ACEC/MaineDOT Bridge Design Subcommittee

MEETING AGENDA

December 12, 2023

Location
Hybrid: Virtual/MDOT HQ Room 317

Time
1:00 PM to 3:00 PM

Purpose of Meeting
4th Quarter Meeting - 2023

Invitees

- ☑ Garrett Gustafson, MaineDOT
- ☑ Laura Krusinski, MaineDOT
- ☐ Ron Taylor, MaineDOT
- ☑ Richard Myers, MaineDOT
- ☐ Devan Eaton, MaineDOT
- ☑ Joshua Hasbrouck, MaineDOT
- ☐ Tim Aguilar MaineDOT
- ☐ Chad Lewis, MaineDOT
- ☑ Keith Wood, Kleinfelder
- ☑ Ashley Stephens, HNTB
- ☑ Andrew Blaisdell, GZA
- ☑ Ben Toothaker, TYLIN
- ☑ Shannon Beaumont, Fuss & O'Neill

AGENDA ITEMS

1. Members
    a. Keith Wood's last meeting
2. Meeting Minutes Submission – *Meetings minutes were submitted and uploaded to ACEC site.*
3. Information Dissemination by MaineDOT
    a. Contracting/workload
        - Work plan update –
            - *Nearing completion of 24-25-26 workplan, 2025 has 97 project and 2026 has 126 project which is really steep increase in projects. For reference 2024 has 69 projects.*
            - *Alternative project delivery ideas the Department is investigating, RFP for more total project delivery including survey, utility, possibly ROW mapping. Survey is a big need and mapping, property office is half staffed currently.*
            - *Regions large culverts are tripling due to government budget and grants.*
            - *3 Design Build Packages are being considered:*
                a. *2024 – I95 NB/SB in Bangor;*
                b. *2025 – 6 bridge replacements from Sidney to Waterville, Dinsmore road to Trafton road;*
                c. *2026 – 6-9 bridge on 395 from Bangor to Brewer.*
                d. *2025 and 2026 may be dependent on successful grant application.*
    b. Federal Grants & Federal Funding Updates: *Received culvert grant, another culvert grant to be submitted.*
    c. MaineDOT Staffing Update: *Interviewing for multiple ATE positions. Will change postings to specific discipline, technicians, TE2 (licensed engineers). Fabrication engineer remains unfilled, which is a TE3.*
    d. Construction Cost Estimating/Bid Result updates: *Rich and Wayne conducted contractor feedback meetings: Cianbro, R&R, T-Buck, W&S, CPM: Takeaways include the following:*

- *No night work as it challenges staff retention;*
- *CIDD process is working well for all;*
- *Smaller contractors have to be really selective with projects to determine if they have the right staff and project location.*
- *Contract duration sweet spot 2-3 years. Projects with schedule options, smaller contractors like that.*
- *Complex rehabs – very little interest overall in rehabilitations, particularly concrete chip and patch.*
- *Bridge paving still really expensive since there are only two major contractors.*
- *Certain fabricators are not bidding work for steel due to work load.*

e. Standards Update (BDG, PDR/PIC, CADD, Notes) –
   - BDG update – *Chapters 1 to 3 are close to being done.*

f. OpenRoads update – *See discussion topics.*

4. Summary of Designer Meetings (See attached)
   - *Sept. 28: NSBA Steel materials/fabrication*
   - *Oct. 12: Tokyo Rope*
   - *Nov. 1: Durability Inc. on corrosion*
   - *Nov. 20: GFRP Design.*
   - *Nov. 29: Hydrovac for excavation; Maine Coastal Flooding Hydraulic Model update – only tidal model, does not include riverine flows locations but will identify which controls.*
5. Geotechnical Update (Laura K.)
   a. *Freeport Integral Pile Detail. Abutment 2 utilized the VTrans variation of the rock-socketed H-pile, where the entire excavation is filled with pea stone. Prior to testing, the test pile location was pre-drilled into competent bedrock. The entire excavation was backfilled with pea stone to subgrade. Dynamic pile testing was conducted by "proofing" the test pile after installation. The test pile was impacted with an approved drop hammer with increasing drop heights until no additional pile penetration into rock was observed. Each production pile was "proofed" replicating the successful test. Construction controls were a challenge. A template was specified, but not adequately installed. The test pile defected out-of-plumb. A prescriptive driving process was required, and it was difficult to ensure the installed piles were plumb, introducing a risk of P-delta effects on short piles. Challenging construction controls established concerns about the use of this detail on future projects.*
   b. *Micropile moratorium for MassDOT, they have had a hard time rejecting micropiles for IAB's for deign builds so they implemented the moratorium to control that. In the meantime, MassDOT is building a trial IAB in Sturbridge to test this application. The hope is to get data to develop design requirements for micropile-supported IAB's for their Bridge Manual.*
6. Discussion Topics
   a. OpenRoads challenges with bridge detailing, schedule on large culvert workspace.
      - *Workflows are being updated and can be sent if not on the website*
      - *Detailing – yet to be seen for line weights and font sizing since we are early in the process.*
   b. Anchoraged ends, priority based on hazard
      - *See design meeting minutes.*
   c. MHHW, new preferred method compared to BDG. NOAA calculators?
      - *Evolving process to understand MHHW so white paper to get to determine.*
      - *Mike Wight has done white papers for specific projects.*
   d. Milled deck surfaces, impacts to Camber, BOS, etc. Structure preferences?
      - *No real guidance, waiting to see how things are after a few years in service.*

e. APJ – Integral abutment bridge preferences, structure type, span length
    - *Very specific to bridge and project team.*

f. *Driveway assisted devices (DADs): drive traffic control, interim approval from FHWA to use DADs. Looking for pilot projects.*

g. *Steel 3-Bar and steel 3-bar transition whenever possible, specifically on NHS. Entering contract to test barrier – 3-bar height concrete transition, 4-bar height concrete transitions, 4-bar steel rail behind sidewalk.*

h. *Training – hydraulics, seismic, drilled shafts micropiles, curved/high skew bridge, bridge rehab.*

i. *Ways to improve productivity/improving efficiency to deliver larger work plan*
    - *General discussion on bundling projects*
    - *Total project delivery*
    - *Progressing forward with a solution compared to the perfect solution*

j. Other –

7. Future Discussion Topics
    a. *Ways to improve productivity/improving efficiency should be on-going discussion*
8. Subcommittee Rotation for Consultants
    a. Active:
        - Keith Wood, Kleinfelder — Q1 2022 thru Q4 2023
        - Ashley Stephens, HNTB (Co-chair) — Q2 2022 thru Q1 2024
        - Andrew Blaisdell, GZA — Q2 2022 thru Q1 2024
        - Ben Toothaker, TYLIN — Q4 2022 thru Q3 2024
        - Shannon Beaumont, Fuss & O'Neill — Q2 2023 thru Q1 2025

    b. Future:
        - Bryson Welch, Thornton Tomasetti — Q1 2024 thru Q4 2025
        - Robert Blunt, VHB — Q2 2024 thru Q1 2026
        - Bryan Steinert, H&A — Q2 2024 thru Q1 2026
        - John Byatt, BETA Group — Q4 2024 thru Q3 2026
9. The Next Meeting is set for: March 5th, 2024.

Designers Meeting Minutes

Thursday, September 28, 2023

Conference Room 317 A&B

12:00-1:00 PM

NSBA

Material Availability

- Nationally, most steel mills are at around 75% capacity.
- Steel plate lead time is typically in the 8-10 week range (smaller quantities probably in stock).
- MaineDOT fabricators are currently saying roughly 1 year lead time to final product.
- Stainless girders have suffered low availability.
- Research looking into chromium.

Improving Capacity

- Material capacity is improving at new plants.
- Example: New Nucor, Kentucky Plate Mill
    - Improved capacity, sustainability
        - Improvements have been made in fabrication sustainability.
        - Buy clean legislation requires energy use monitoring on some projects.
        - Energy consumption and recycled material use
        - Joint document on sustainability from AISC and PCI
        - Mills are making more use of sustainable energy and can provide certification.
- Example: Philadelphia I95 fire: NSBA was able to work with mills to procure materials for the emergency project.

New Reports

- *Uncoated Weathering Steel Reference Guide* published in 2022 (MaineDOT usage seems to be roughly in accordance with these guidelines)
- *Single Coat Inorganic Zinc Protection for Steel Bridges* published in 2023
- *Lean-on Bracing Reference Guide* published in 2022

Current Research

- Coatings durability study at University of Delaware with direct comparison of zinc paint, galvanized, metalized, and weathering steel. Phase 1 complete, Phase 2 in progress.

Designers Meeting Minutes

Thursday, October 12, 2023

Conference Room 317 A&B

1:00-2:00 PM

Tokyo Rope

- Company started producing manila rope and was the first manufacturer of steel wire rope in Japan. Background is in the manufacture of all kinds of rope and cable.
- Carbon strand from TR is a twisted rope, not pultruded.
- Can be formed into shaped bars and cured to give rigidity
- Chuck system on strand has been reworked to be more flexible and easy to install

Designers Meeting Minutes

Wednesday, November 1, 2023

Conference Room 317 A&B

1:00-2:15 PM

Presentation from Jorge Costa, PE of Durability, Inc.

Intro and background

- Corrosion in the news
- Corrosion is commonly addressed as a surface issue
    - "Patch and pray"
- Corrosion isn't properly addressed due to economic factors.
- "Watch for Debris" signs and debris nets instead of repair.

Financial Cost

- Estimated 3% GDP spent addressing corrosion.
- Replacing structures is even more expensive.

Corrosion and Energy – How corrosion happens chemically.

- Metal in nature (ore) is at a lower energy state.
- Processing metal at mills and foundries add energy into it.
- Energy leaves the metal over time via electrical currents.
    - This is oxidation.
- Corrosion is the process of a member returning to a lower energy state.
- Stopping the energy transfer stops corrosion.

Concrete as a Corrosion Environment

- Steel does not corrode in high pH (basic) environments.
- Concrete has a naturally high pH.
    - However, other factors (e.g. chloride penetration, water, and carbon dioxide) lower the pH.
- When concrete is cast around rebar, a protective coating forms.
    - This is a passive layer.
- When these penetrate the passive layer, corrosion occurs.
- There have been efforts to determine the chloride level which initiates corrosion.

Corrosion in Concrete

- Different ways corrosion can manifest in concrete.
- Remaining stress from fabrication can form a corrosion cell.

- Cathodic protection: aluminum and steel together.

Corrosion Cycle

- 1. Initiation
  - Chlorides and carbonation enter the structure.
  - Hopefully this takes a long time.
- 2. Propagation
  - Electrochemical processes begin.
  - Immunity is lost.
  - No external signs
- 3. Failure
  - Cracking, spalls, delamination, etc.
  - Loss of structural integrity.
- Different countermeasures for each stage.

Countermeasures

- Phase 1: Risk assessment, design, preventative measures,
  - Best time to address corrosion issues.
  - Least expensive time to address.
- Phase 2: Evaluation, topical repair, active protection strategies.
  - Middle cost
- Phase 3: Repair
  - Most expensive
  - Should design repairs to resist future corrosion.

Corrosion Assessments

- Analysis: AASHTO t-260-A, ASTM C1152
  - Acid or water soluble.
- Carbonation
  - Solution spray shows where the pH has changed (from carbonation).
  - pH change causes corrosion.
- Electrical Potential Map
  - Non-destructive method.
  - Reference electrode gives stable voltage.
  - Attach clamp to rebar, measure voltage against the reference. Tells probability of active corrosion.
  - Only need to uncover the steel in a few areas to establish electronic continuity.
    - In an example they were able to do an entire pool with only 2 patches exposed.
  - Reactive intervention occurs between phases 2 and 3.

Mitigation

- "Corrosion is economical rather than technical."
    - We have the technology to prevent corrosion, but it's expensive, so it doesn't get done as frequently as it should.
- Proactive intervention: analyze structure before corrosion becomes an issue.
- Mitigation Strategies by Phase
    - Phase 1: Coatings, sealers, mix design
    - Phase 2: Electrochemical techniques
    - Phase 3: Compatible repairs
        - Don't create a difference in repair materials.
        - Prevent the formation of corrosion cells/ring corrosion.
- Corrosion Sensors
    - Electrodes embedded in the concrete
    - Monitoring rather than prevention.
- Cathodic Protection Systems
    - Sacrificial anode
    - Put net flow through the rebar to keep electronic discharge frim causing corrosion.
- Cathodic Protective Jackets
    - Forms with a zinc mesh
        - FRP jacket
        - Cost → zinc cost is tied to metal market, FRP is expensive.
            - Life cycle cost analysis would be required before use.
            - Adds about 30 years or more to the structure's lifespan.
- Metalizing
    - Spray zinc or aluminum alloy on the concrete surface.
    - The whole surface becomes the anode.
    - 20 mm thick.
    - The coating has a 10–15-year service life.
- Corrosion Protection with TI Ribbon Anode
    - Titanium ribbon embedded in the structure.
    - Delivers current to the reinforcing.
    - Hypothetical 75-year life.
    - Special grout to allow transfer of current.
    - Need to avoid contact with the rebar. This causes shorts and near-shorts.
- Cassette Anode
    - Similar to the TI Ribbon Anode, but with fiberglass cassettes on the surface of the concrete.
    - As effective as an embedded ribbon.
    - Significantly reduces cost of installation.

    - Easier to replace.
- Conductive Paint Corrosion Protection
    - Original paints were not successful in the US.
    - New paint is mineral based instead, and works well.

Connectivity

- Systems and sensors can be connected and monitored via the internet
    - Adjustments can be made over the internet.
- Self-healing coating with microcapsules can heal microscopic damage.

Designers Meeting Minutes

Monday, November 20, 2023

Conference Room 317 A&B

11:00-12:00 AM

GFRP Design Properties

- Inconsistency between what has been used on different projects
- Historically, started with VTrans values that they developed from research
- Switched to D7957, but ultimate strength isn't consistent between bars
- Newer spec D8595 has higher properties and includes basalt bar
- Fabrication group determined all manufacturers could meet properties in D8595 but testing should still be in accordance with D7957
- QPL requirements will be updated to match
- New designs should use:
    - 100 ksi minimum tensile strength
    - 1.1% minimum ultimate tensile strain
    - 8,700 ksi (60 GPa) minimum elastic modulus

Bar Detailing

- Significant time impact if changes during construction and new bent bars need to be produced
- Cost of corrosion resistant bar is higher and has bigger impact to project budget if bars are missed
- Make sure to check all rebar schedules thoroughly
- ChromeX is significantly harder to bend in the field than plain bar, avoid field bends and field cutting when possible

Prestressing Strands Projecting out of Precast

- Bending strand has been done, but often difficult and dealing with bird nesting of strands after cut
- Avoid by using pinned integral connections instead of full integral
    - True for all precast types, including bulb tees

Utility Issues during Construction

- Utility companies can be a major delay during construction
- Even temporary moves can be time consuming
- Consider all moves carefully and if they can be minimized

Mast Arms

- Try to keep them shorter than 45-50', otherwise the foundation design can get very large and difficult to manage

Guardrail Anchorage Assemblies

- Guardrail anchorage assemblies should only be used in special circumstances
- Consider use if meets all three of these general criteria:
    - Leading end
    - 3rd post from end is in the clear zone
    - Extreme hazard behind the guardrail (dropoff, water, etc. not just slope)

Designers Meeting Minutes

Wednesday, November 29, 2023

Conference Room 317 A&B

1:00-2:00 PM

Using hydrovac for excavation

- Milo, Old Toll Bridge project called for 10’ of drilling to excavate stiff glacial till and allow more room for pile to move and relieve stresses
- No permanent casing required, just install of loose cushion sand
- Contractor proposed using hydro excavation instead of mobilizing a drill rig
- After driving pile, hydrovac came in to excavate around pile
- Performed well, hole became slightly larger in order to fit vac pipe around the corners of the pile flanges
- Was able to cut through glacial till, definitely faster in areas with more sandy material
- Biggest slow down was cobbles that were roughly diameter of vac pipe and would need to be picked up and dumped out of the hole before work could continue

Status of the Maine Coastal Flooding Hydraulic Model

- Contract with Woods Hole Group started in early 2023
- Delay in start of actual modeling because NOAA collecting tidal lidar data that is much more consistent and higher quality than previously available in all areas, that data is starting to be delivered
- Model results will be grid of data with storm flood elevations at various recurrence intervals and sea level rises
- Model will identify areas that are completely controlled by tidal, and an outside range of where there is no tidal effect – in between those two the interaction between tidal and riverine flows will not be known and will need to be developed on a project by project basis