

I-4 Braided Ramp Bridge Deck Cracking

BY:

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General Project Info

- FIN: 416518-1-52-01
- Construction Cost is about \$10M
- Scope includes building a new 2-Span bridge and interchange enhancements.
- Original Contract time 564 Days
- Contractor UIG
- CCEI – Mehta & Assoc.
- Started 2-13-12
- Final acceptance 1-17-14

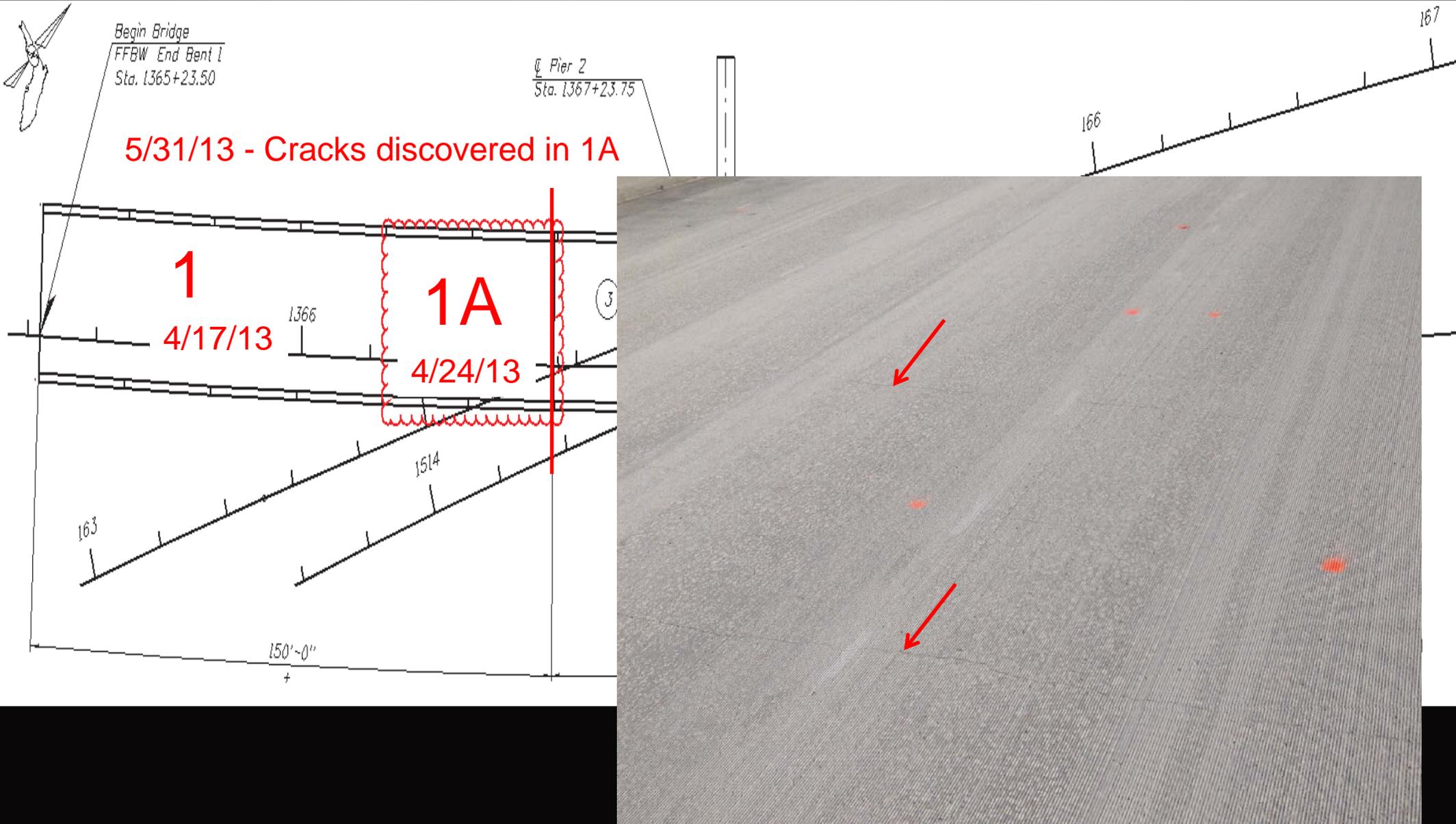


Structural System

- 30' wide
- 2-200' Spans
- Continuous Steel beams with CIP composite deck



Background



5/31/13 - Cracks discovered in 1A

1

4/17/13

1366

1A

4/24/13

3

1514

163

150'-0"

166

167

Demolition

- Many unknowns associated with the demolition (unloading the bridge) due to the fear of developing cracks elsewhere.
- Contractor proposed Hydrodemo then later changed to conventional with light equipment



Removing Deck



Forming



Steel in Place & Dry-Run



Pouring



Ramp Ready for Traffic



11/18/2013 16:06

TRANSVERSE CRACKING AND POURING SEQUENCE

FIELD

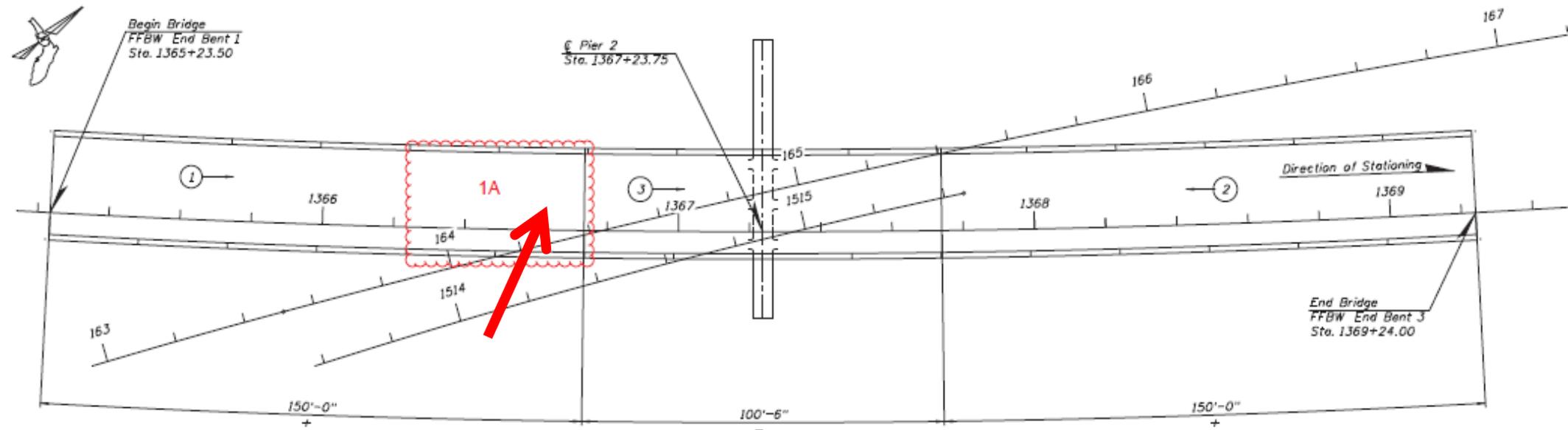
THEORY

ALTERNATIVES

- 1. DESIGN IS INVESTIGATING**
- 2. CRACKING IS COMPLICATED**
- 3. ONLY POURING SEQUENCE, HERE**

DISCLAIMERS

FIELD



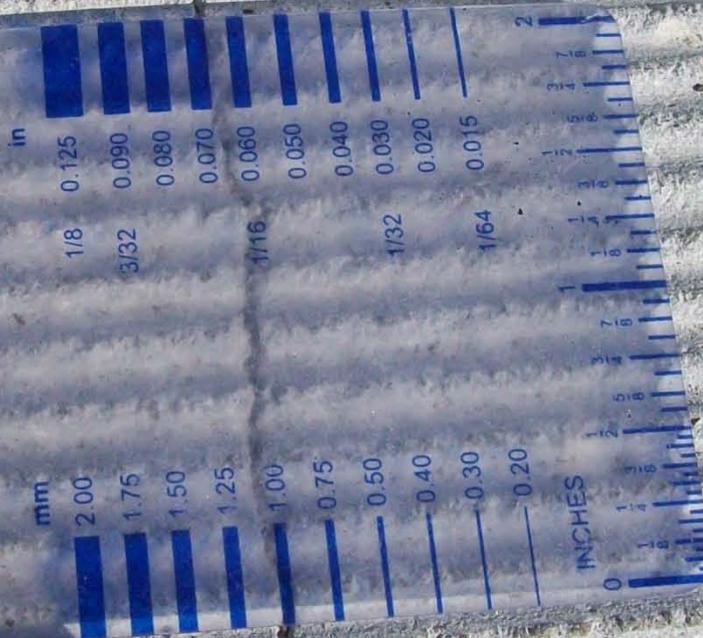
SLAB POURING SEQUENCE

#920205, I-4 BRAIDED RAMP



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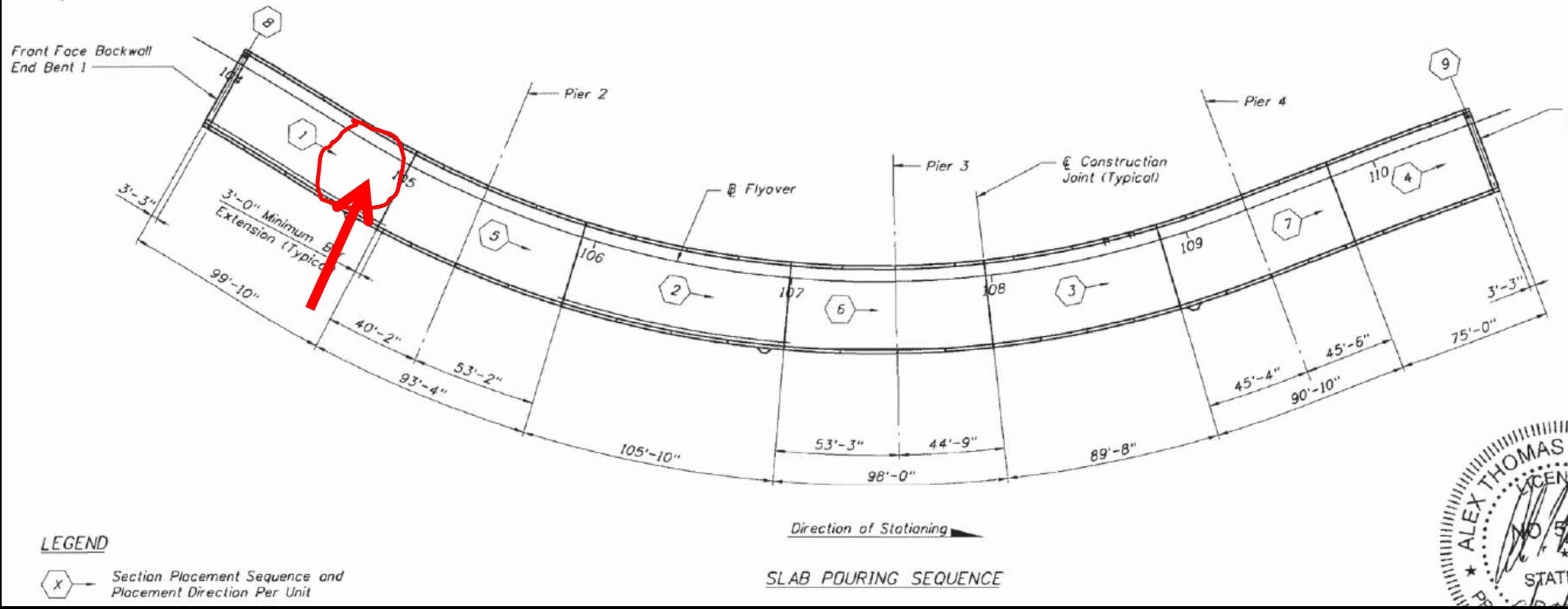


#920205
CRACKS NEAR END OF POUR No. 1



#920205
CRACKS NEAR END OF POUR No. 1

**IS THE
BRAIDED RAMP
UNIQUE?**



#770090
RED BUG LAKE FLYOVER



nts Reserved.
Approximate.

0
cm

INCHES

0.060

0.050

0.040

0.035

0.030

0.025

0.020

0.016

0.012

0.010

0.009

0.007

0.006

0.004

4

5

6

7

8

#770090

CRACKS NEAR END OF POUR No. 1

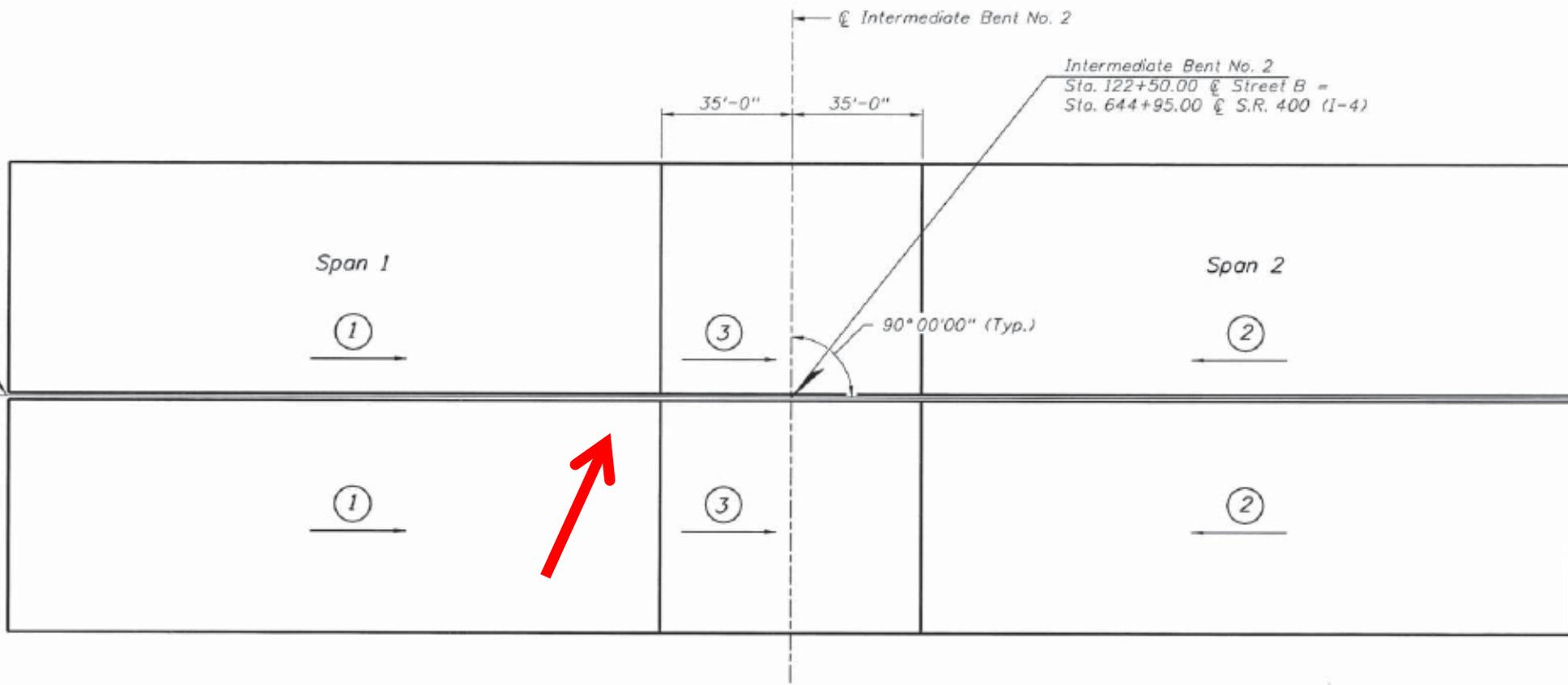


#770090
CRACKS NEAR END OF POUR No. 1



#770090

CRACKS NEAR END OF POUR No. 1



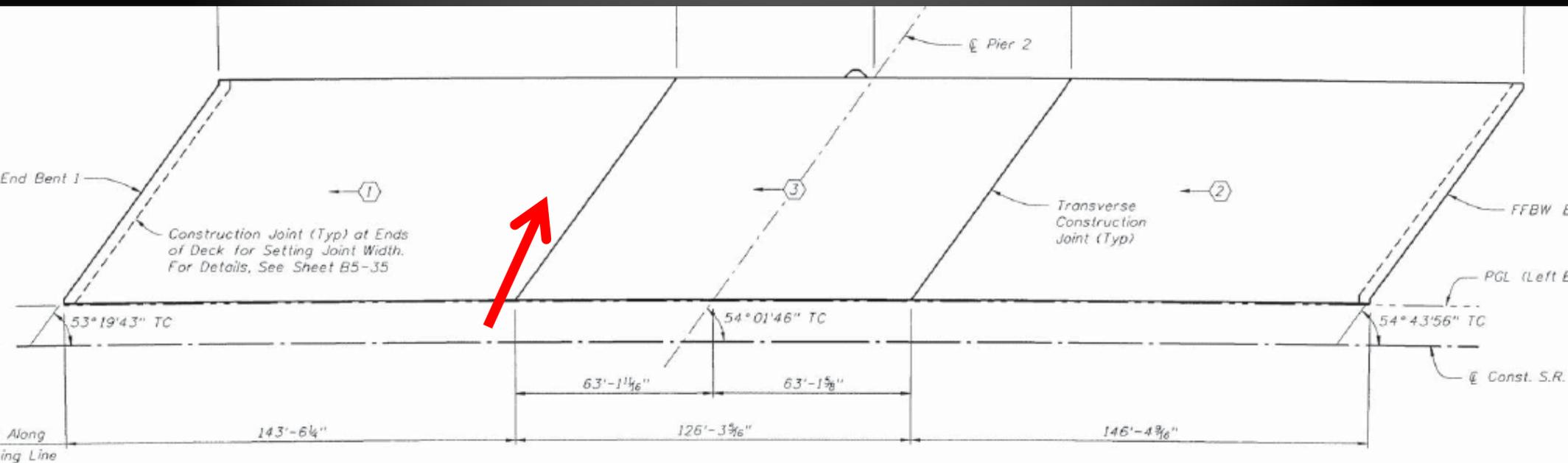
PLAN

#754115

FENTON/WILDWOOD OVER I-4

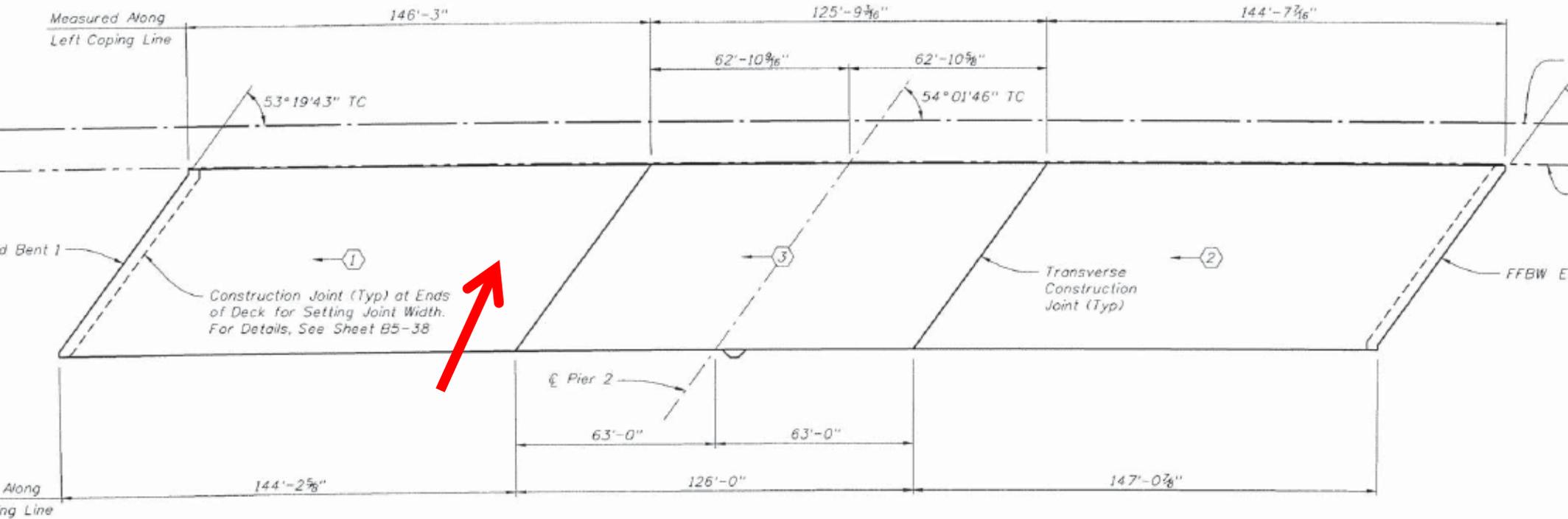


#754115
CRACKS NEAR END OF POUR No. 1



PLAN (LEFT BRIDGE) - SLAB PLACEMENT SEQUENCE

#750738
SR429 SB over US441



PLAN (RIGHT BRIDGE) - SLAB PLACEMENT SEQUENCE

#750739
 SR429 NB over US441



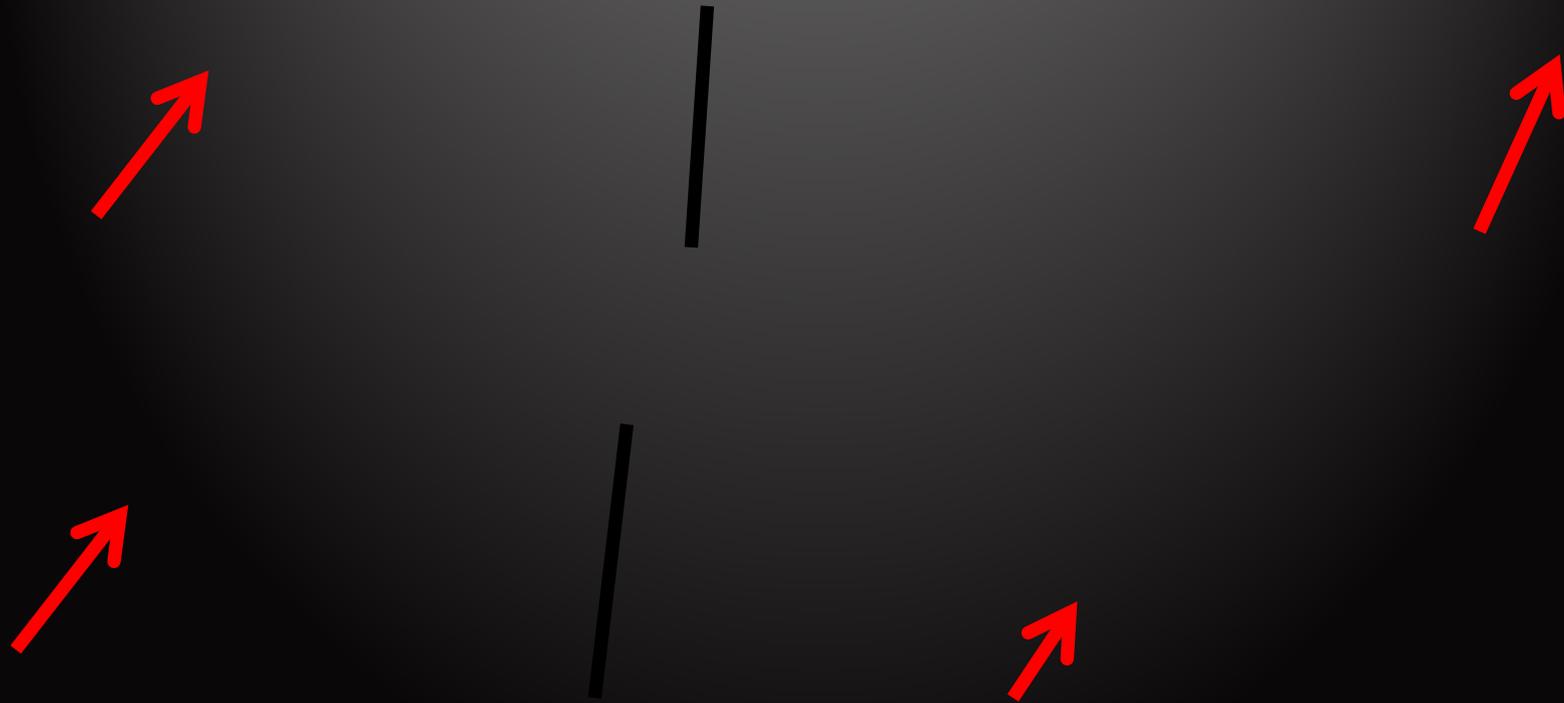
#750739

CRACKS NEAR END OF POUR No. 1



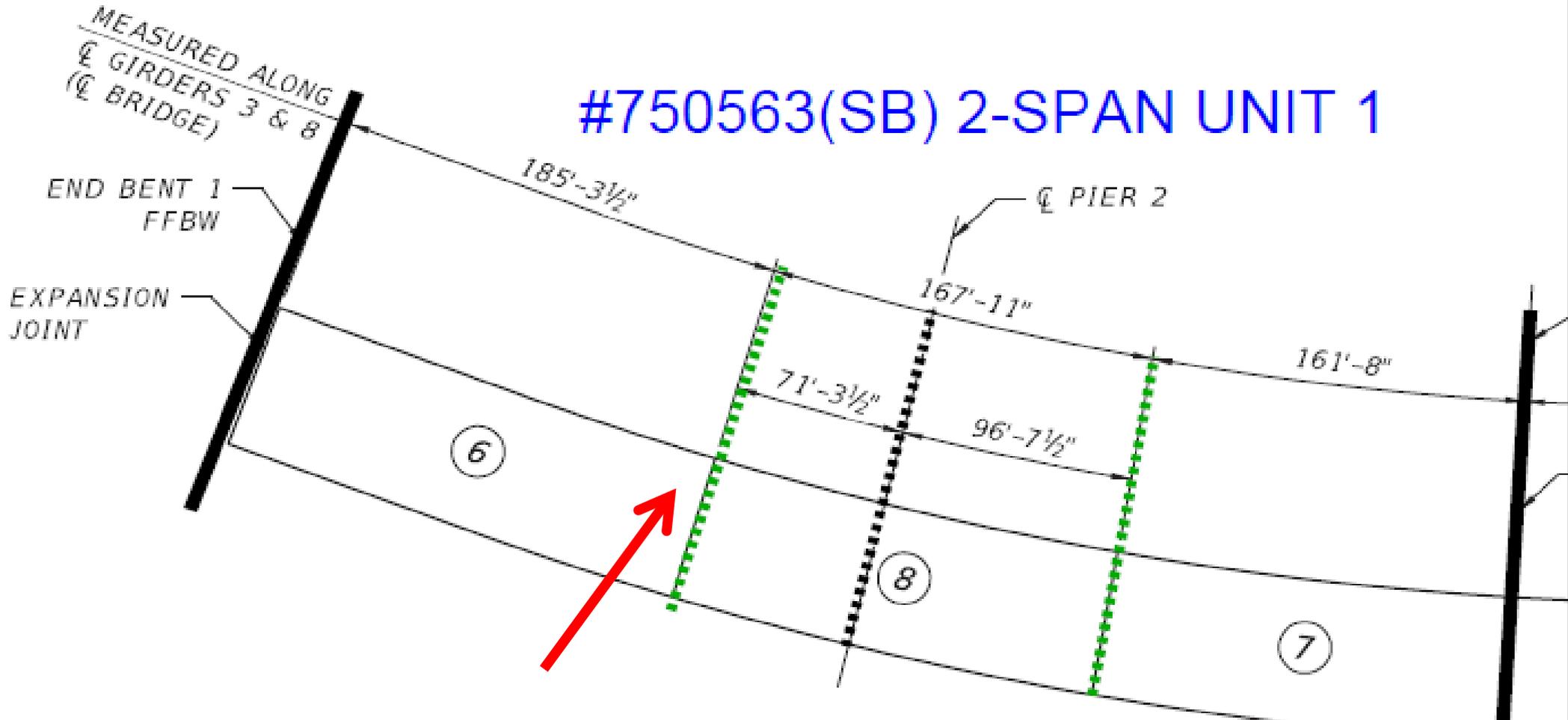
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CRACKS NEAR END OF POUR No. 1

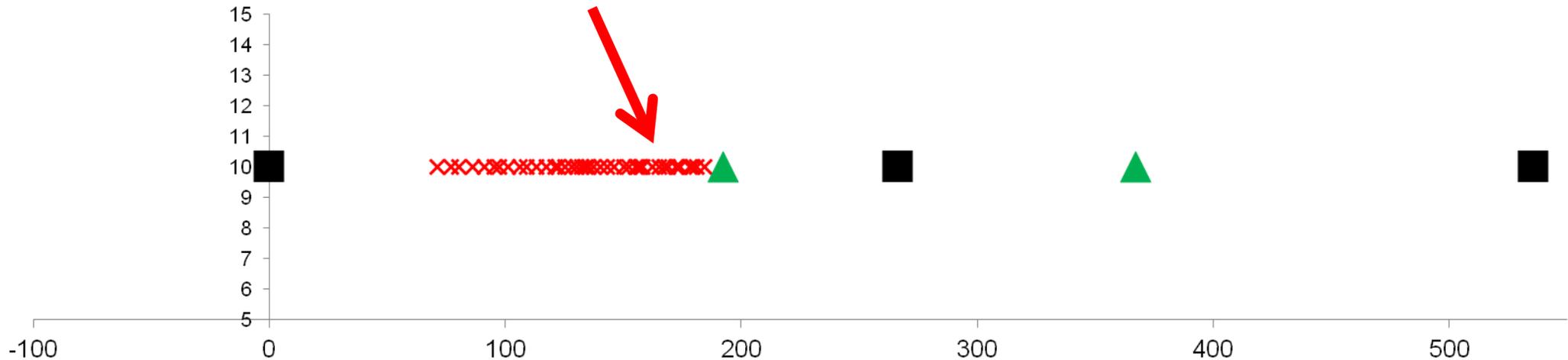


#750563(SB) & #750564(NB)
SR423/434 JOHN YOUNG PARKWAY

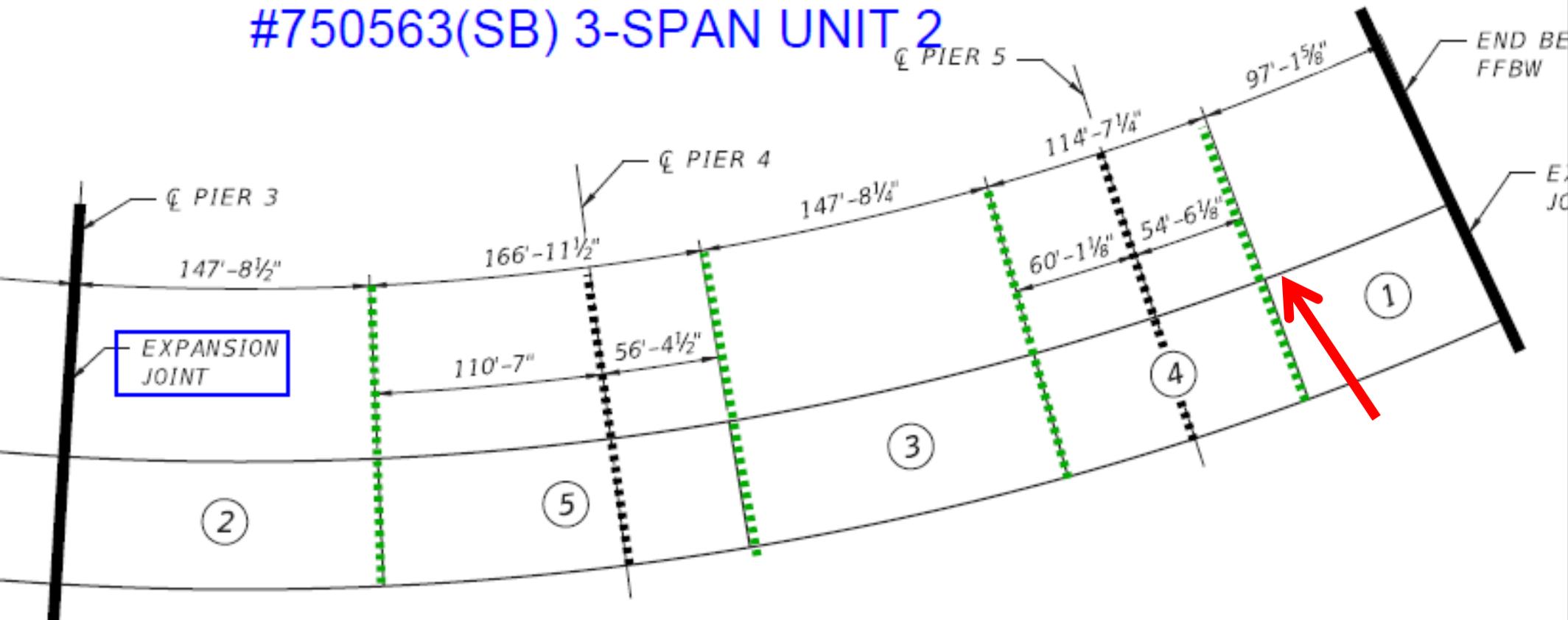
#750563(SB) 2-SPAN UNIT 1



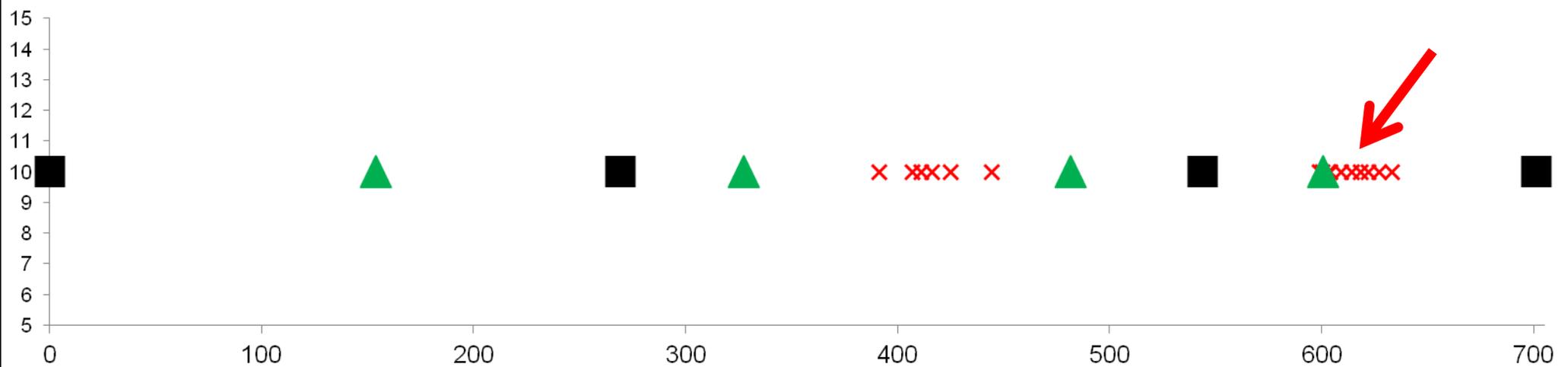
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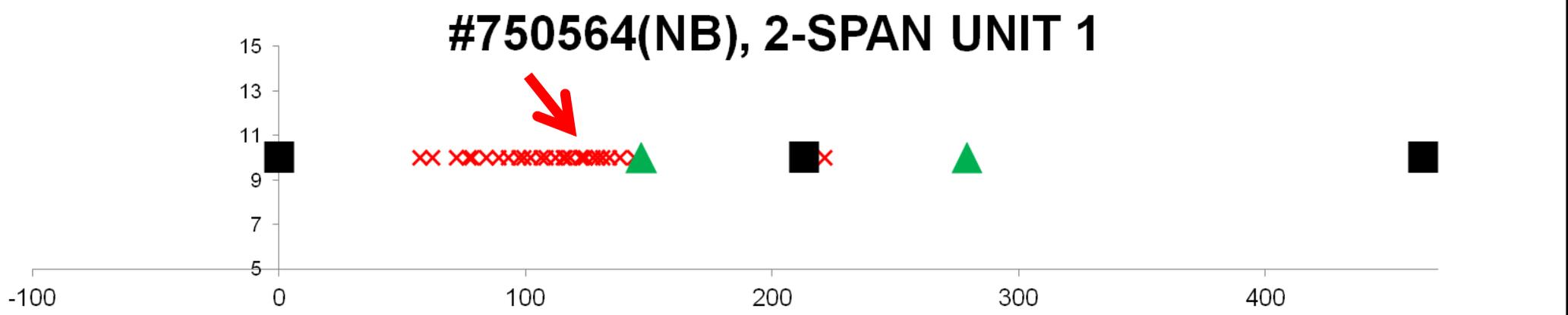
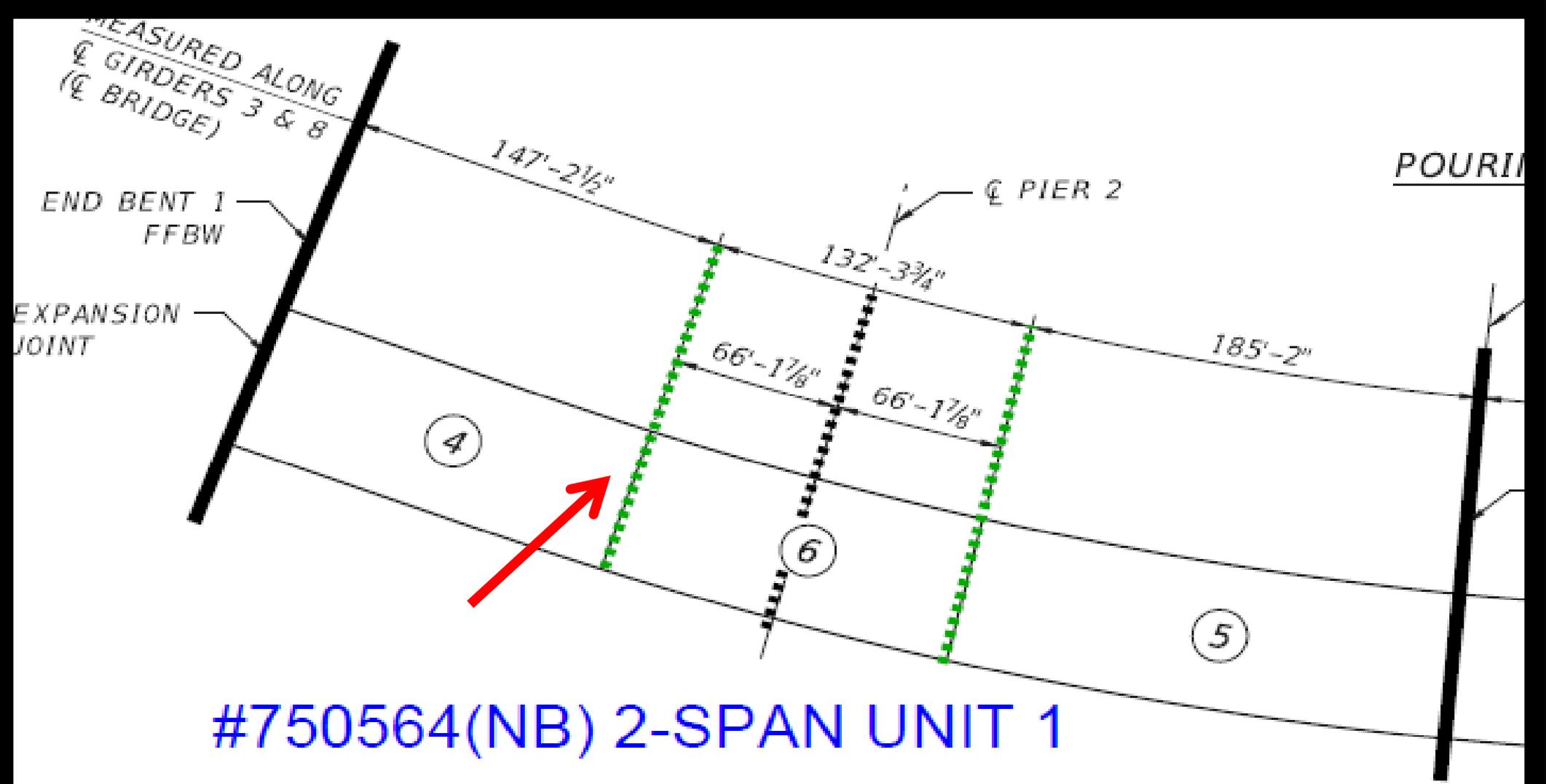


#750563(SB) 3-SPAN UNIT 2

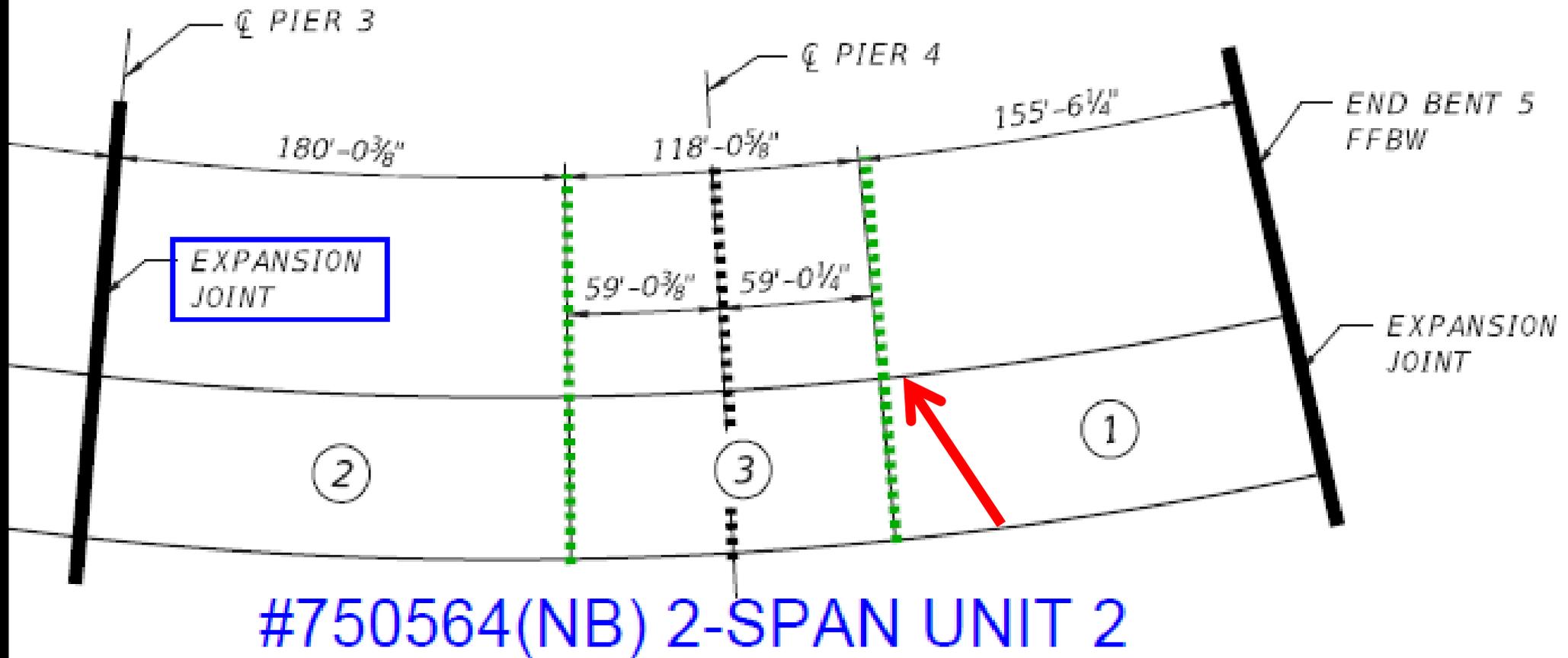


#750563(SB), 3-SPAN UNIT 2

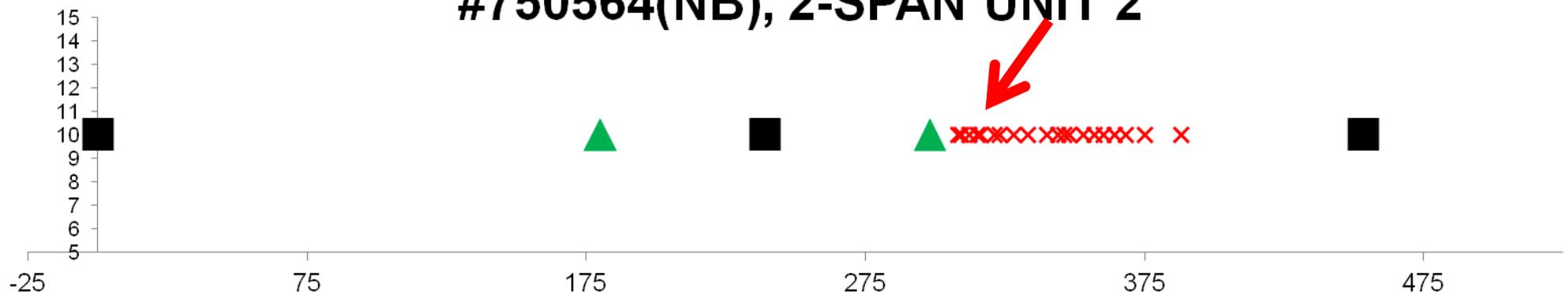




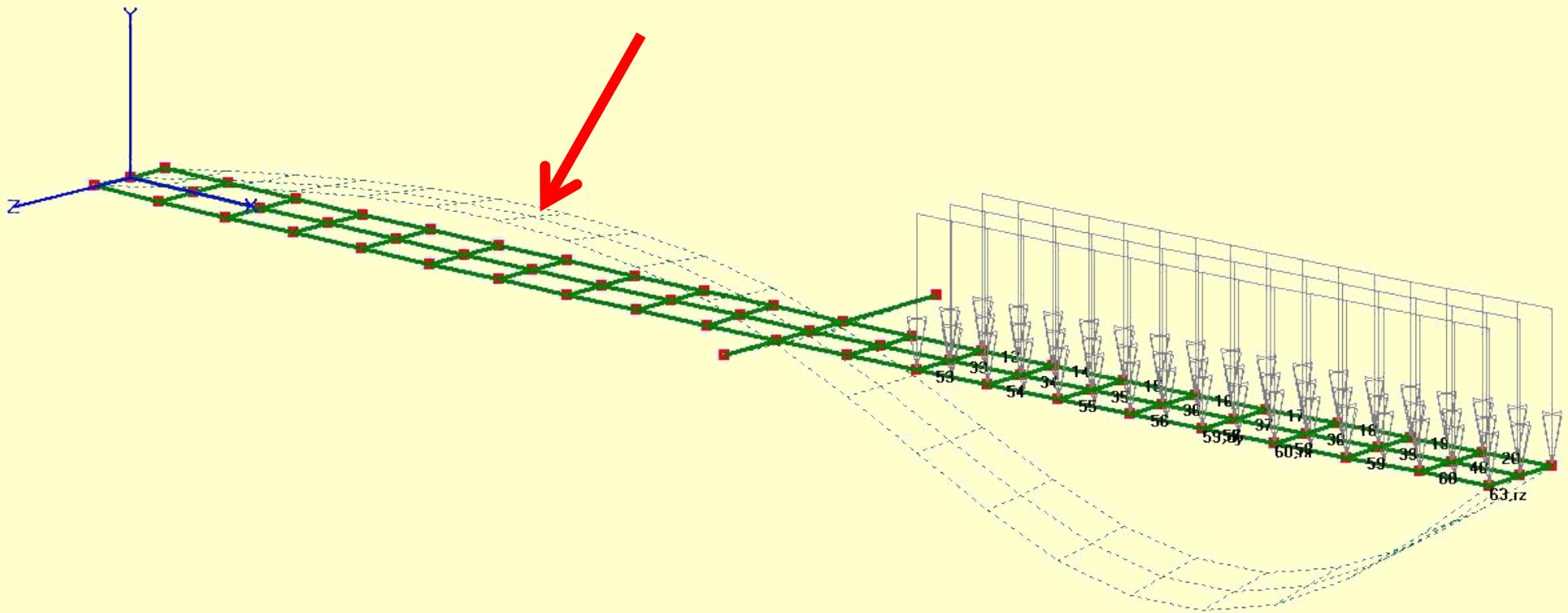
POURING SEQUENCE PLAN - SOUTHBOUND



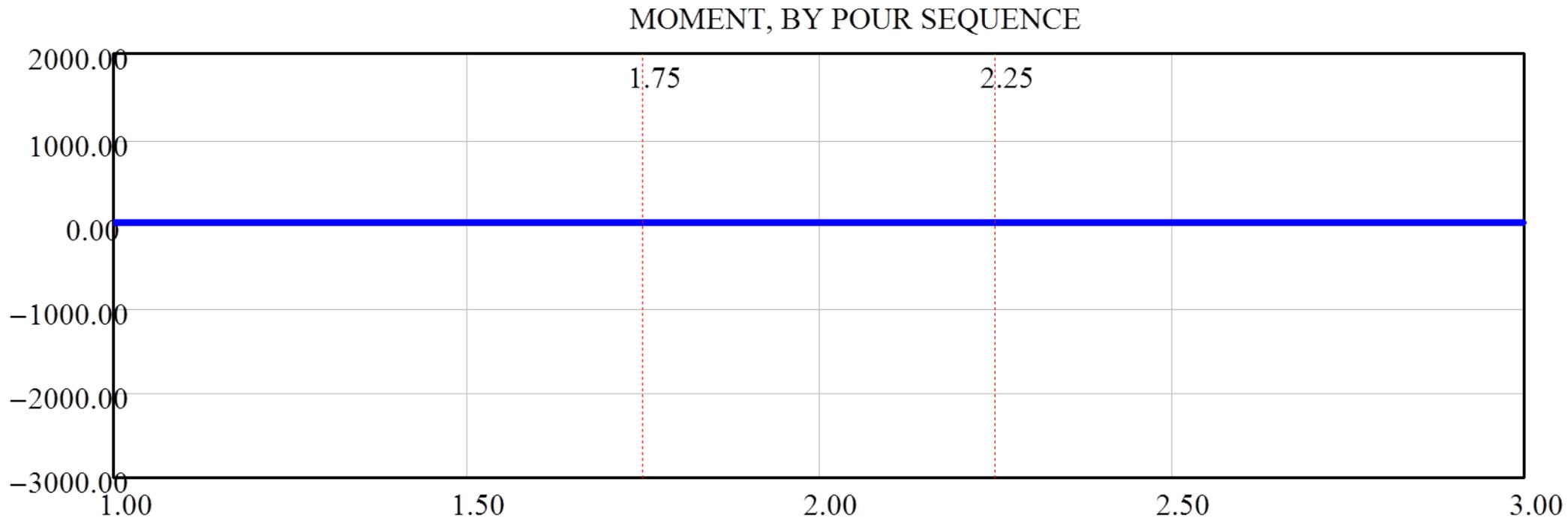
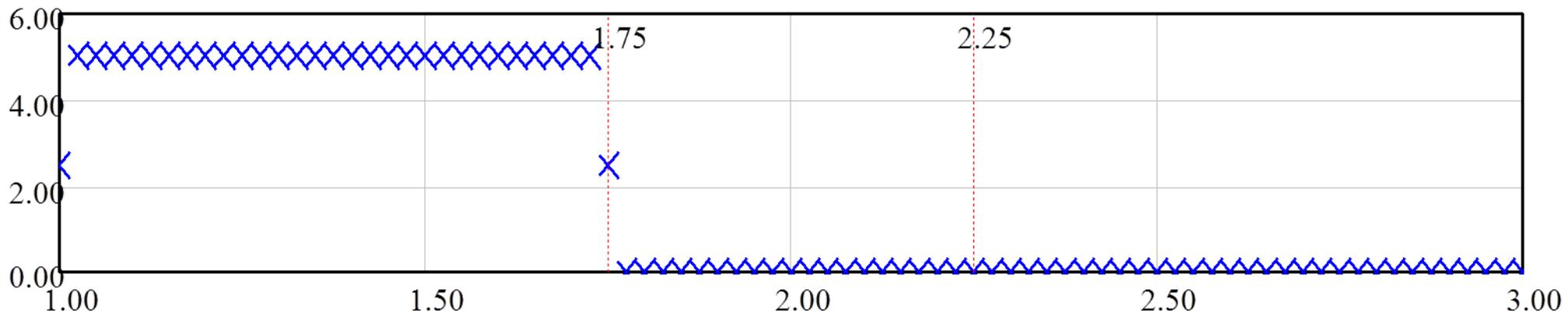
#750564(NB), 2-SPAN UNIT 2



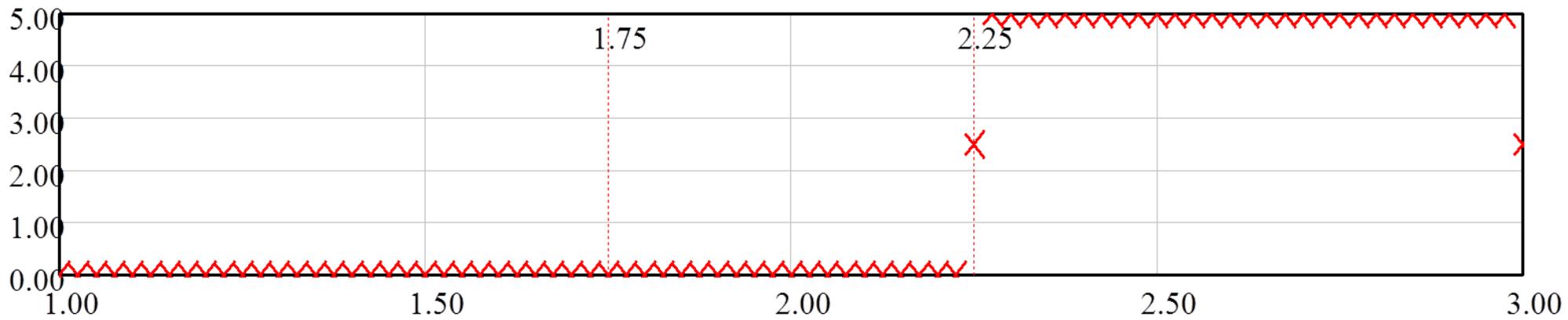
THEORY



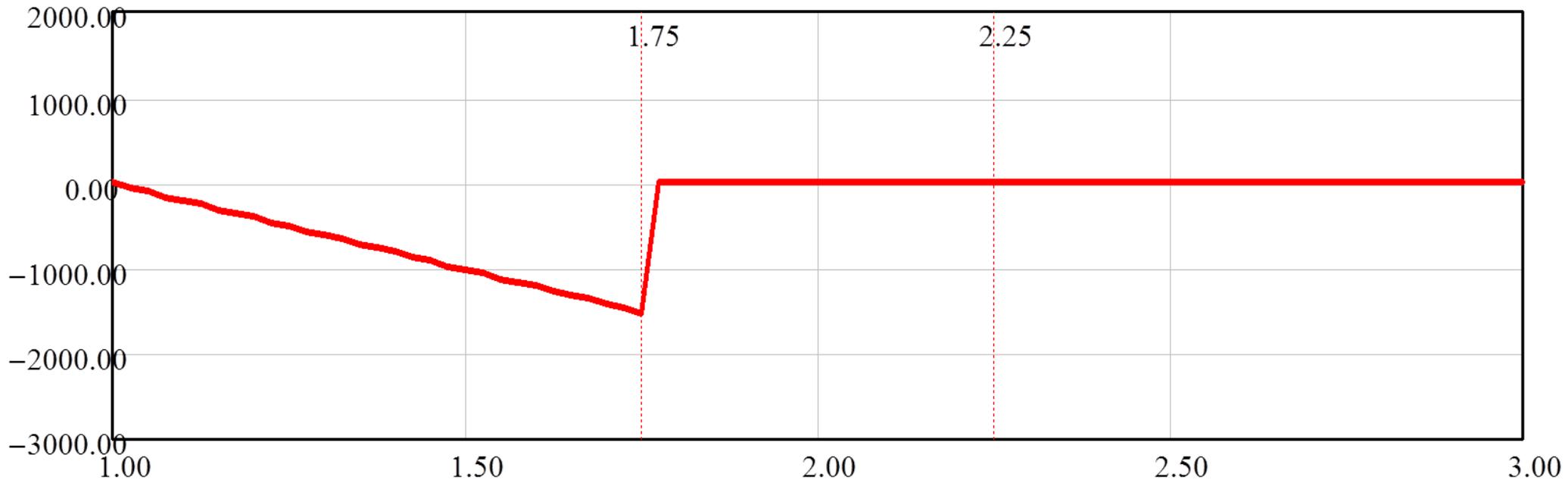
**THEORY: POURING SEQUENCE
INFLUENCES CRACK LOCATIONS**



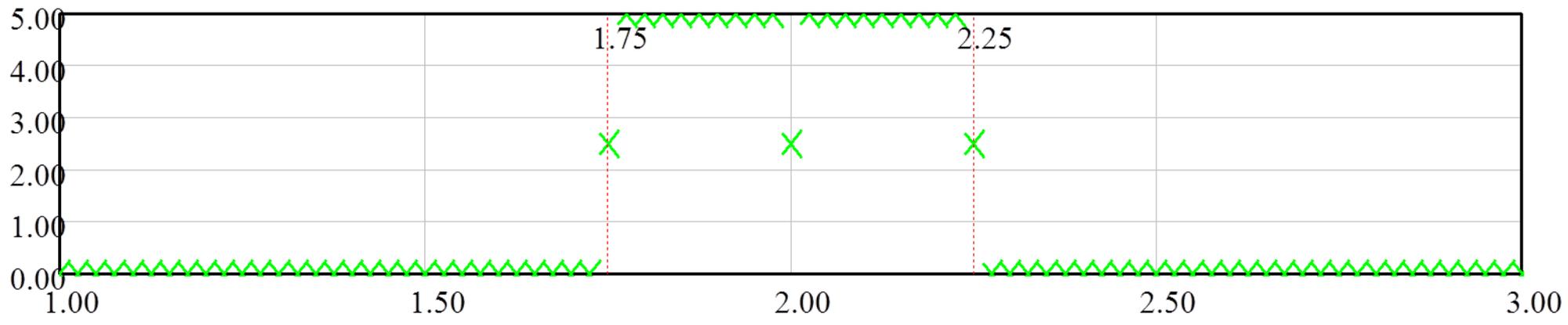
POUR No. 1



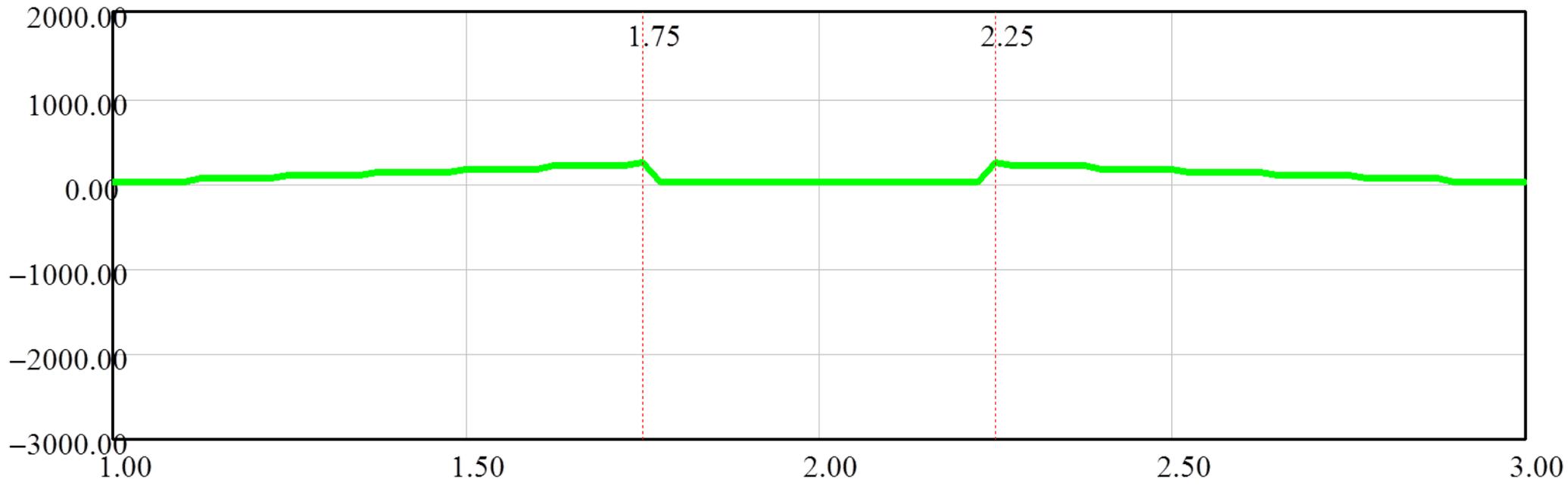
MOMENT, BY POUR SEQUENCE



POUR No. 2

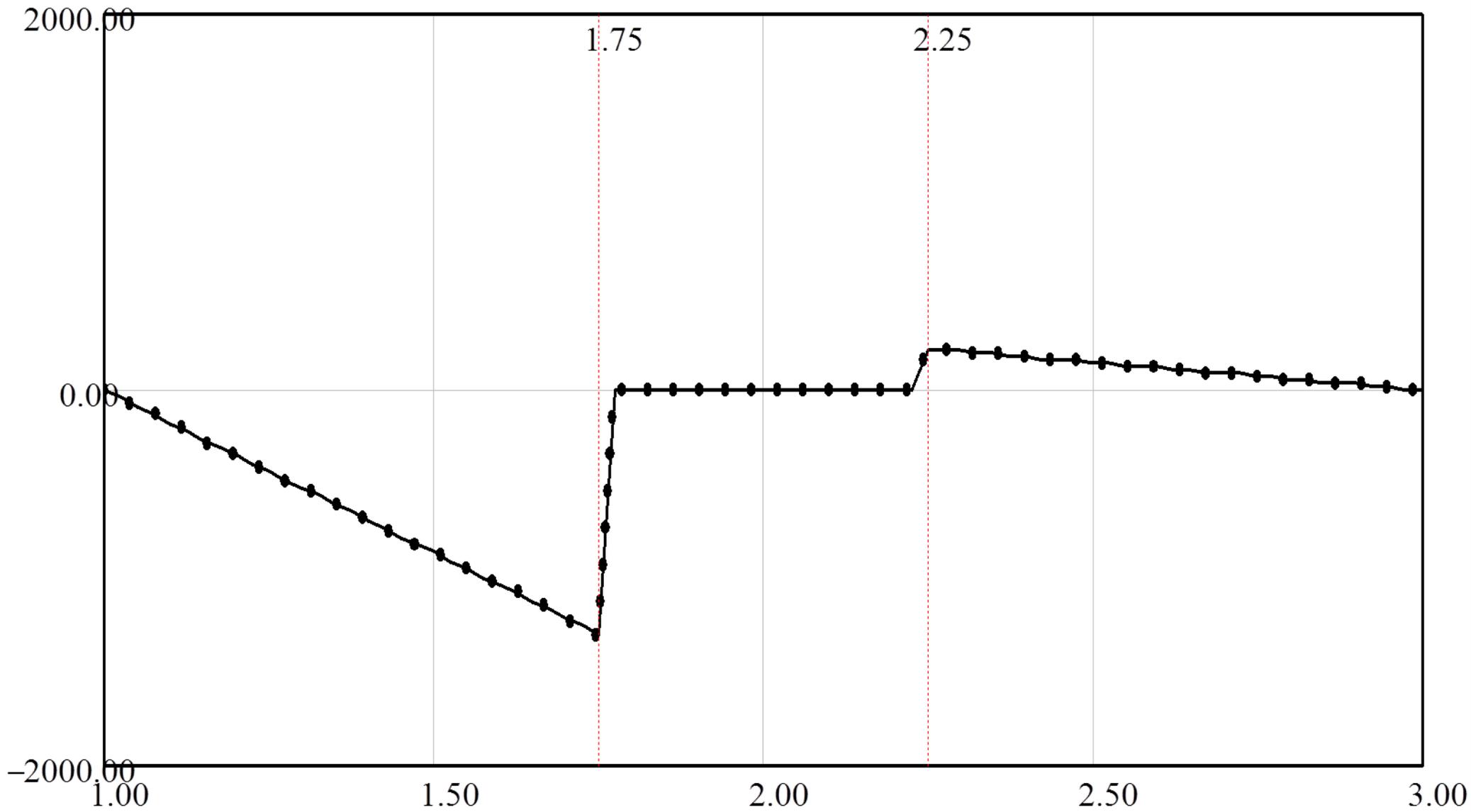


MOMENT, BY POUR SEQUENCE



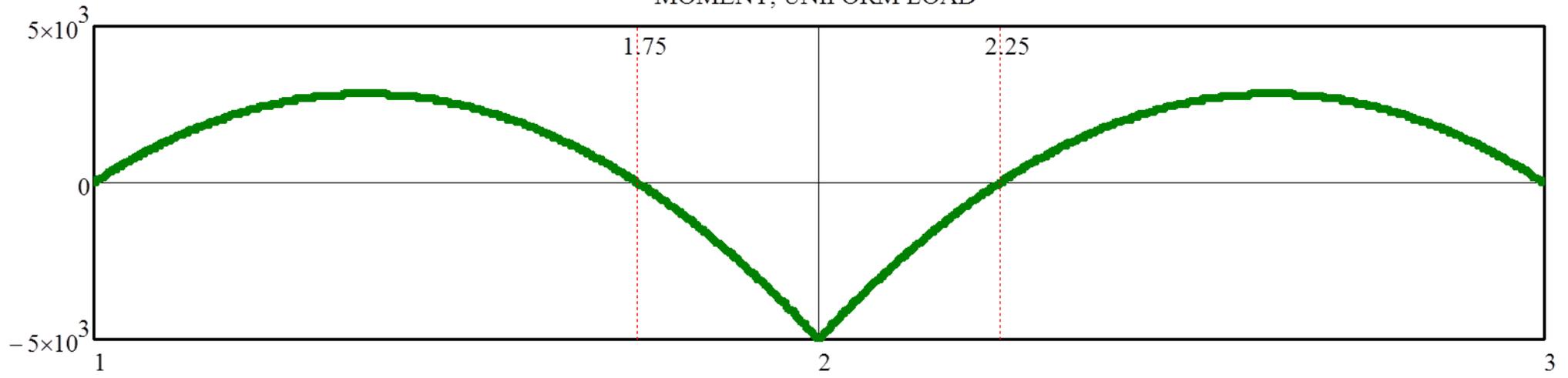
POUR No. 3

MOMENT, BY POUR SEQUENCE

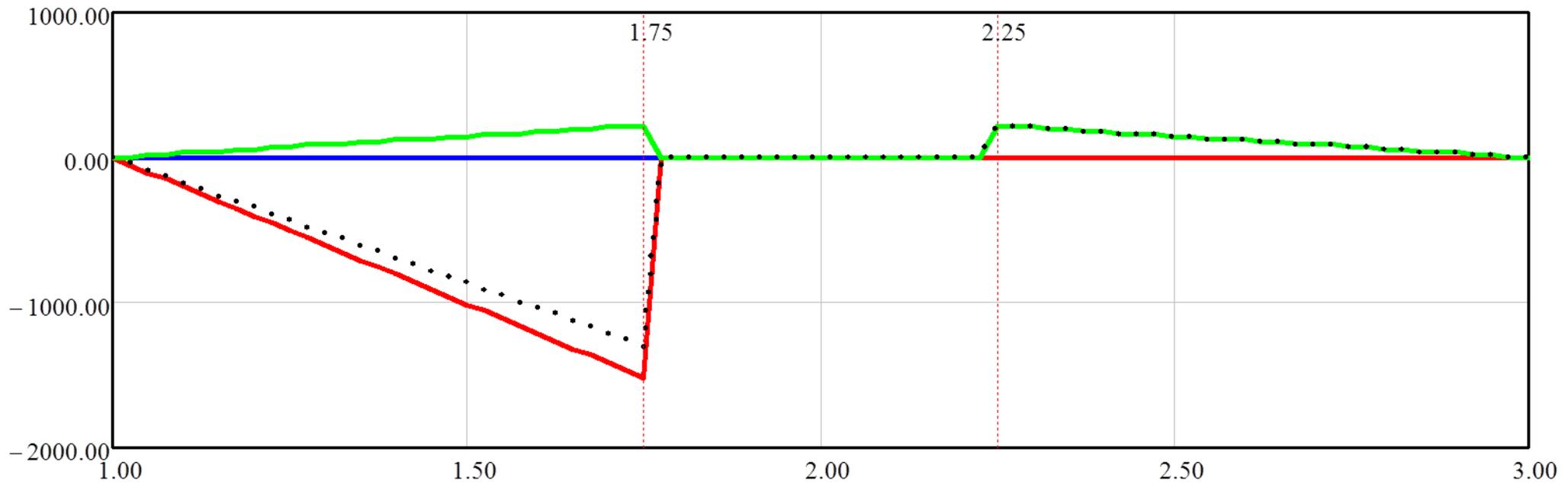


SUM OF ALL POURS

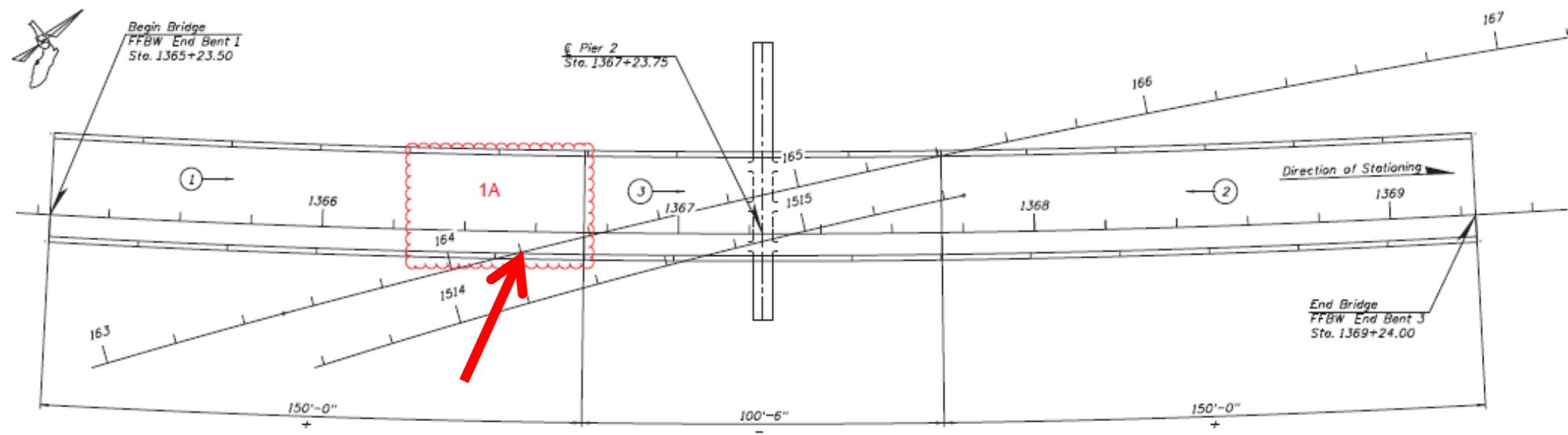
MOMENT, UNIFORM LOAD



MOMENT, BY POUR SEQUENCE

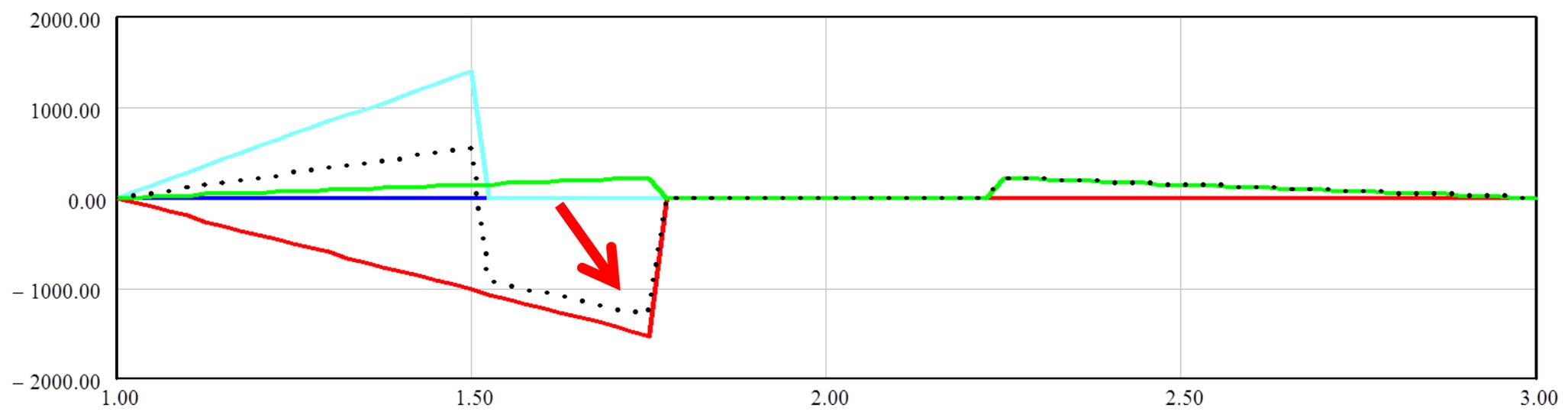


SEQUENCE BY CONTRAFLEXURE



SLAB POURING SEQUENCE

#920205, I-4 BRAIDED RAMP

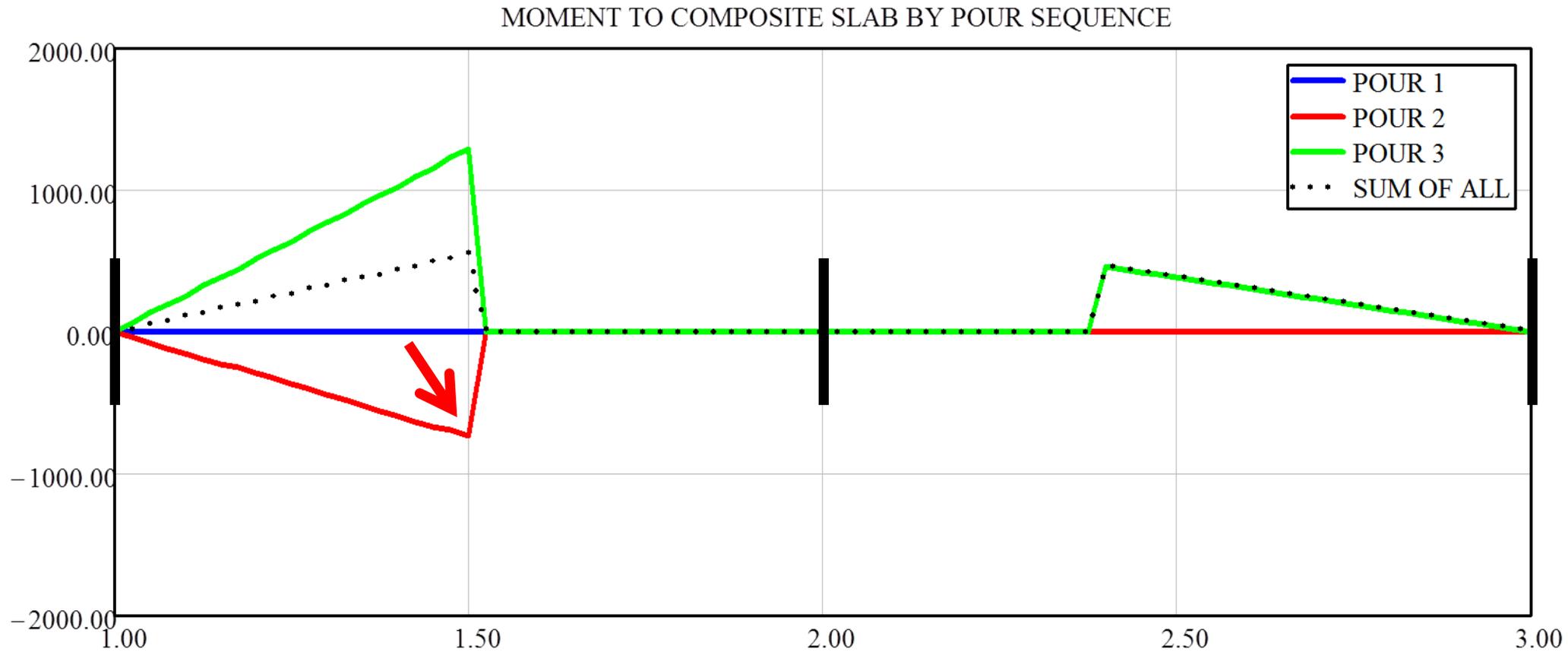


- 1. ASYMMETRIC**
- 2. WISCONSIN**
- 3. FHWA**

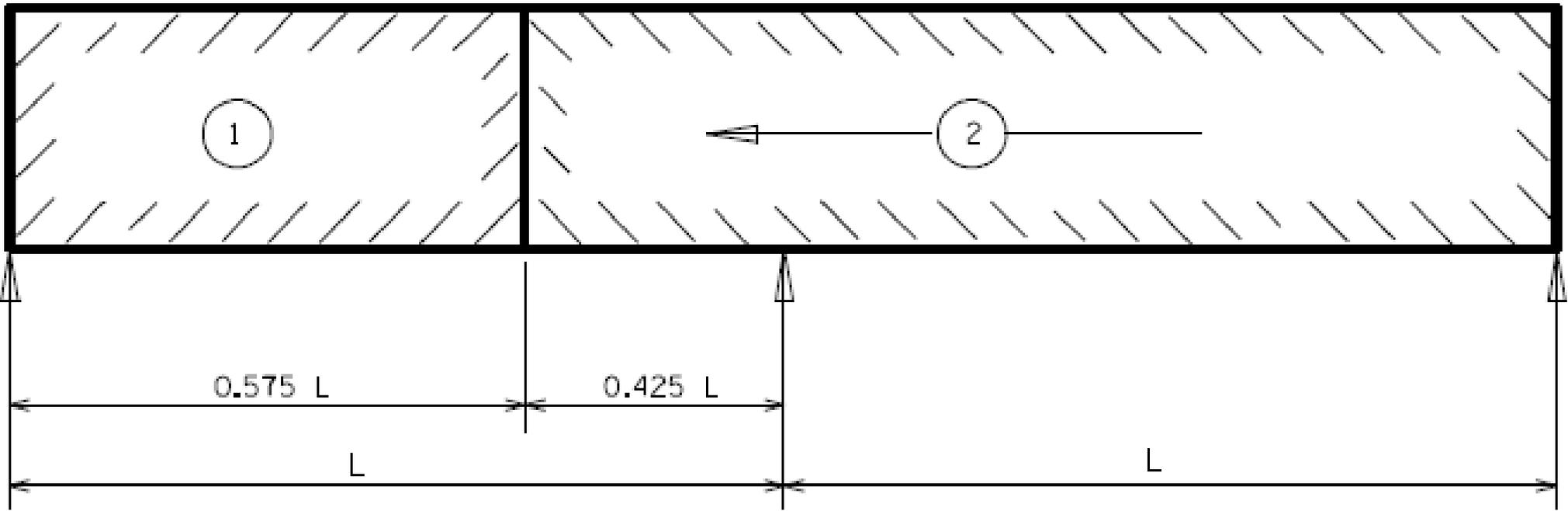
ALTERNATIVES

$$P\Sigma M := P\Sigma Meq \left[\begin{pmatrix} 200 \\ 200 \end{pmatrix}, 40, \begin{pmatrix} \text{"POUR 1"} & 1.00 & 1.50 \\ \text{"POUR 2"} & 2.40 & 3.00 \\ \text{"POUR 3"} & 1.50 & 2.40 \end{pmatrix} \right]$$

WORST-CASE MOMENT $\min(\text{PLTM2}(P\Sigma M)^{\langle 2 \rangle}) \cdot \text{kip}\cdot\text{ft} = -738\cdot\text{kip}\cdot\text{ft}$



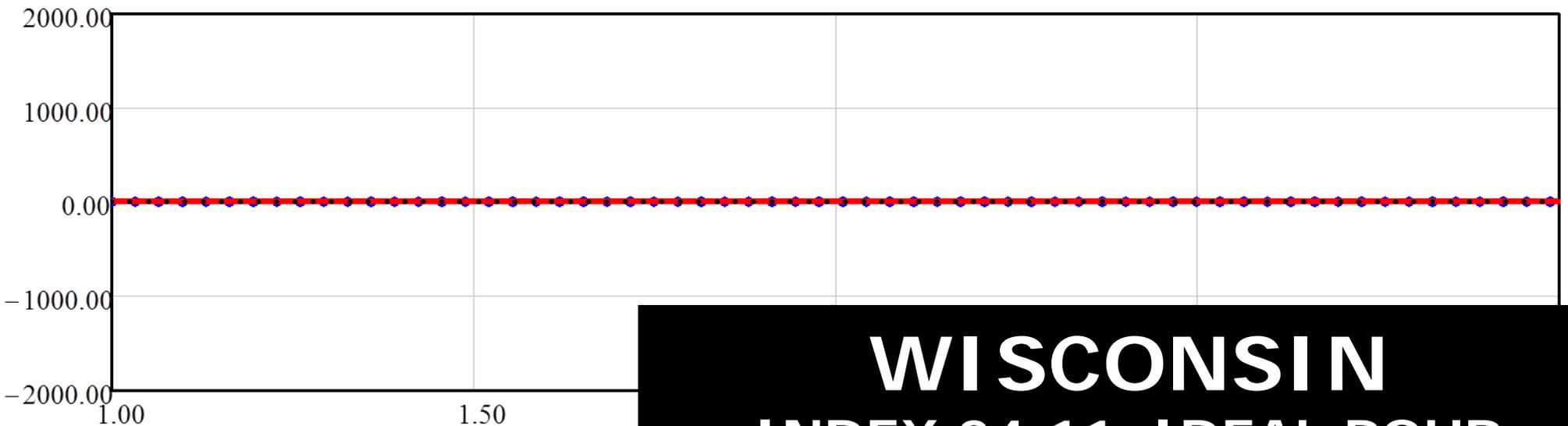
ASYMMETRIC



$$P\Sigma M := P\Sigma Meq \left[\begin{pmatrix} 200 \\ 200 \end{pmatrix}, 40, \begin{pmatrix} \text{"POUR 1"} & 1.000 & 1.575 \\ \text{"POUR 2"} & 1.575 & 3.000 \end{pmatrix} \right]$$

$$\min \left(PLTM\Sigma M(P\Sigma M)^{\langle \text{cols}(PLTM2(P\Sigma M)) \rangle} \right) \cdot \text{kip}\cdot\text{ft} = -3 \cdot \text{kip}\cdot\text{ft}$$

MOMENT TO COMPOSITE SLAB BY POUR SEQUENCE



WISCONSIN
INDEX 24.11, IDEAL POUR

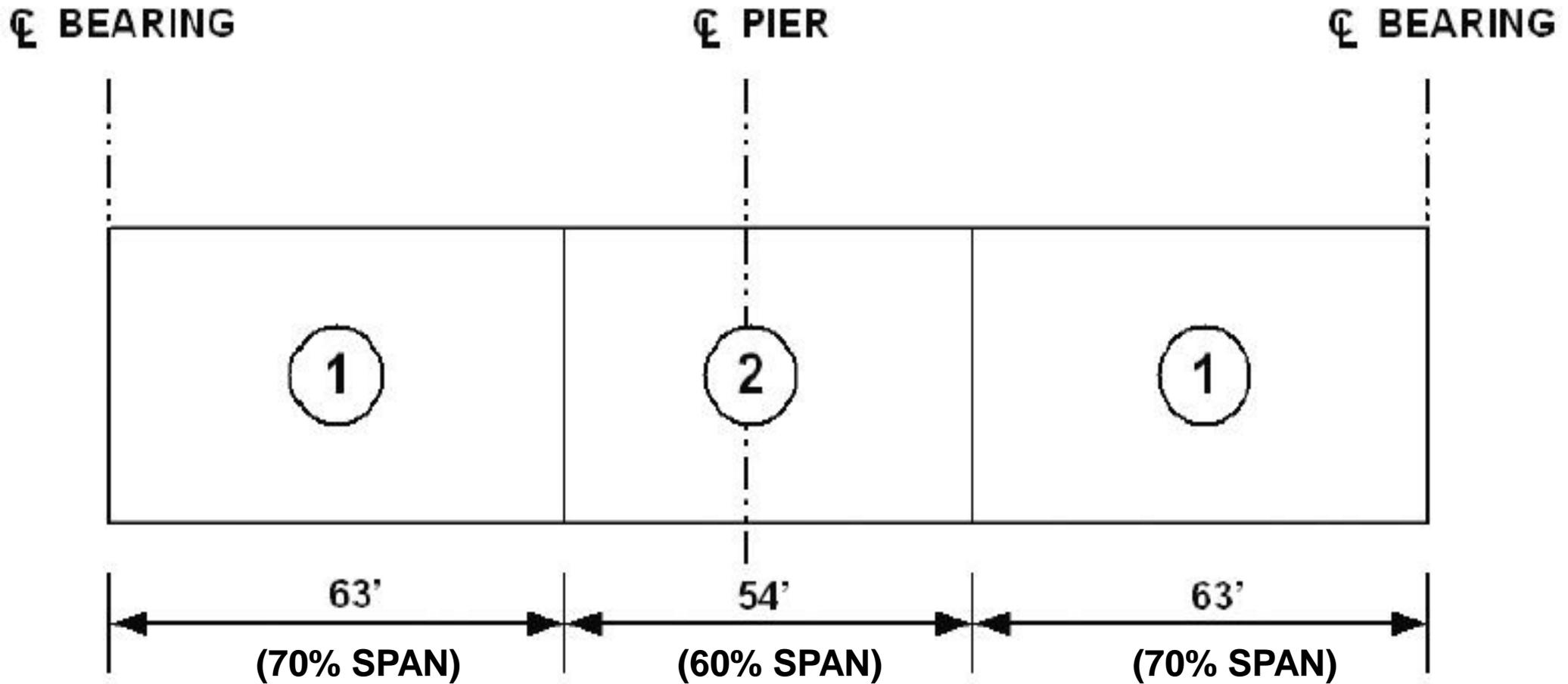


Figure 15 Deck Placement Sequence

SIMULTANEOUS POURS (FHWA)

<http://www.fhwa.dot.gov/bridge/steel/pubs/if12052/designexample02.pdf>

D5 ALONE?



D1
#130089



D2
#780121



D3

#580168



D4
#860524



D6
#871001

In Summary

Issue is not unique to Braided ramp project and D5

Pouring Sequence is not the only factor but a major one

Recommend Raising awareness by:

- ❑ Sharing this info with FDOT Staff and Consultants
- ❑ Add to ERC check lists and develop verbiage

Recommend revising the Standard Spec 400-21

Concern with the demolition method/sequence.

QUESTIONS?