✓			●	●	●	●	●	●
20 Public announcements		✓	✓	✓	○	●	●	◗	●	●
21 Delegation of authority		✓	✓	✓	●	●	●	●	●	●

● = Recommended; ◗ = Consider Case-by-Case; ○ = Not Recommended

Tools for D-B contract administration	Contract administration phase				Project complexity			Project size		
	Alignment	Design	**Construction**	Closeout	Non-complex	Moderately complex	Complex	≤ $10 M	$10 M - $50 M	> $50M
Phase 3: Administer Construction of D-B Project										
8 D-B specific partnering	✓	✓	✓	✓	◗	●	●	◗	●	●
9 Continuity of team members	✓	✓	✓	✓	◗	●	●	◗	●	●
10 FHWA involvement overview	✓	✓	✓	✓	●	●	●	●	●	●
11 Permit commitment database	✓	✓	✓	✓	◗	●	●	●	●	●
20 Public announcement		✓	✓	✓	○	●	●	◗	●	●
21 Delegation of authority		✓	✓	✓	●	●	●	●	●	●
22 Contractor controlled QC testing			✓		●	●	●	●	●	●
23 Contractor involvement in establishing QC standards			✓		◗	●	●	◗	●	●
24 Incentive/disincentive program for superior quality			✓		◗	●	●	●	●	●
25 Real-time electronic quality management information			✓		●	●	●	●	●	●
26 Dual CEI roles			✓		◗	◗	●	◗	●	●
27 Witness and hold points			✓		◗	●	●	◗	●	●
28 Payment checklist			✓	✓	●	●	●	●	●	●

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Case Study: Appendix C

Alignment Strategy – Establish clear project goals and create productive relationships within the agency, and between the agency and D-B team members.

Scope Strategy – Ensure the project scope and responsibilities are understood and agreed upon by all parties.

Design Quality Strategy – Ensure design quality through active participation in design reviews and accurate implementation of the RFQ/RFP requirements.

Construction Quality Strategy – Promote quality during construction and enforce requirements of the D-B contract.

Construction Efficiency Strategy – Implement a system that increases efficiency during construction and aligns with roles and contractual responsibilities.

Case Study: Breakout Room Directions

Exercise time: 30 minutes. You will be randomly assigned to a room; please select ***Join***. When you have 2-3 minutes left, you will be informed. At the end of the 30 minutes, you will be redirected to the main session automatically.

a. After you Join the room, please start by **unmuting and showing your video**.
b. Briefly **introduce yourselves** to your teammates.
c. Assign a **team leader** who can facilitate the discussion and take notes. Your leader can also be your presenter, when your group is invited to share your thoughts with everyone.
d. Read the case study scenario and the assignment.
e. Discuss your thoughts and **answer the questions as a group.**
f. Report out in the main session, when called upon.

P.S: do not spend the whole time answering one question; what is more important is going through all questions to experience how they connect. Plan ~5 minutes per question.

Report Out and Discussion

Case Study: Instructions

1. List some of the advantages of using D-B for this project.
2. List some contract administration tools for the design phase that apply to this project. Justify why you are choosing these tools for this particular project.
3. List some contract administration tools for the construction phase that apply to this project. Justify why you are choosing these tools for this particular project.
4. What are some typical risks for a project of this scope, and how do some of the chosen tools help manage that risk?
5. Which strategies will have been tackled with the chosen tools? And which strategies do you think are most salient for the success of this project? Discuss the thinking behind your answers.

Today's Learning Objectives

- **Phases and strategies** – Introduce the *closeout* phase
- **Tools** – Explain the following tools, illustrated with examples from DOTs:
  - Witness and hold points
  - Payment checklist
- **Case study** – Analyze a case study and suggest tools from your toolkit for enhancing post-award contract administration for a fictitious highway project
- **Peer exchange** – Share additional resources related to D-B and CM-GC

Peer Exchange

DOT ACM Peer Group

Erika Drury, PE

Alternative Delivery Program Manager

Kentucky Transportation Cabinet

Progressive Design-Build

Lisa Washington, CAE
Executive Director/CEO
Design-Build Institute of America (DBIA)

The CASE webtool

Dana Dietz, PE
Structural Materials Engineer
Idaho Transportation Department

Implementation Guidance

Keith Molenaar, PhD

Dean

College of Engineering and Applied Science
University of Colorado Boulder

Peer Exchange: Open to All

- Do you want to share any other resources that your peers should be aware of?

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Path Forward & Wrap-up

Next: Phase 2 Opportunity

- **What?** Individualized agency training on the tools and strategies.
- **Who?** Priority given to state agencies most prepared to implement the guidebooks; e.g., agencies who have participated in the 8 training sessions which gave them the foundational knowledge required.
- **How?** Through working closely with our research team in-person, as needed (cost covered by NCHRP).
- **Why?** To help in selecting and implementing tools that are applicable to your projects, evaluating the agency's implementation strategy, and offering guidance as needed.
- **When?** January-May 2023.

Next: Phase 2 Outcomes

- Individualized feedback on how to use the D-B and CM-GC guidebooks with their specific ongoing projects.
- Select and implement appropriate tools for various types of D-B and CM-GC projects for all phases of contract administration.
- Improve project communication, management, and documentation.
- An opportunity to participate in a final implementation workshop with the agencies other who engaged in phase 2 to share lessons learned.

Path Forward Poll

- Places are limited; priority for agencies who have attended the 8 training sessions
- CEUs

Key Takeaway Points

- **Witness and hold points** are used to verify that work is according to plan before it gets enclosed.
- **A payment checklist** creates an organized system for the contractor's preparation of invoices and agency's review of invoices.
- **There are additional resources available** on the topic.
- **There are at least 36 tools** that can help with post-award contract administration; pick the ones that are most relevant to your project and within your context.

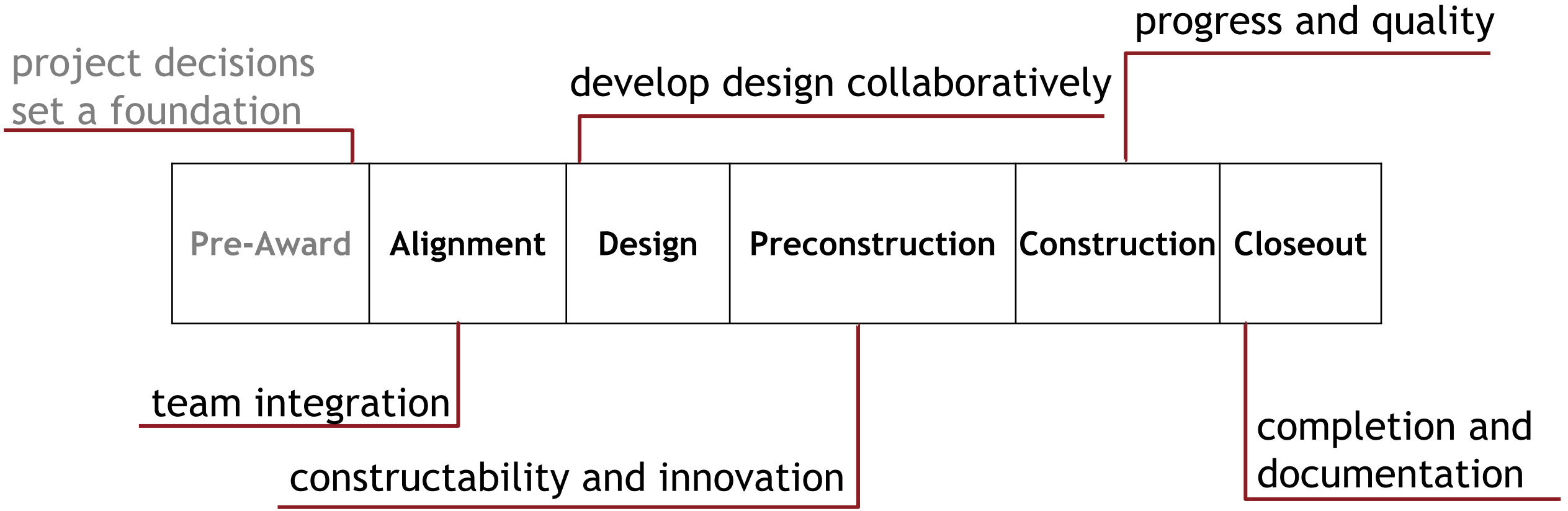
Overall Learning Objectives

1. Navigate and interpret the information in the D-B and CM-GC Guidebooks that is relevant to your project.

2. Select and implement appropriate tools for various types of D-B and CM-GC projects for all phases of contract administration.

5 Contract Administration Phases

The guidebooks describe the following phases of D-B and CM-GC contract administration



6 Overarching Contract Administration Strategies for D-B and CM-GC

Alignment Strategy

Scope Strategy

Design Quality Strategy

Preconstruction Services Quality Strategy

Construction Quality Strategy

Construction Efficiency Strategy

36 Tools (1 of 2)

	Contract administration phase					Project complexity			Project size		
Tools for D-B and CM-GC contract administration	Alignment	Design	Preconstruction (CM-GC only)	Construction	Closeout	**Non-complex**	**Moderately complex**	**Complex**	**≤ $10 M**	**$10 M - $50 M**	**> $50M**
Kickoff meeting	✓					●	●	●	●	●	●
Roles and responsibilities	✓					◗	●	●	●	●	●
Confidential one-on-one meeting	✓					◗	●	●	◗	●	●
Glossary of terms	✓					●	●	●	●	●	●
Co-location of key personnel	✓	✓	✓			○	◗	●	○	◗	●
Regulatory agency partnering	✓	✓	✓			○	●	●	◗	●	●
External stakeholder coordination plan	✓	✓				◗	●	●	◗	●	●
CM-GC management fee table	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
ACM-specific partnering	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
Continuity of team members	✓	✓	✓	✓	✓	◗	●	●	◗	●	●
FHWA involvement overview	✓	✓	✓	✓	✓	●	●	●	●	●	●
Permit commitment database	✓	✓	✓	✓	✓	◗	●	●	●	●	●
Plan standards		✓	✓			◗	◗	●	◗	●	●
Deviations from agency standards		✓	✓			◗	●	●	◗	●	●
Discipline task force		✓				○	◗	●	◗	●	●
Independent party design review		✓				○	●	●	○	●	●
Cost savings matrix		✓				◗	●	●	◗	●	●
In-Progress design workshops		✓	✓			◗	●	●	●	●	●

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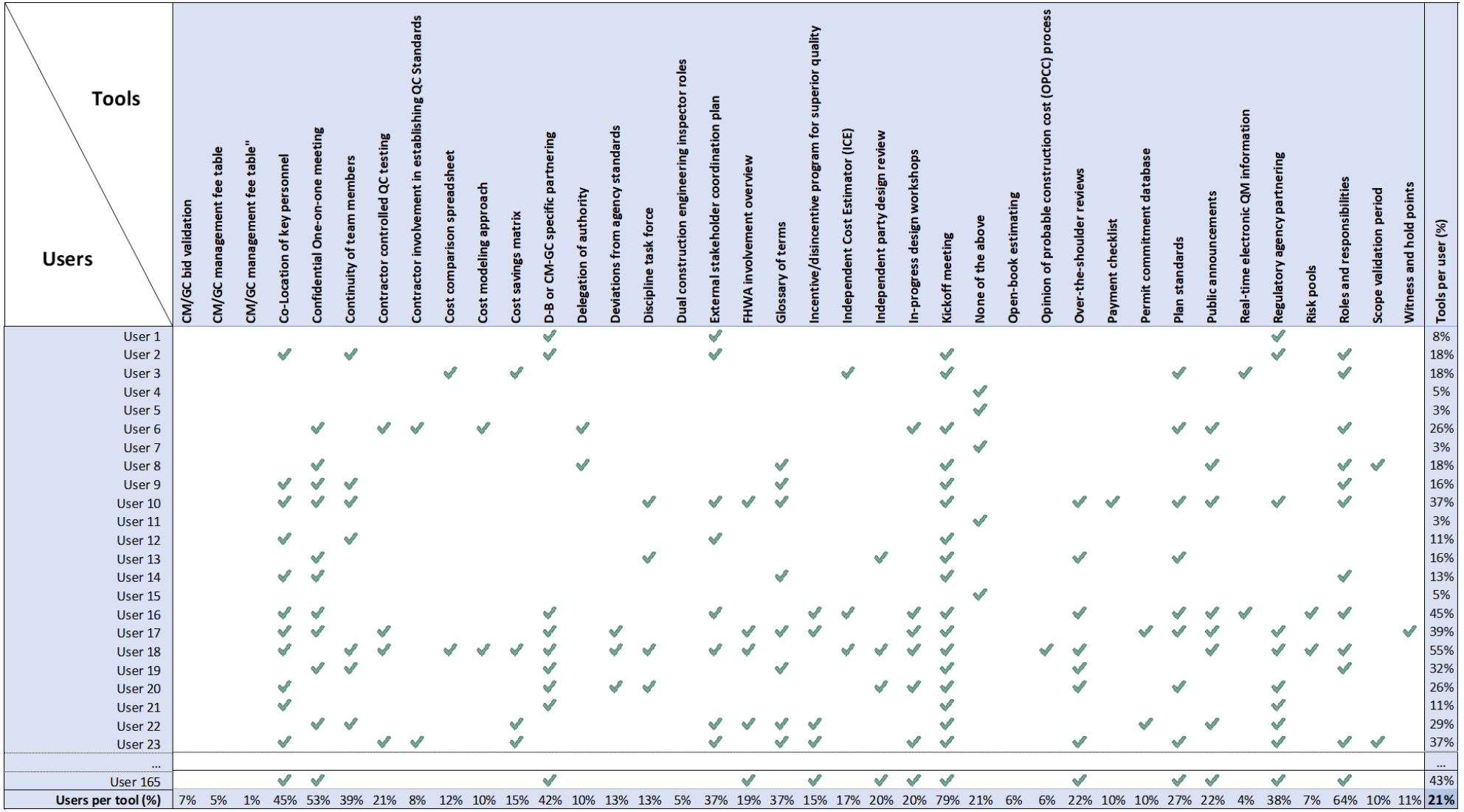
36 Tools (2 of 2)

	Contract administration phase					Project complexity			Project size		
Tools for D-B and CM-GC contract administration	Alignment	Design	Preconstruction (CM-GC only)	Construction	Closeout	**Non-complex**	**Moderately complex**	**Complex**	**<= $10 M**	**$10 M - $50 M**	**> $50M**
Over-the-shoulder reviews		✓	✓			◗	●	●	●	●	●
Scope validation period	✓	✓				●	●	●	●	●	●
Public announcements		✓	✓	✓	✓	○	●	●	◗	●	●
Delegation of authority		✓	✓	✓	✓	●	●	●	●	●	●
Open-book estimating			✓	✓		◗	●	●	◗	◗	●
Cost comparison spreadsheet			✓			◗	●	●	◗	●	●
Cost modeling approach			✓			◗	●	●	◗	●	●
CM-GC bid validation			✓			◗	●	●	◗	●	●
Independent cost estimator			✓			◗	●	●	◗	●	●
Opinion of probable construction cost			✓			◗	●	●	◗	●	●
Risk pools			✓	✓		○	●	●	◗	●	●
Contractor controlled QC testing				✓		●	●	●	●	●	●
Contractor involvement in establishing QC standards				✓		◗	●	●	◗	●	●
Real-time electronic QM information				✓		●	●	●	●	●	●
Incentive/disincentive program for superior quality				✓		◗	●	●	●	●	●
Dual construction engineering inspection roles				✓		◗	◗	●	◗	●	●
Witness and hold points				✓		◗	●	●	◗	●	●
Payment checklist				✓	✓	●	●	●	●	●	●

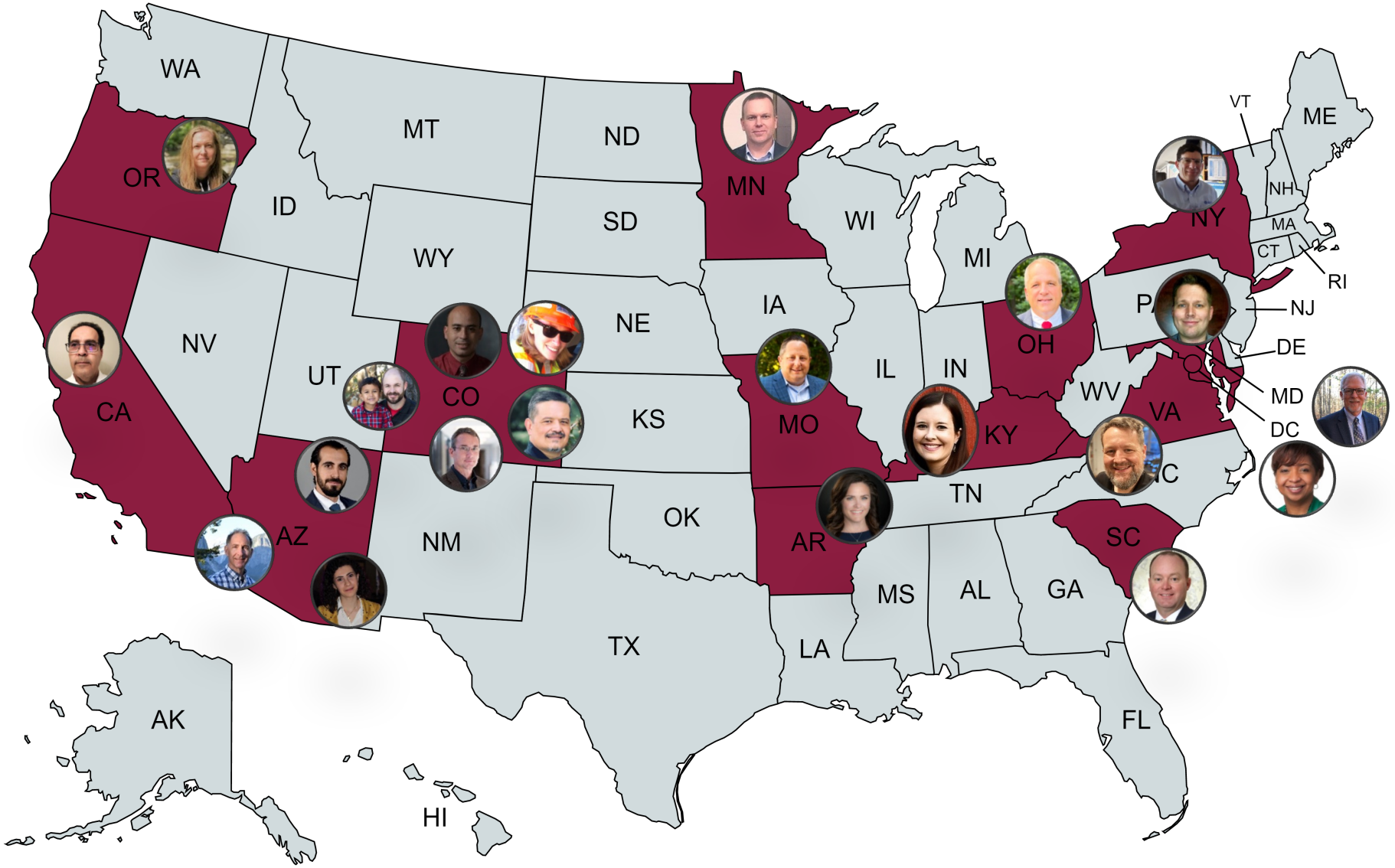
● = Recommended; ◗ = Consider Case-by-Case; ○ = Not Recommended

Session 1 vs. Session 8

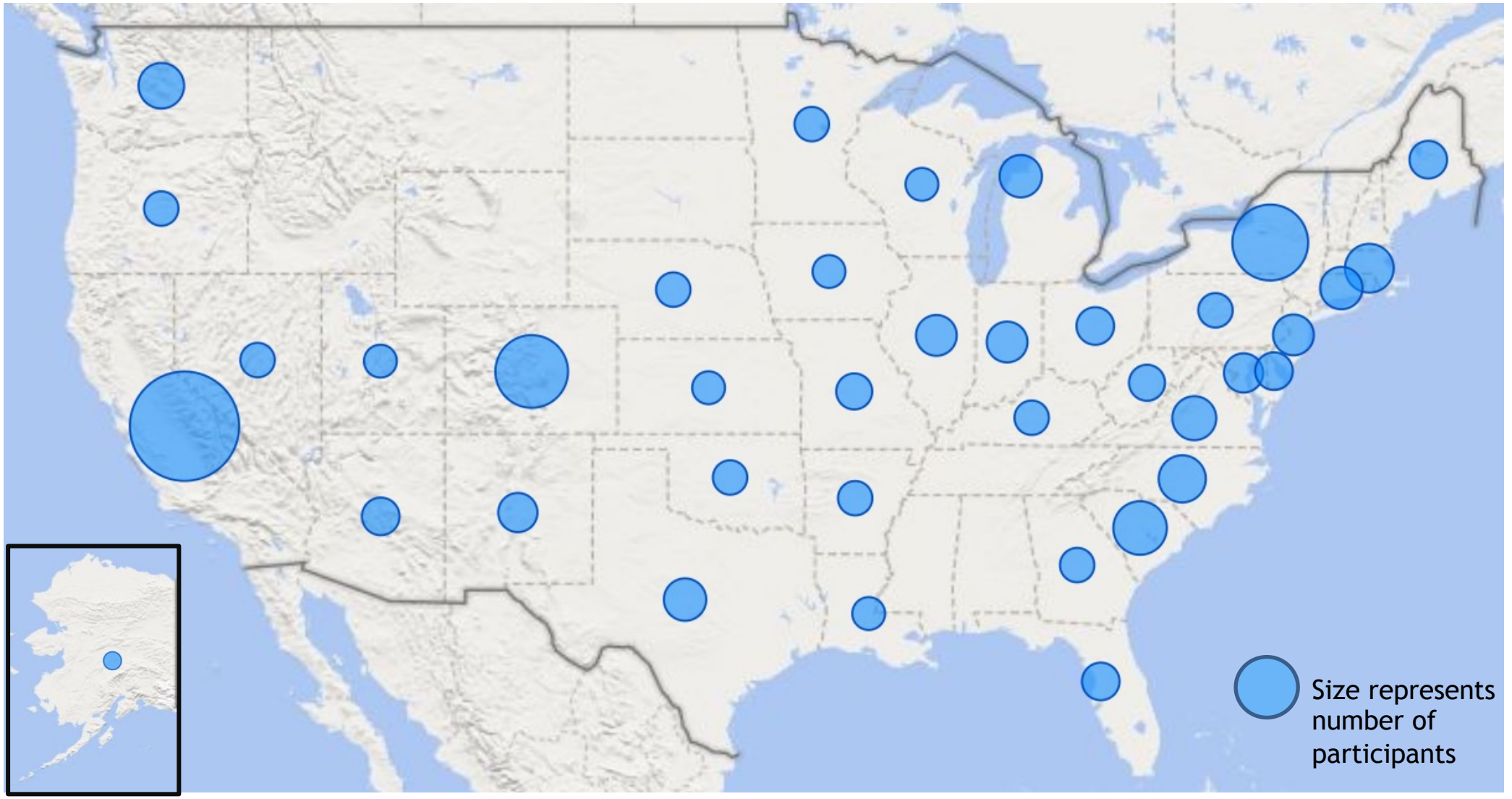


Users \ Tools	CM/GC bid validation	CM/GC management fee table	CM/GC management fee table"	Co-Location of key personnel	Confidential One-on-one meeting	Continuity of team members	Contractor controlled QC testing	Contractor involvement in establishing QC Standards	Cost comparison spreadsheet	Cost modeling approach	Cost savings matrix	D-B or CM-GC specific partnering	Delegation of authority	Deviations from agency standards	Discipline task force	Dual construction engineering inspector roles	External stakeholder coordination plan	FHWA involvement overview	Glossary of terms	Incentive/disincentive program for superior quality	Independent Cost Estimator (ICE)	Independent party design review	In-progress design workshops	Kickoff meeting	None of the above	Open-book estimating	Opinion of probable construction cost (OPCC) process	Over-the-shoulder reviews	Payment checklist	Permit commitment database	Plan standards	Public announcements	Real-time electronic QM information	Regulatory agency partnering	Risk pools	Roles and responsibilities	Scope validation period	Witness and hold points	Tools per user (%)
User 1												✓					✓																	✓					8%
User 2				✓		✓						✓					✓							✓										✓		✓			18%
User 3									✓		✓	✓									✓			✓							✓		✓		✓			18%
User 4																									✓													5%
User 5																									✓													3%
User 6					✓		✓	✓		✓			✓										✓	✓							✓	✓				✓		26%
User 7																									✓													3%
User 8					✓								✓						✓					✓								✓				✓	✓	18%
User 9				✓	✓	✓													✓					✓											✓			16%
User 10				✓	✓	✓									✓		✓	✓	✓					✓				✓			✓	✓		✓		✓			37%
User 11																									✓													3%
User 12				✓		✓											✓							✓														11%
User 13					✓										✓							✓		✓				✓			✓							16%
User 14				✓	✓														✓					✓											✓			13%
User 15																									✓													5%
User 16				✓	✓							✓					✓			✓	✓		✓	✓				✓			✓	✓	✓		✓			45%
User 17				✓	✓		✓					✓		✓				✓	✓	✓			✓	✓					✓		✓	✓		✓			✓	39%
User 18				✓		✓	✓		✓	✓	✓	✓		✓	✓		✓	✓			✓	✓	✓	✓			✓	✓				✓		✓	✓	✓			55%
User 19					✓	✓						✓							✓					✓				✓							✓			32%
User 20				✓		✓						✓		✓	✓							✓	✓	✓				✓			✓			✓				26%
User 21				✓								✓												✓										✓				11%
User 22					✓	✓					✓						✓	✓	✓	✓				✓						✓		✓		✓				29%
User 23				✓			✓	✓			✓						✓		✓	✓			✓	✓				✓			✓			✓		✓	✓		37%
...																																						...
User 165				✓	✓							✓						✓		✓		✓	✓	✓				✓			✓	✓		✓		✓			43%
Users per tool (%)	7%	5%	1%	45%	53%	39%	21%	8%	12%	10%	15%	42%	10%	13%	13%	5%	37%	19%	37%	15%	17%	20%	20%	79%	21%	6%	6%	22%	10%	10%	27%	22%	4%	38%	7%	64%	10%	11%	**21%**

Thanks to NCHRP & our Expert Guests



300+ Participants from 38 States & 5 Countries



Canada

China

Panama

Papua New Guinea

UK


Say
CHEESE

Course Evaluation

Anonymous Course Evaluation

- Please take a few minutes to let us know how we did.
- Thank you!

OPEN DISCUSSION