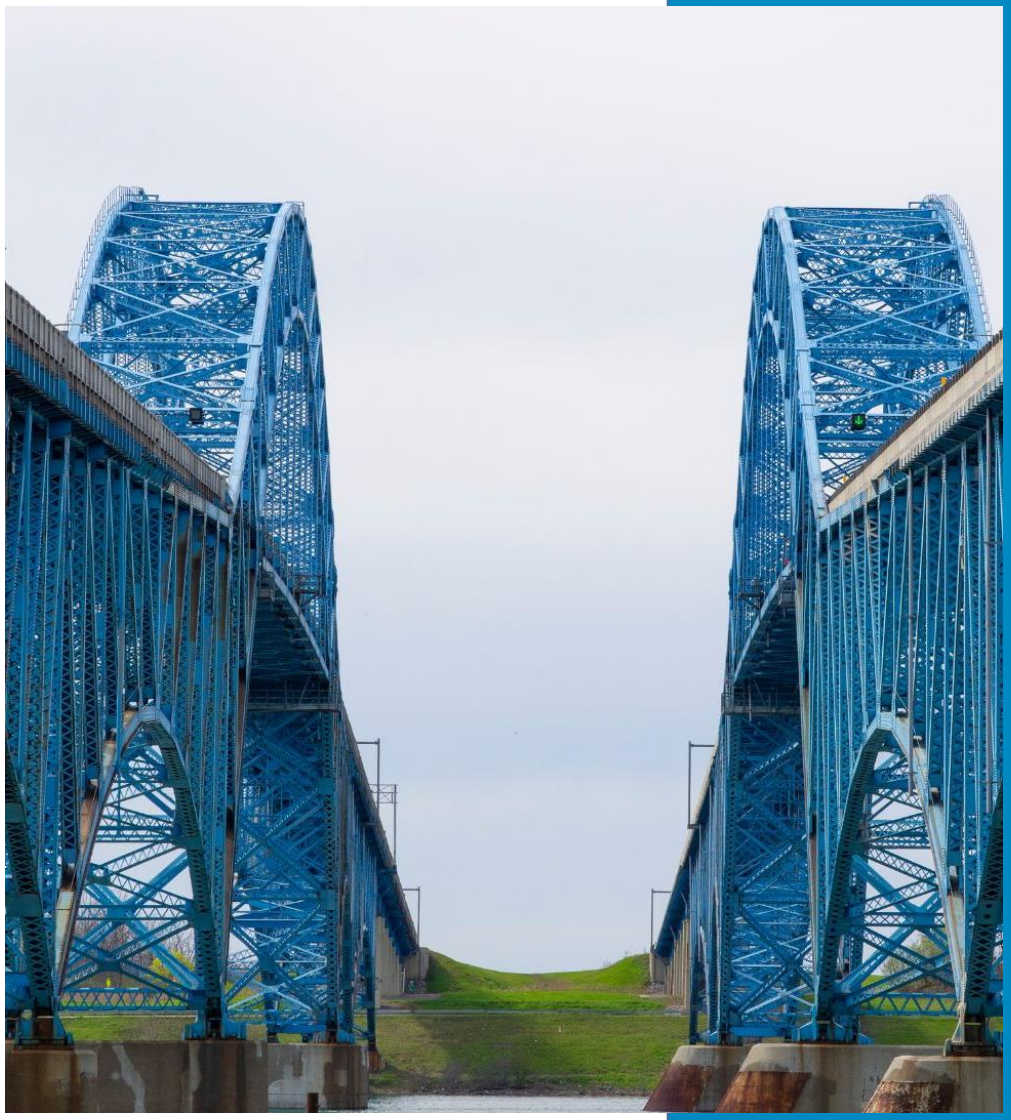
AASHTOWare™ BRIDGE DESIGN AND RATING

Update to AASHTOWare BrDR for Soil/Structure Interaction

Jennifer Hart, P.E., Indiana DOT

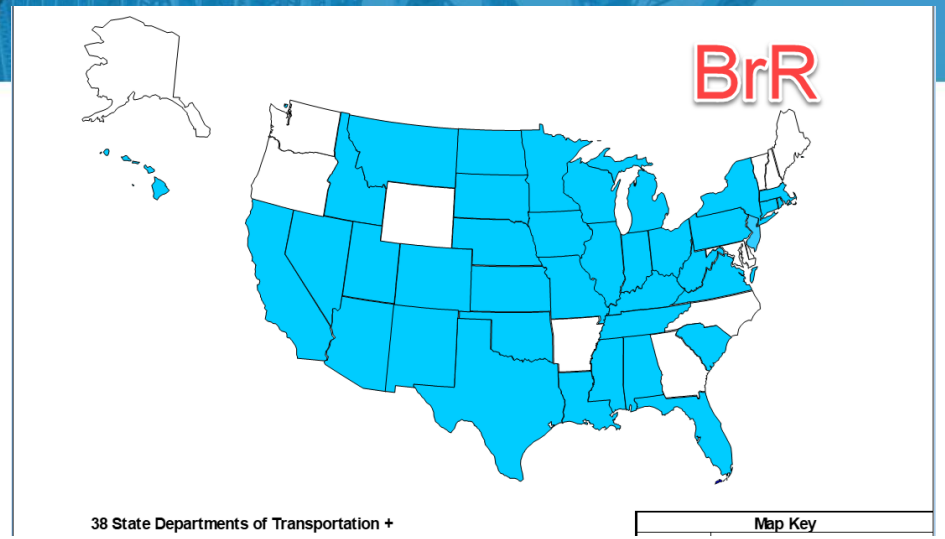
Mark Mlynarski, P.E., ProMiles

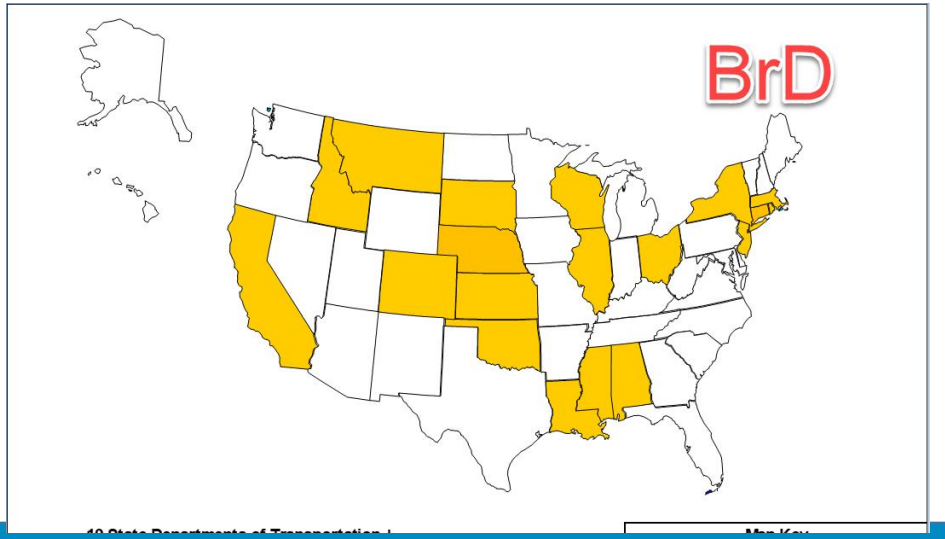


RADBUG 2024 | August 6-7 | Buffalo, NY

BrDR licensees

- BrR 40+ State DOT's and agencies
- BrD 20 State DOT's and agencies
- 27 unlimited licenses
- 700+ other licenses
- 100,000+ bridge models entered into BrDR
- RADBUG (Rating and Design Bridge User Group)





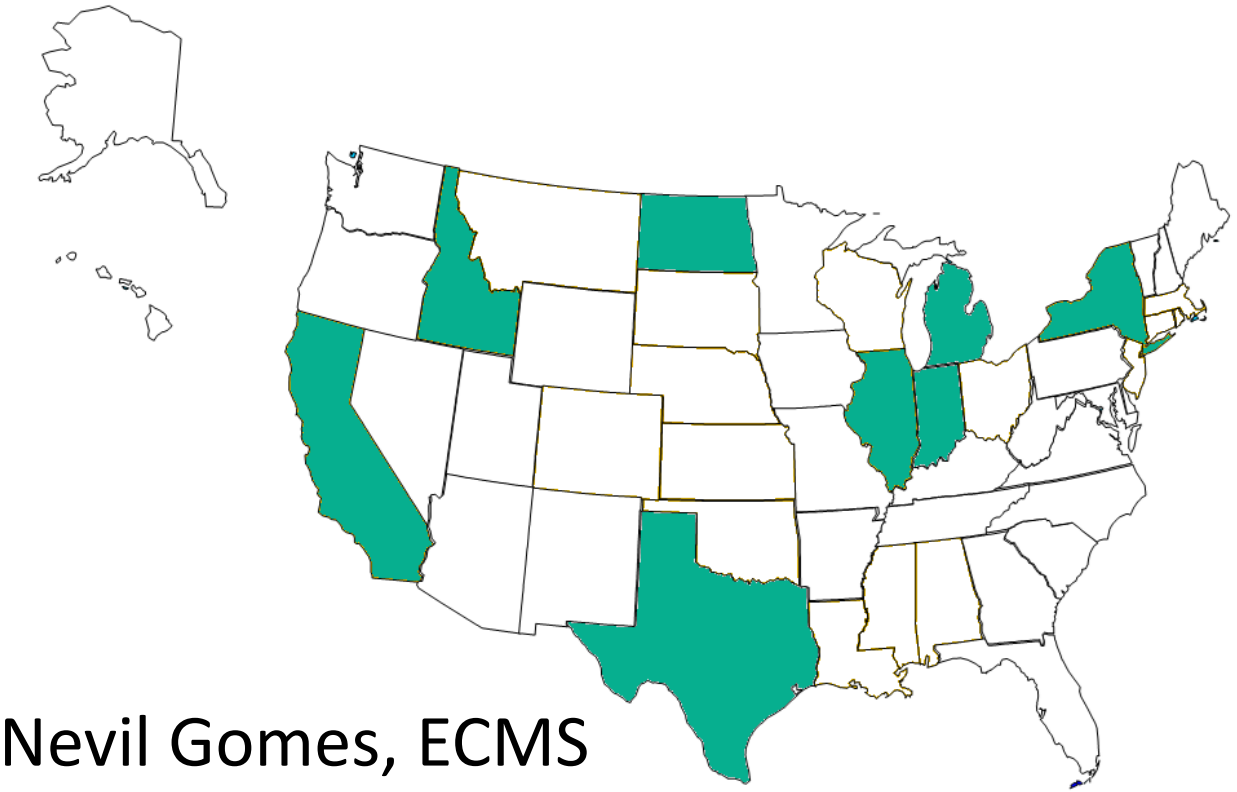
BrR RADBUG voting

AASHTOWare Bridge Rating (BrR) – 28 state agencies returned the ballot with 113 unique enhancements.

Rank	Points	Key	Summary
1	3247.1	BSSD-3824	Create a CANDE-like modeling/engine for BrDR *The BrDR 7.7 development will start tackling this enhancement by implementing non-linear finite element formulation of soil-culvert interaction. The development of the user interface, modeling capabilities, and specification checking are currently under planning.*
2	2484.3	BSSD-3618	Allow adding Girder(s) to either Left or Right side of Girder System model
3	2060.8	BSSD-3503	Add steel curved girder functionality to the load rating tool for both LFD and LRFR
4	2016.0	BSSD-1692	Steel girder strengthening: Cover plates and Post-Tensioning

Culvert TAG participants – 8 DOTs, 2 consultants

- Jennifer Hart, Indiana, Chair
- Mike Johnson, Idaho, Vice-Chair
- Mark Mlynarski, ProMiles
- Biniam Aregawi, Texas DOT
- Ruben Boehler, Illinois DOT
- Ratan Huda, New York DOT
- Matt Luger, North Dakota DOT
- Don Tempinson, Michigan DOT
- Richard Tsang, CalTrans



- Nevil Gomes, ECMS
- Damian Silverstrim, AI Engineers

Current and future development status

Mark Mlynarski, P.E., ProMiles

Early stages–Phase I – Version 7.7 (Fall, 2025)

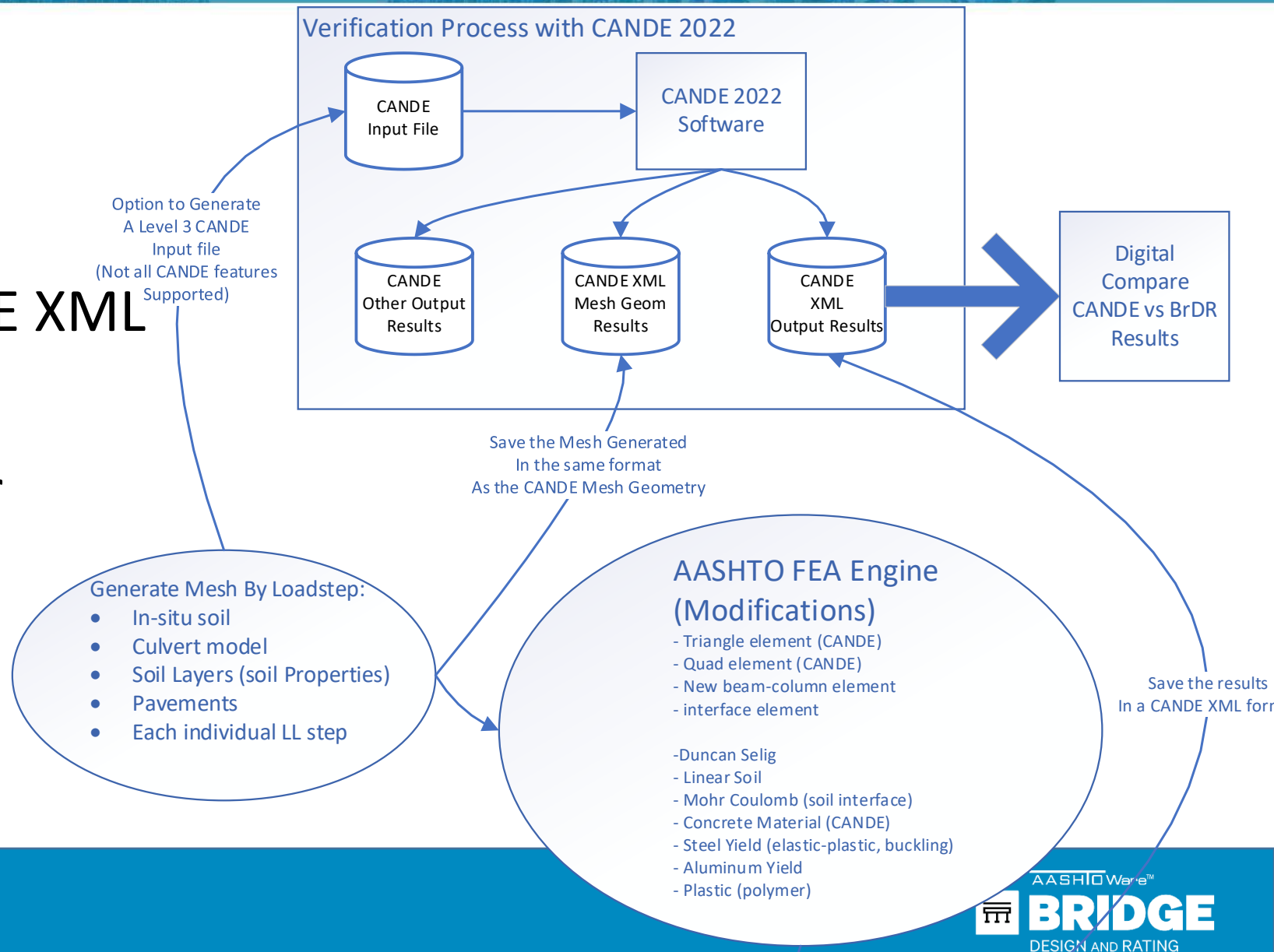
- Developing Elements similar to CANDE
- Using modern programming techniques and practices

  (NOT integrating the existing CANDE into BrDR – just the techniques)
- Creating the analysis engine to run Level 3 models

Early stages–Phase I – Version 7.7 (Fall, 2025)

- Validation with CANDE
  - Tools for comparing the results of existing CANDE models
- Engine included in version 7.7 of the BrDR software
  - Will NOT be available to users (no user interface)
  - User Interface will be provided in later versions (Phase II)

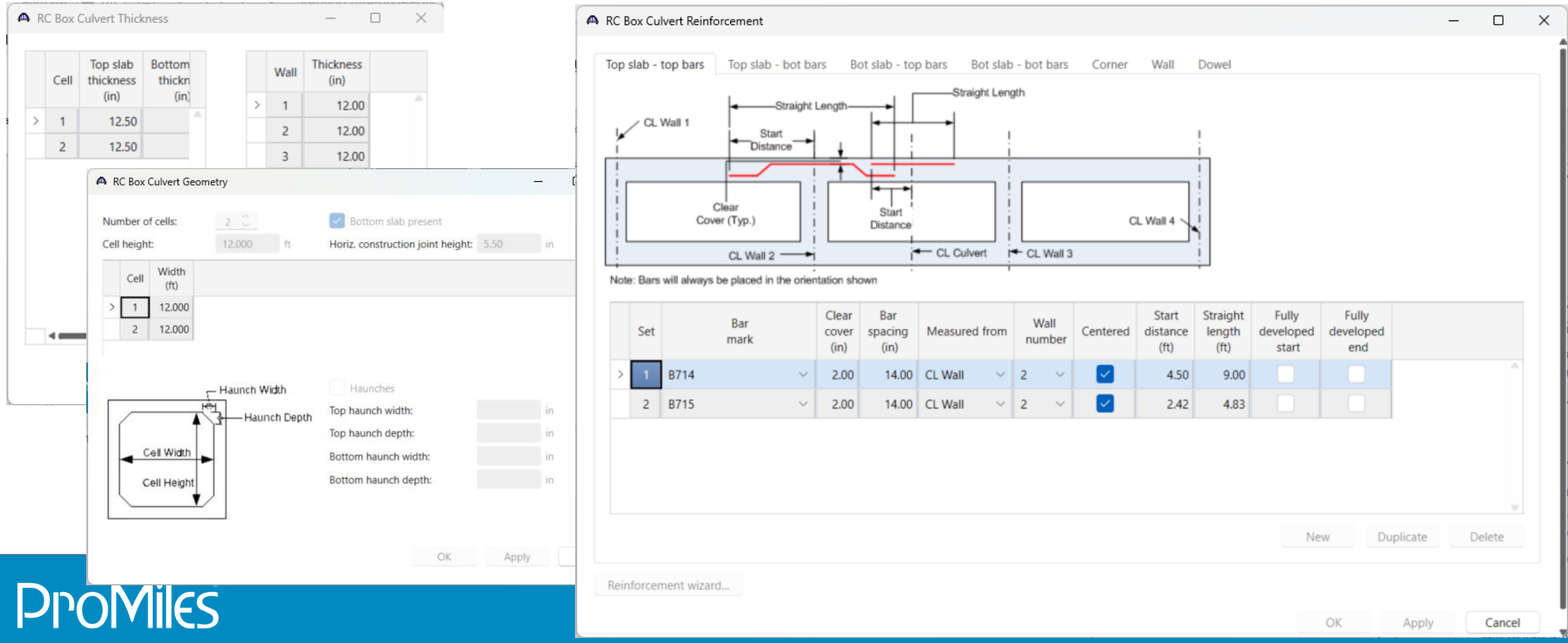
- Validation Process
- Use new engine with SSI elements
- Produce output in CANDE XML format
- Digital (or graphical) comparison of results for various models



Phase II – Version 7.8 (Fall, 2026 - Tentative)

- Model windows for RC Box culverts/CMPs
- Model the RC Box with SSI and produce results (analysis and spec checking)
- Produce Simple CMP pipe models (Single span)
- LL Analysis
- Graphical output

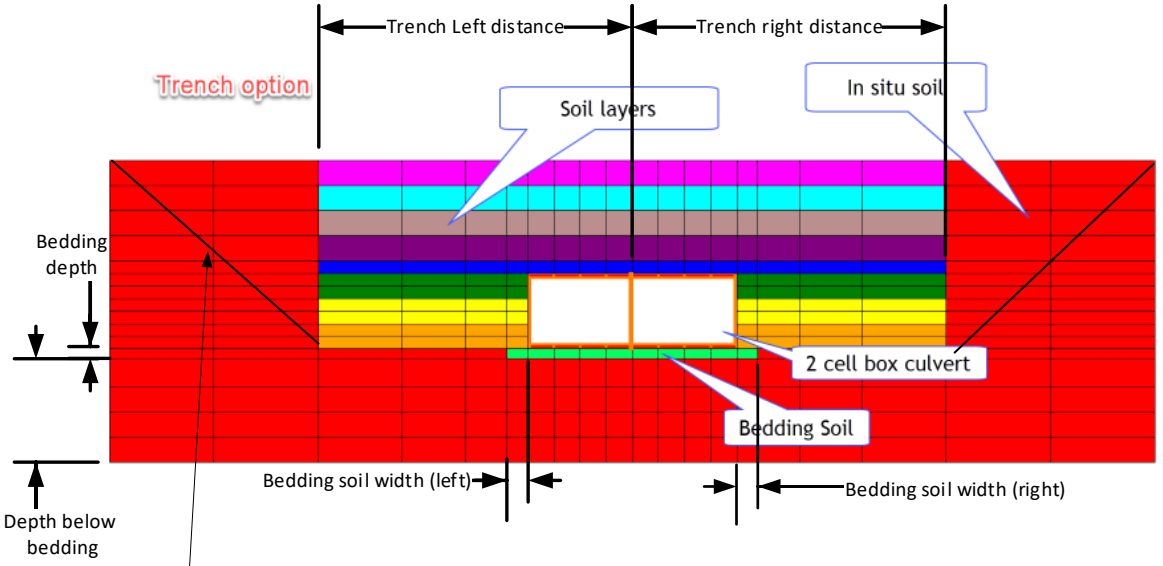
RC Box - Make use of existing models



Additional information required for soil and load steps

In-situ/bedding soil input

Depth below bedding	10'
Number of element Rows	4
In situ soil	Choose soil from drop down
Trench left distance	18'
Trench right distance	18'
Bedding depth	2'
Bedding soil width (left)	1'
Bedding soil width (right)	1'
Bedding Soil	Choose soil from drop down



Optional slope line for trench. Will always be present. Elements will be on either side of this line. In-situ if square trench and soil layers if sloped.

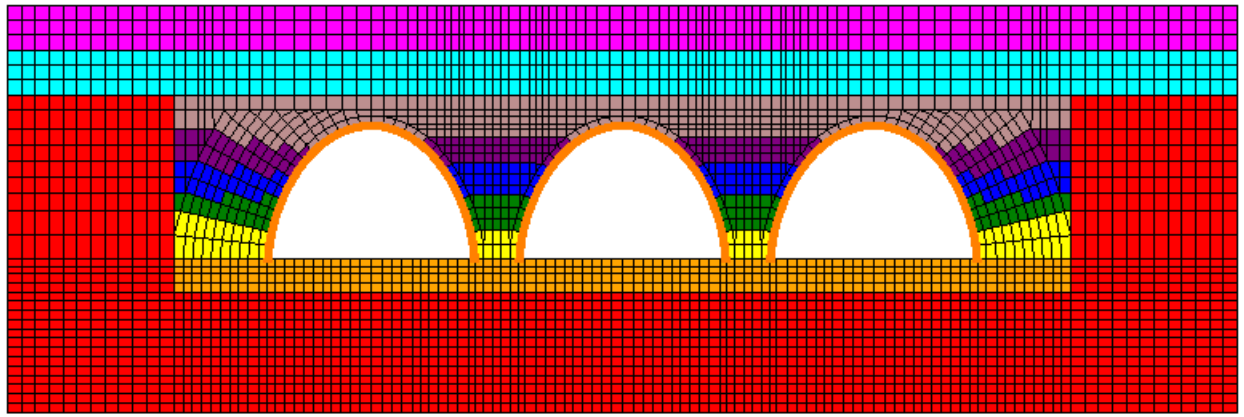
Soil Level Input

Layer #	Soil Type	Layer depth (ft)	Number Rows		

New Duplicate Delete

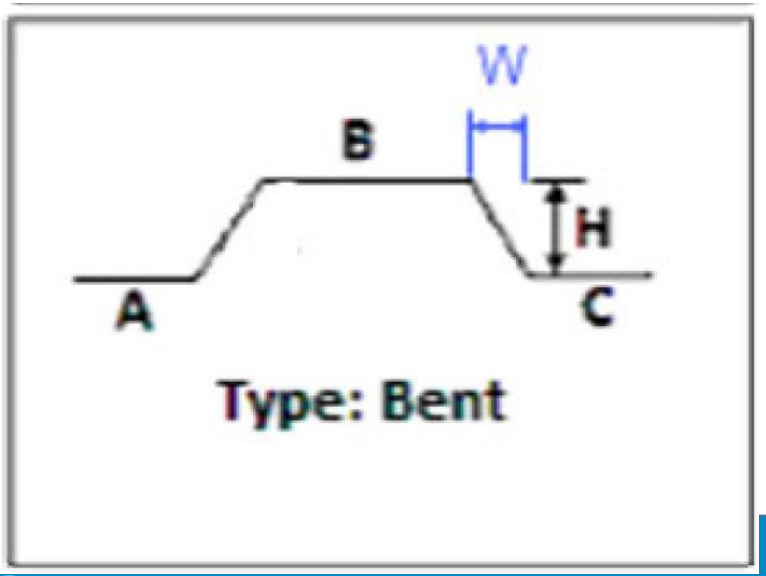
Phase III – Version 7.9 (Fall, 2027 - Tentative)

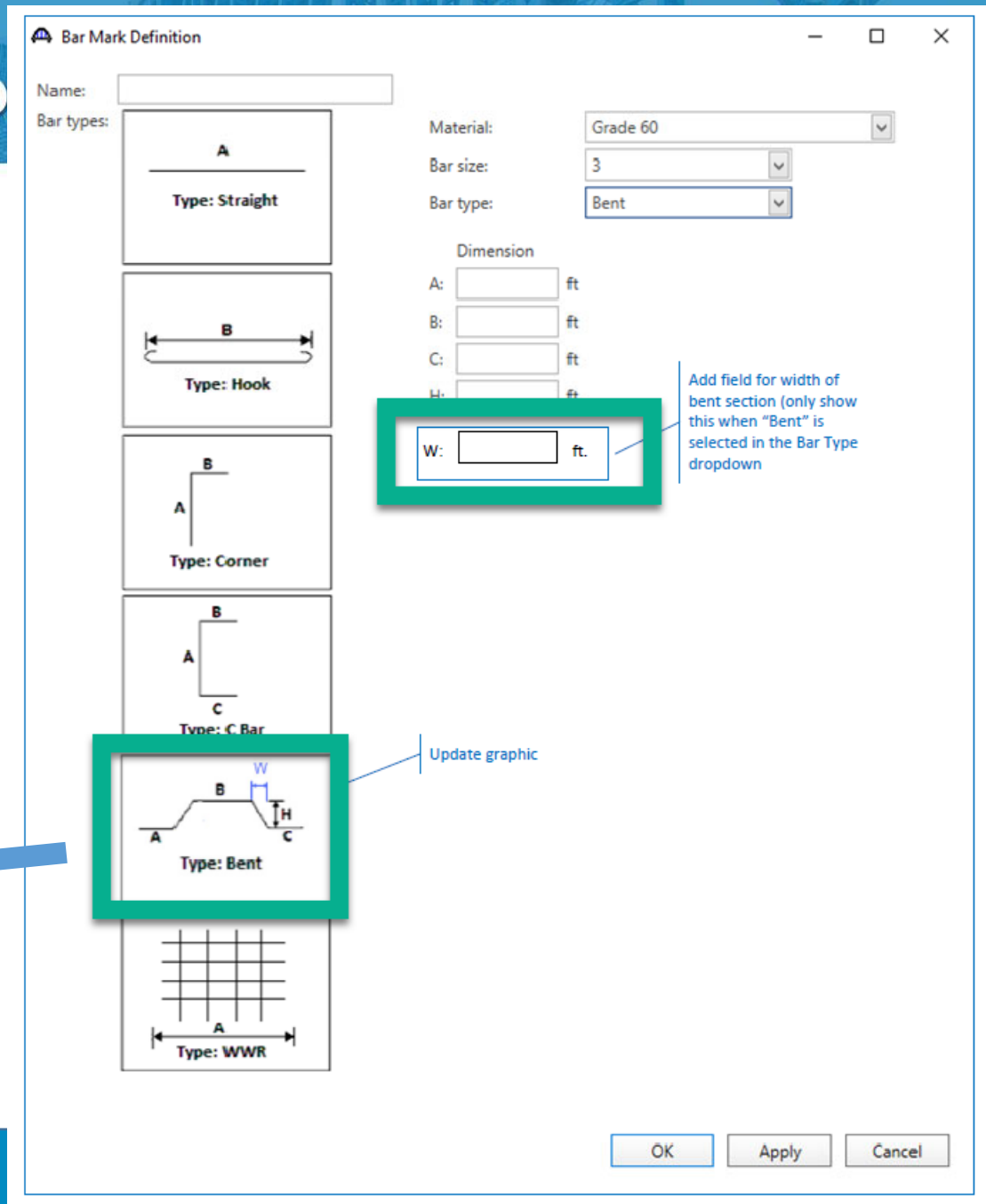
- Produce models for more complicated structures
- Multiple pipes
- Multiple materials
- Consider methods for improving the LL analysis



Other culvert items?

Bent Bar Reinforcement





Other culvert items?

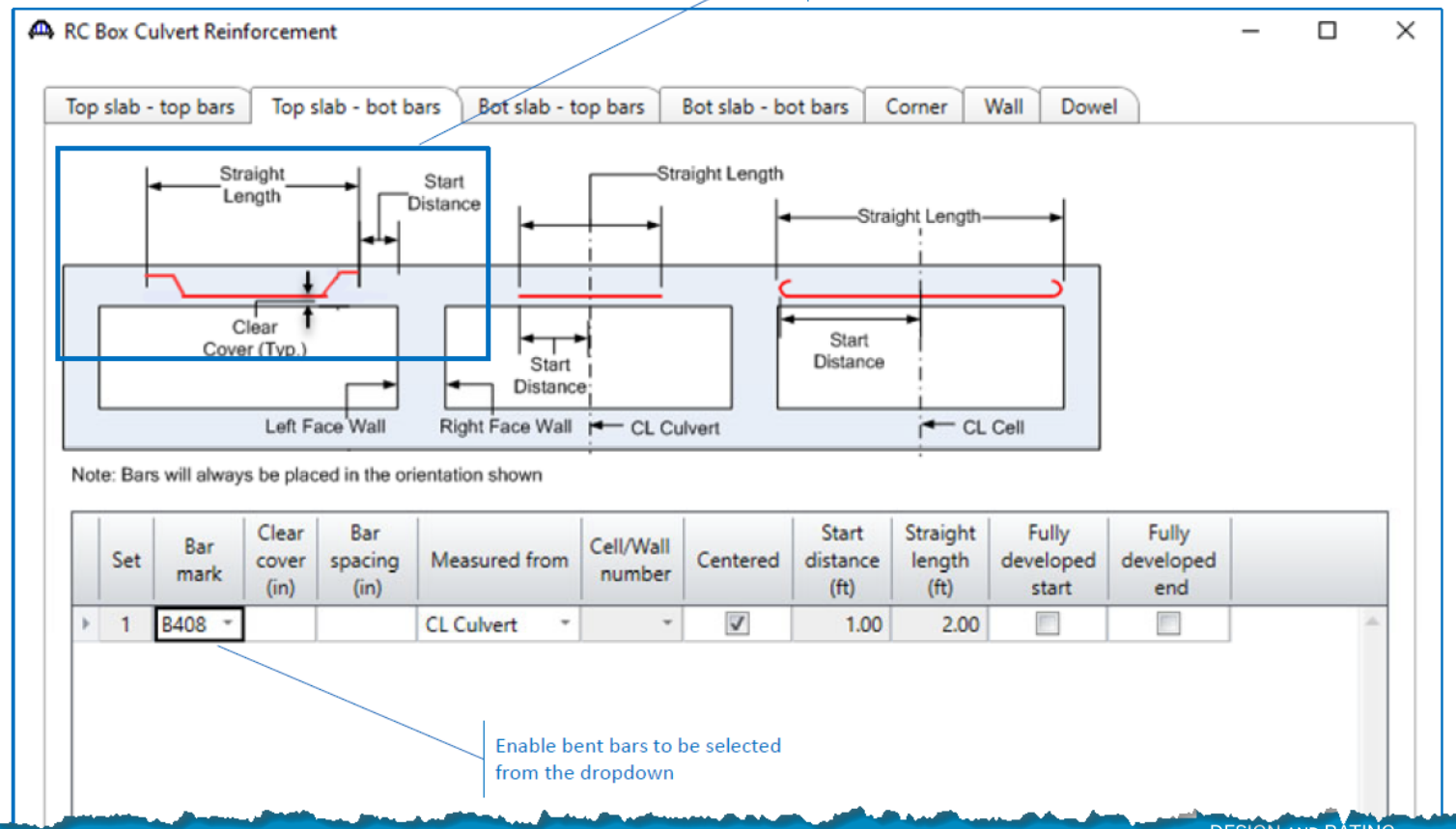
Bent Bar Reinforcem

RC Box Culvert Top slab – bot bars window

This part of schematic currently shows a straight bar. Update to show bent bar as shown here.

Top Slab

Bottom Bars



Other culvert items?

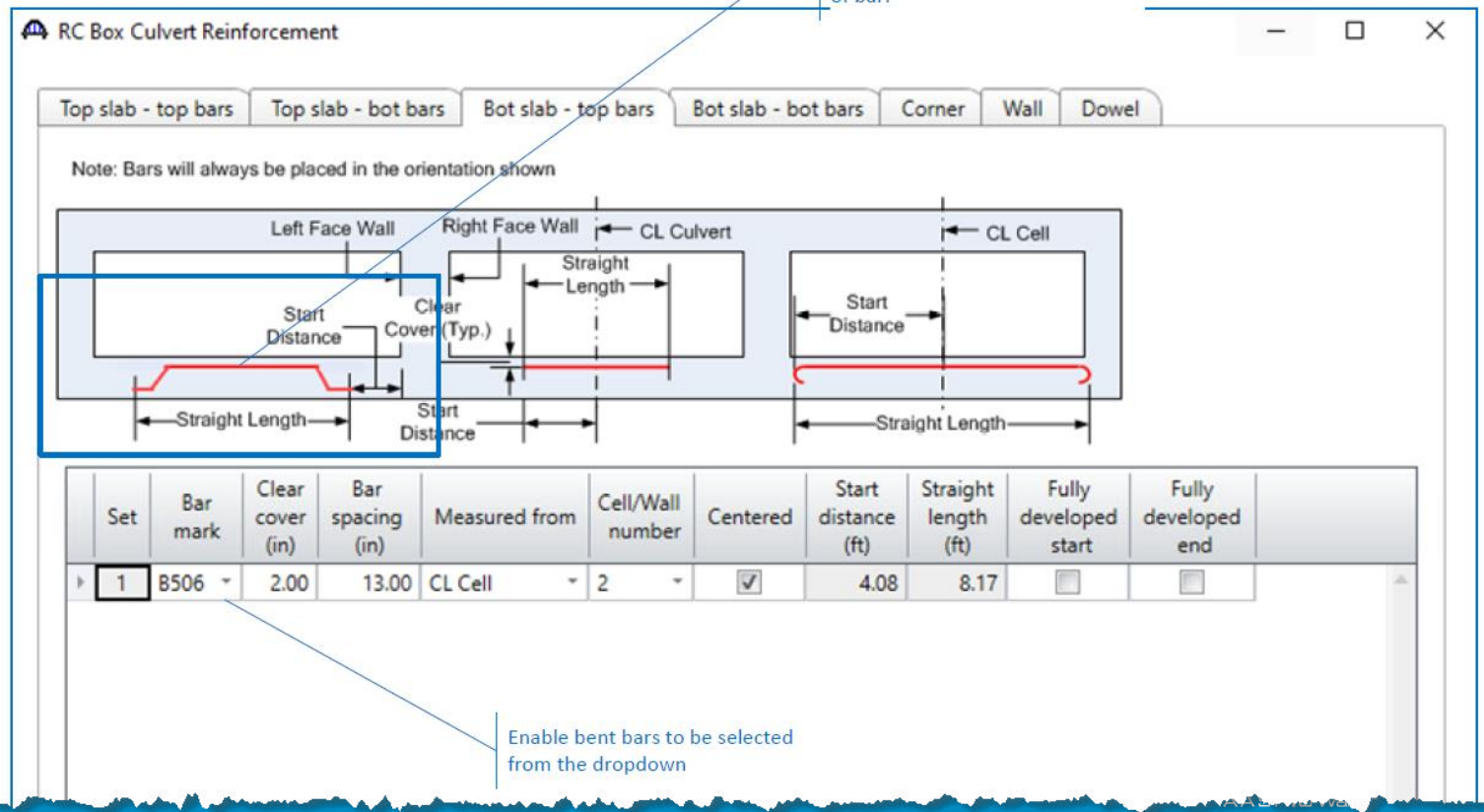
Bent Bar Reinforceme

RC Box Culvert Bot slab – top bars window

This part of schematic currently shows a straight bar. Update to show bent bar as shown here. Add callout for clear cover to this part of bar.

Bottom Slab

Top Bars



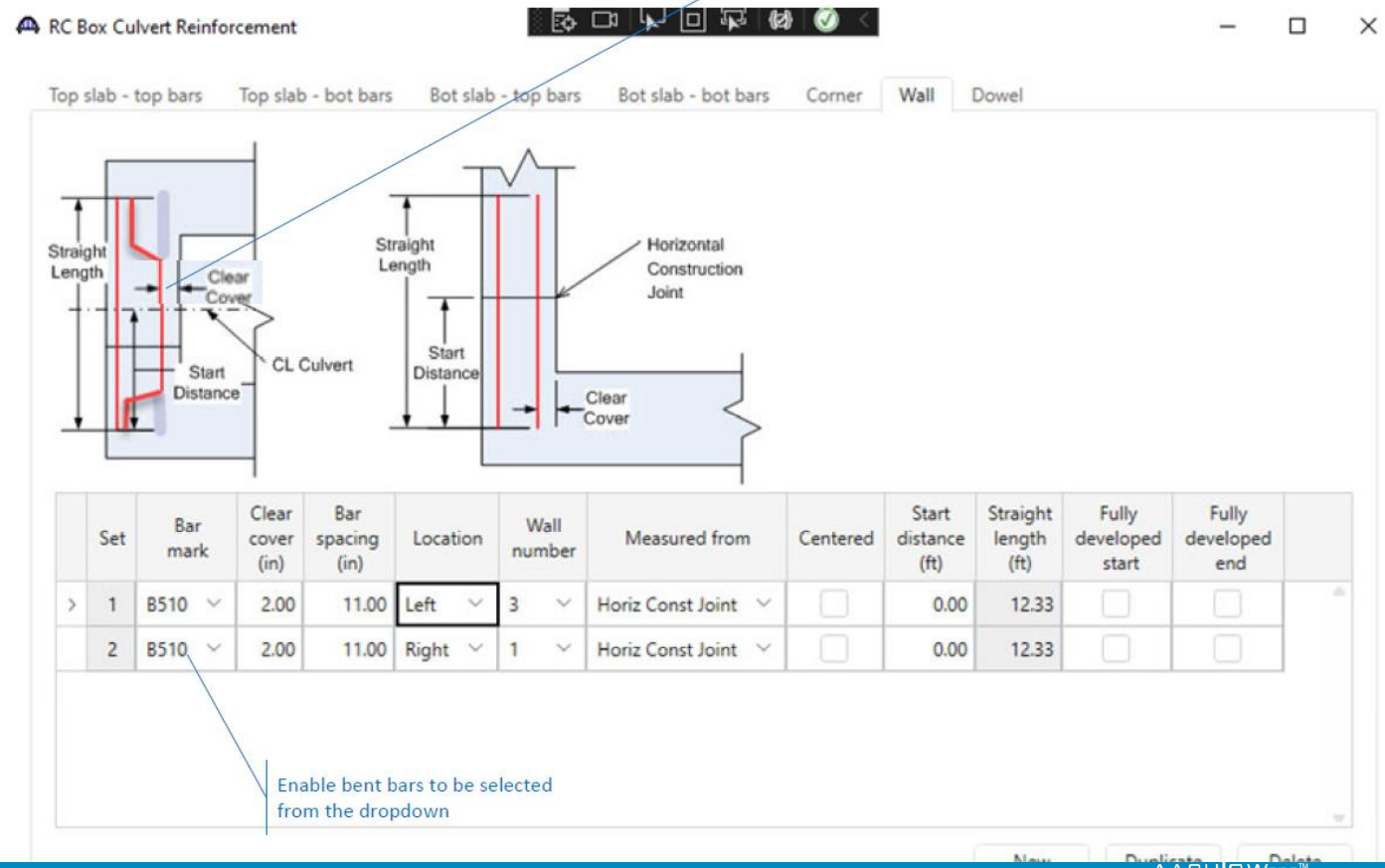
Other culvert items?

Bent Bar Reinforcemen

Wall bars

RC Box Culvert Wall Bars window

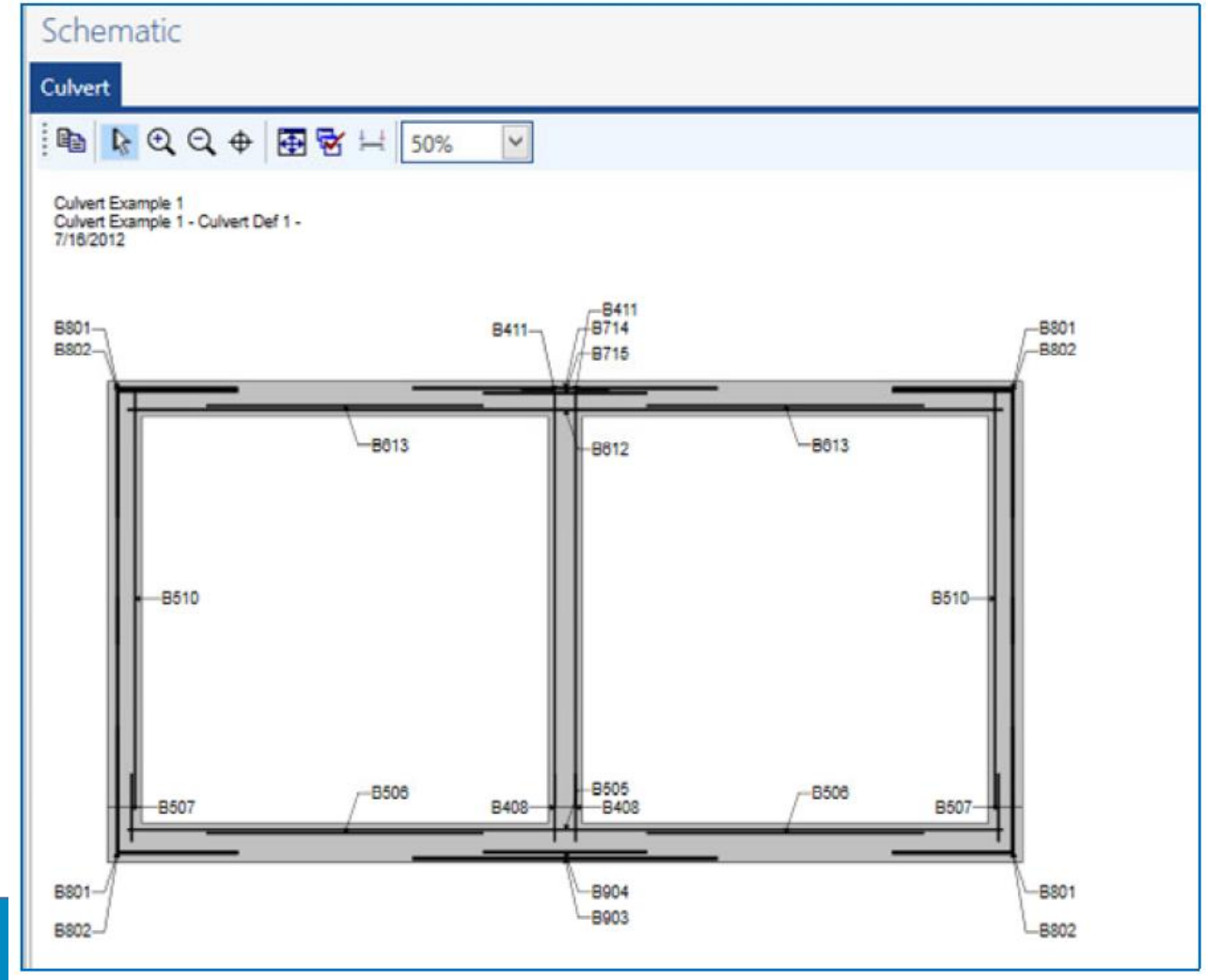
This part of schematic currently shows a straight bar. Update to show bent bar as shown here. Add callout for Clear Cover to this section of the bar



Other culvert items?

Bent Bar Reinforcement

Schematic – currently bent bars are shown as straight



Questions?