

CONTINUOUS BRIDGE DECK POURS FOR STEEL SUPERSTRUCTURES BRIDGES

INDIANA DEPARTMENT OF TRANSPORTATION ASCE/INDOT STRUCTURES COMMITTEE TASK GROUP

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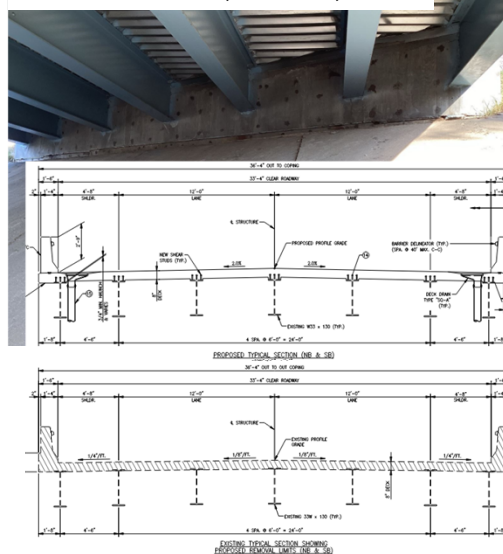
PRESENTED BY: Donald (DJ) Shaw

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PRESENTATION SCOPE

- YES
 - Continuous steel bridge superstructures
 - Beam or girder
 - New or replacement
- NO
 - Complex or major bridges, IDM 70
 - Slab bridges
 - Single span bridges
 - Buried structures
 - Longitudinal phase line closure pour
 - RCBA's poured continuously with bridge decks
 - etc.

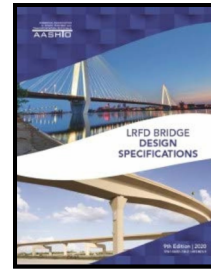
SR41/Wheatland Rd, Old US50, CSX RR



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PROBLEMS THAT REQUIRE GUIDANCE

1. Contractor risk increases cost
 - Bid methods \neq actual methods
 - Bid time \neq actual time
2. Early cracking reduces deck life
 - Correct deck rebar termination points
 - Reduce transverse construction joints (bulkheads)



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CURRENT GUIDANCE

Satisfy LRFD 6.10.1.7 spec.

- Short-term modular ratio, n
- All permanent loads
 - DC1, DC2, DW, etc.
- All transient loads
 - LL, etc.
- Service II
 - DC + DW + 1.3 LL + ...

1. Sequential Pour Analysis

- Locked-in deck stress (ea. Seq.)
 - During deck pour

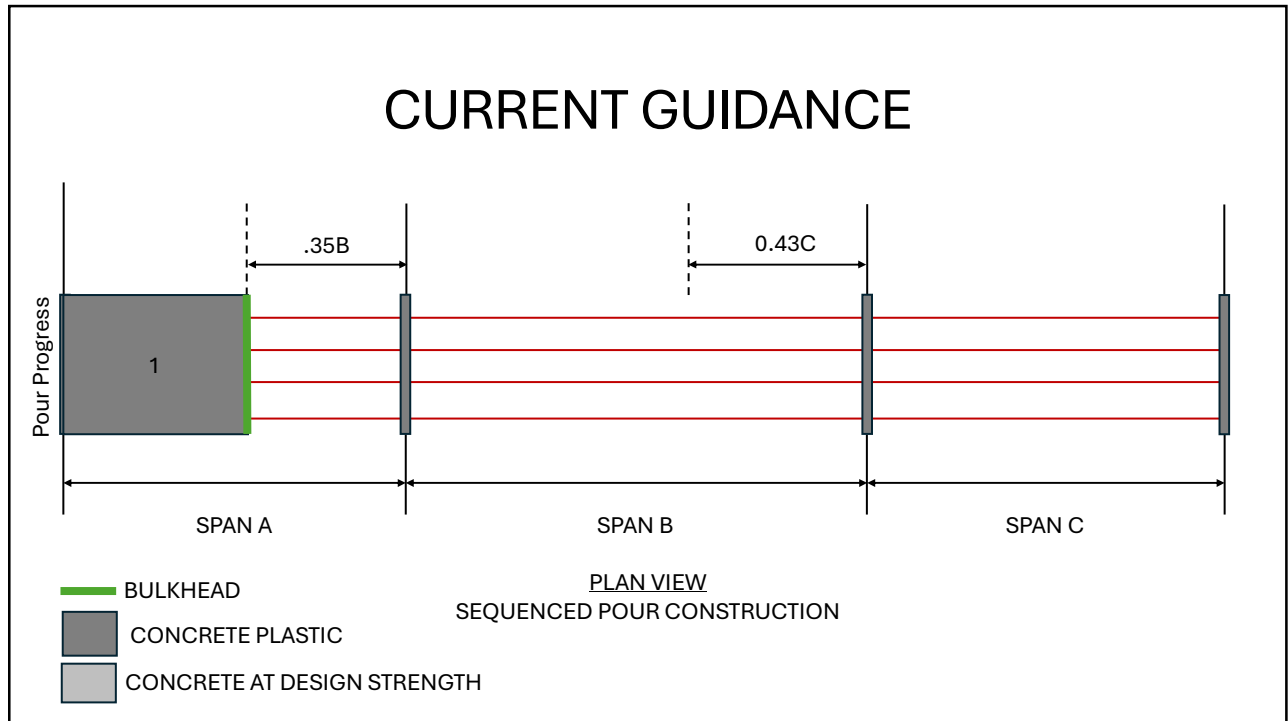
2. Continuous Pour Analysis

- Determine Inflection Points
 - Noncomposite deadload
- Deck stress (after deck poured)

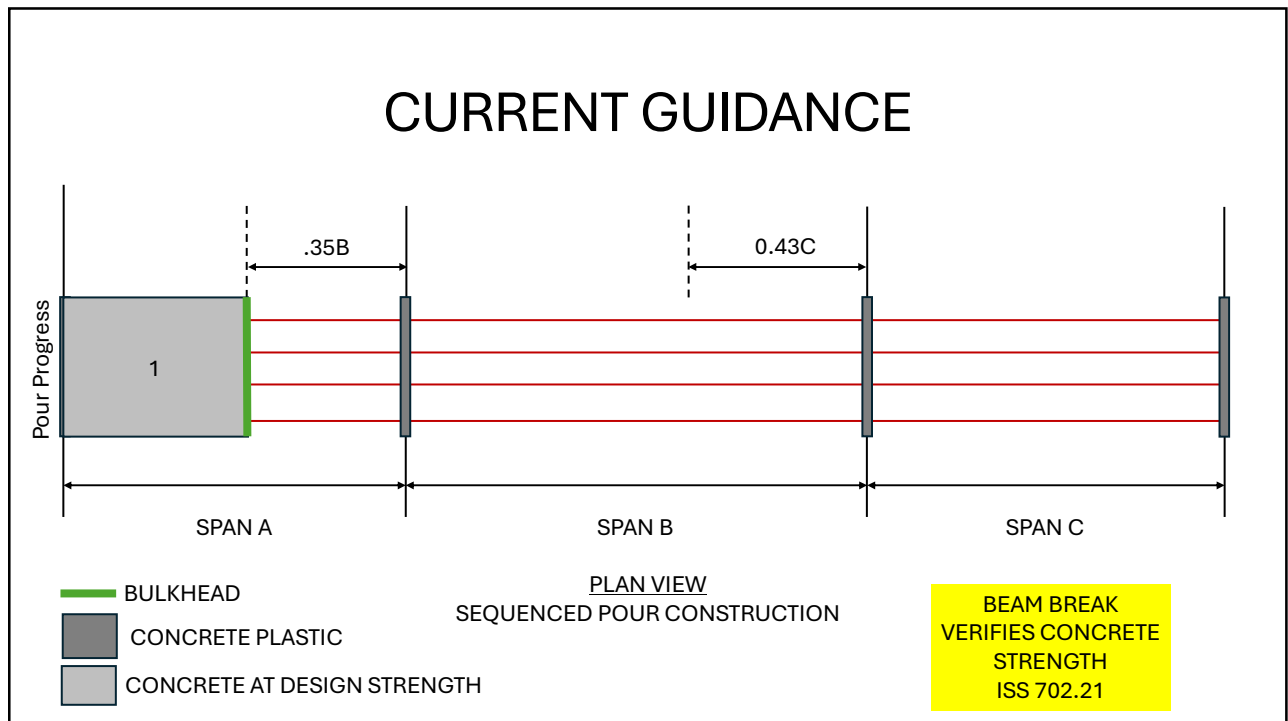
LRFD 6.10.1.7 should not increase number of rebars required for design

Longitudinal deck rebar termination points determined by the controlling analysis

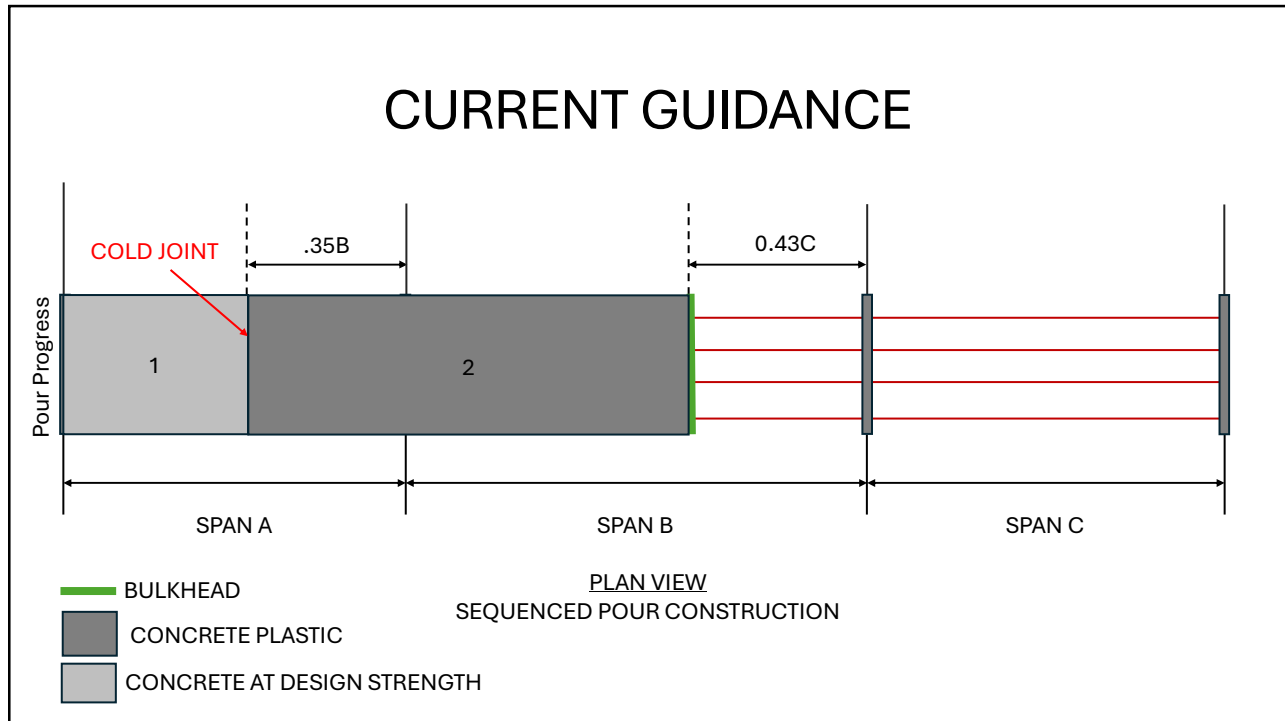
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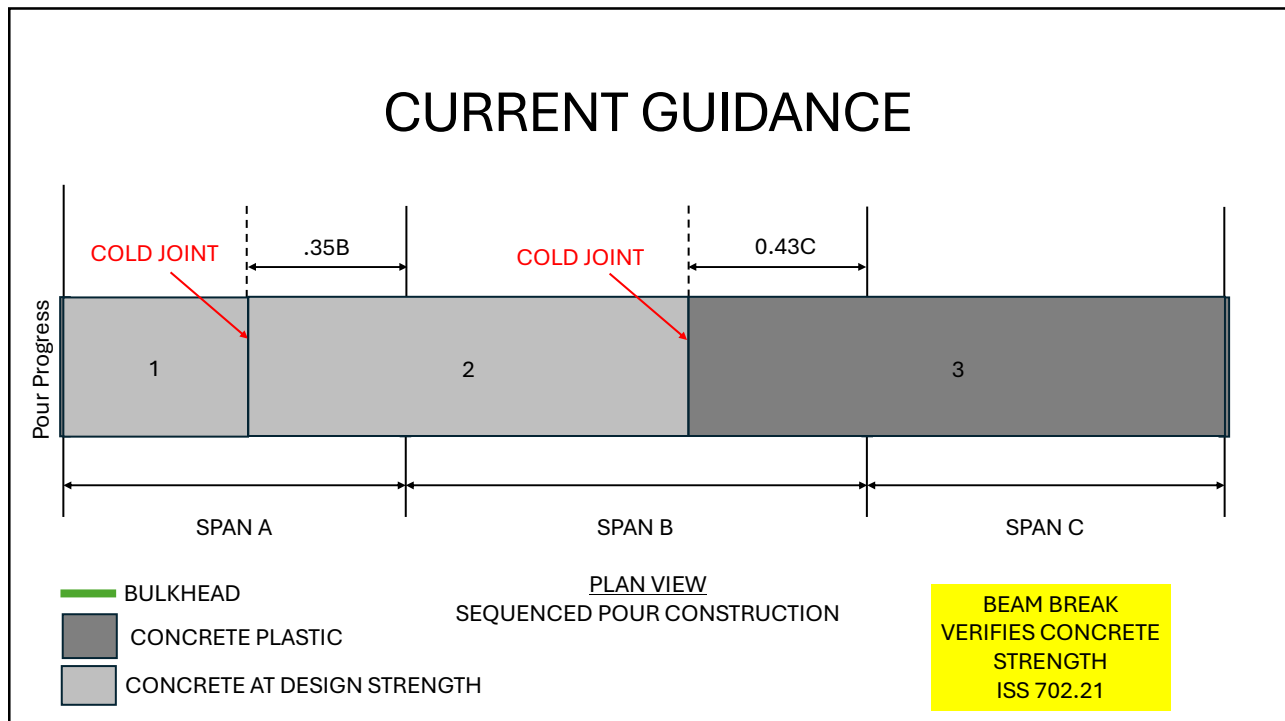
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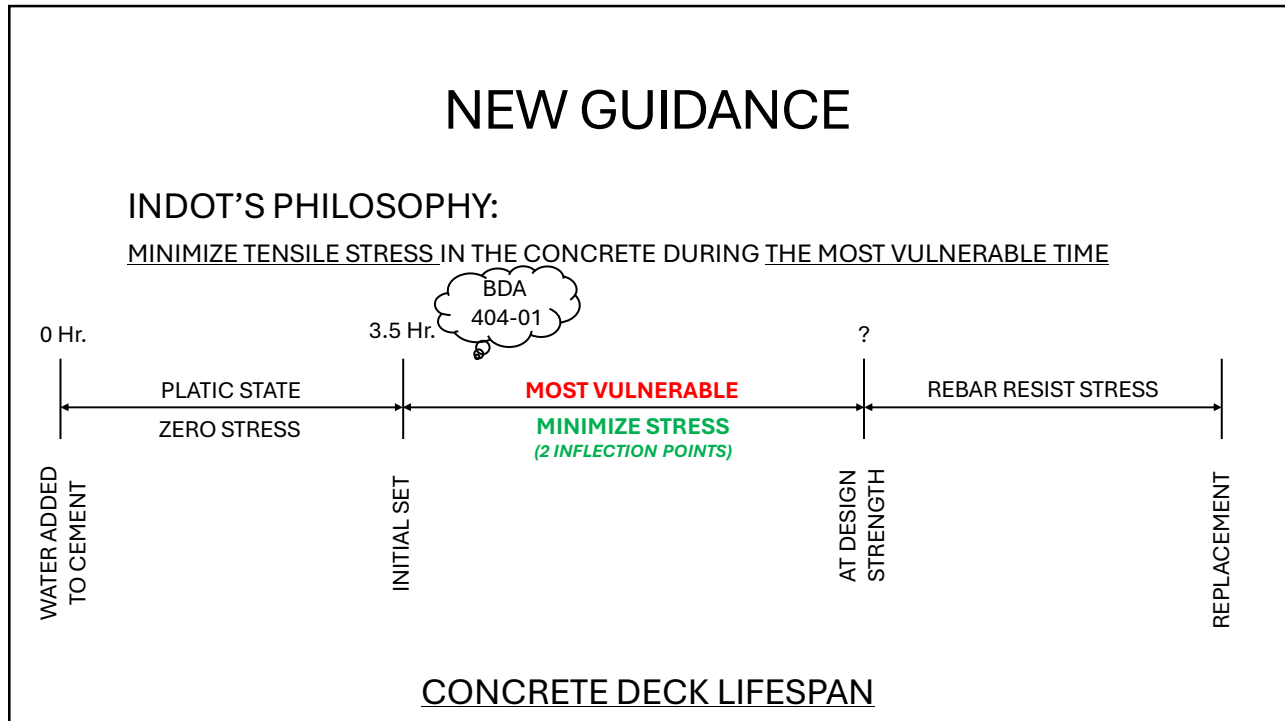
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CURRENT & NEW GUIDANCE

IDM 404-2.06(02)1a [Longitudinal Construction Joint]
*Construction joints need not be used on a deck having a constant cross section where the pour width is less than **65-90 ft.***

IDM 404-2.06(02)2a [Transverse Construction Joint]
*Steel Beam or Girder Structure. **Concrete may be placed continuously on a deck requiring less than 260 yd³ of concrete.** A single span bridge deck that is poured integrally with the end bents may usually be placed with one pour.*

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CURRENT & NEW GUIDANCE

IDM 404-2.06(02)2d [Transverse Construction Joint]

Steel Structure: A continuous deck pour should be allowed at the Contractor's option and noted on the plans if the following criteria are met:

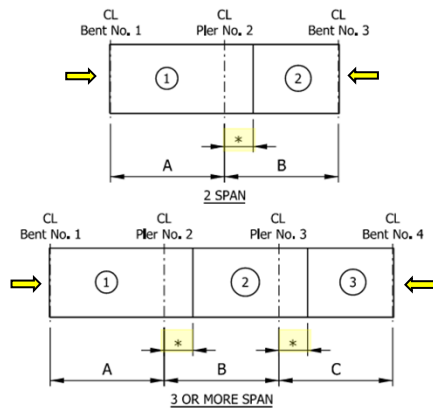
1. *The largest pour, as shown on the sequential pour sequence, can be placed within 3 ½ hours*
2. *The pour rate is less than 80 cubic yards for per hour*

Contractor requested continuous pours using pour rates above 80 cubic yards per hour will require approval by INDOT Construction in addition to the approval of the Designer.



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NEW GUIDANCE



* Construction Joints should be located close to points of uniform noncomposite dead load contraflexure, but should not be placed above beam splices. Avoid rebar lap splices.

The following note, revised as necessary, should be shown on the plans for a continuous steel beam or plate girder bridge:

POUR NUMBERS INDICATE THE SEQUENCE OF POURS. THE SEQUENCE OF POURS MAY BE REVERSED AT THE CONTRACTOR'S OPTION, PROVIDED THE LOCATIONS OF THE CONSTRUCTION JOINTS ARE MIRRORED FROM THOSE SHOWN ON THE PLANS. ALL POUR SEQUENCES AND PROCEDURES SHALL BE SUBMITTED IN ACCORDANCE WITH SECTION 704.04 OF THE STANDARD SPECIFICATIONS.

If a continuous pour is allowable in accordance with the criteria provided in 404-2.06(02), the following note should also be included on the plans:

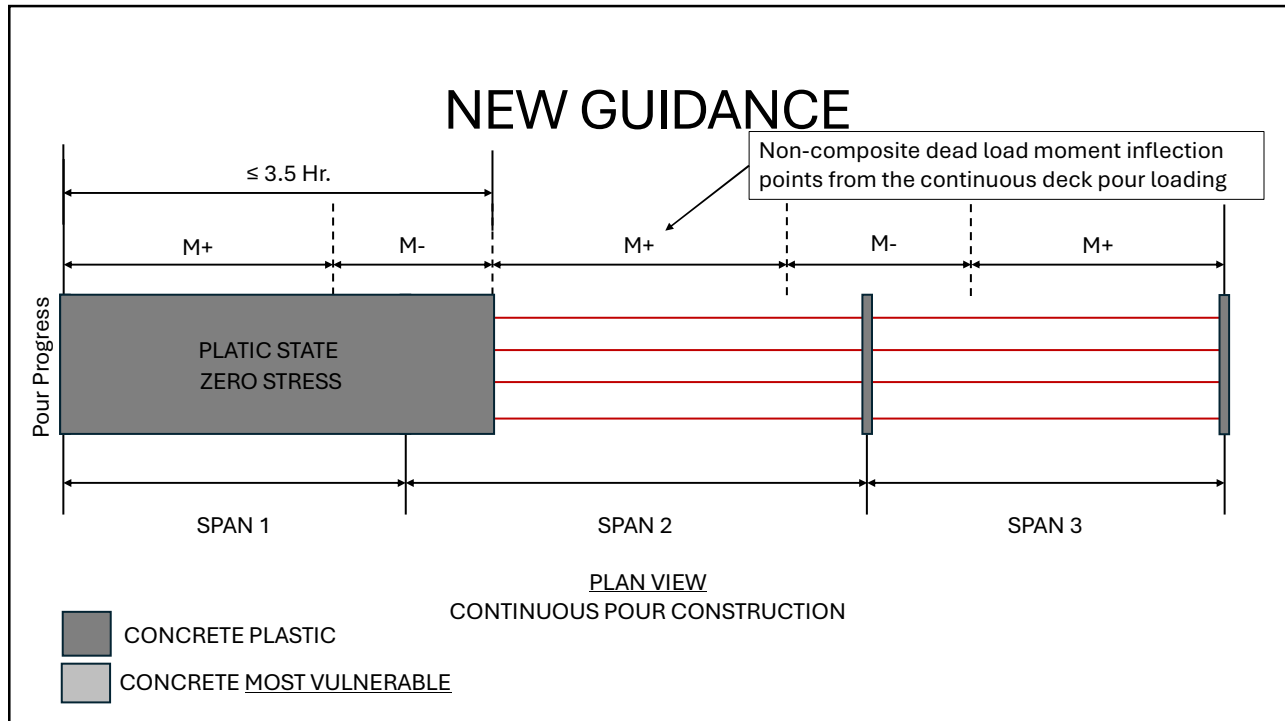
AS AN ALTERNATE, THE CONTRACTOR MAY ELECT TO POUR THE DECK AS ONE CONTINUOUS POUR FROM ONE END TO THE OTHER, THIS WILL BE ALLOWED PROVIDED THE FOLLOWING CRITERIA IS MET:

- THE MINIMUM REQUIRED POUR RATE SHALL BE ___CYS/HR
- THE POUR NUMBER, AS SHOWN ON THE POUR SEQUENCE ABOVE, WITH THE LARGEST VOLUME OF CONCRETE SHALL BE COMPLETED WITHIN 3½ HOURS FROM THE TIME THE CONCRETE IS FIRST PLACED WITHIN THAT POUR REGION.

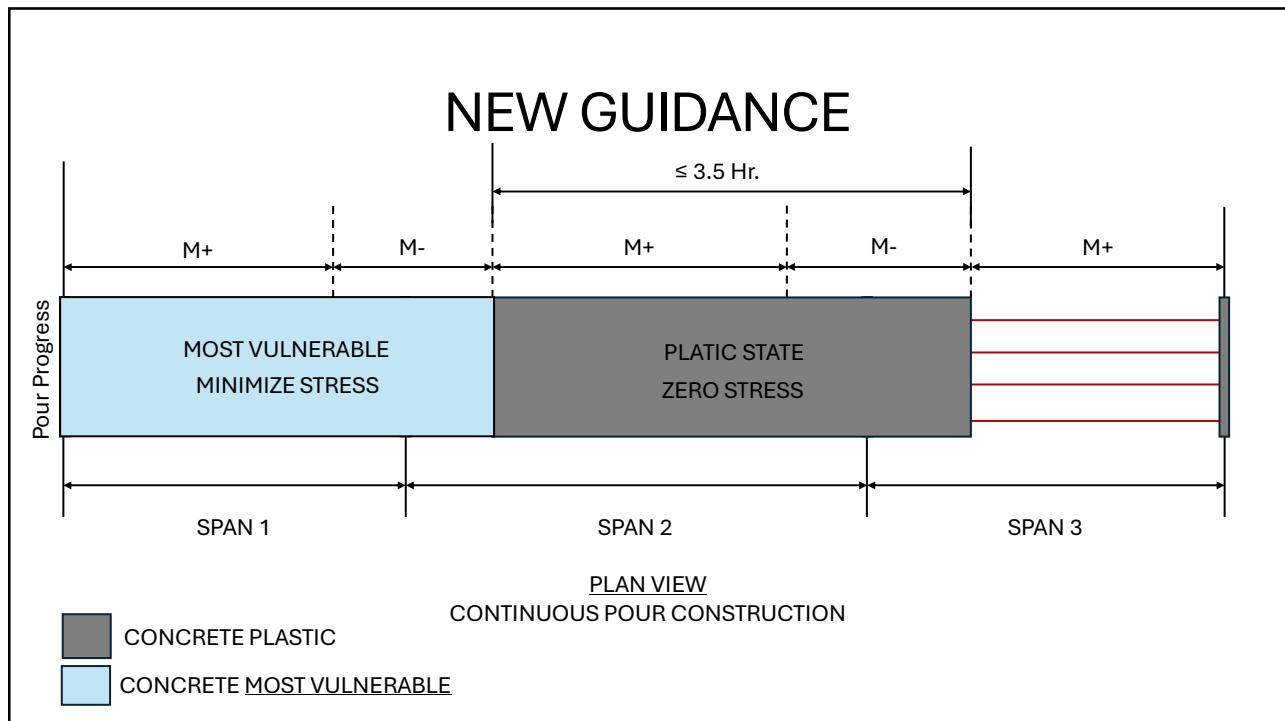
TYPICAL POUR DIAGRAMS
(Continuous Steel Beams or Plate Girders)

Figure 404-2G **NEW GUIDANCE**

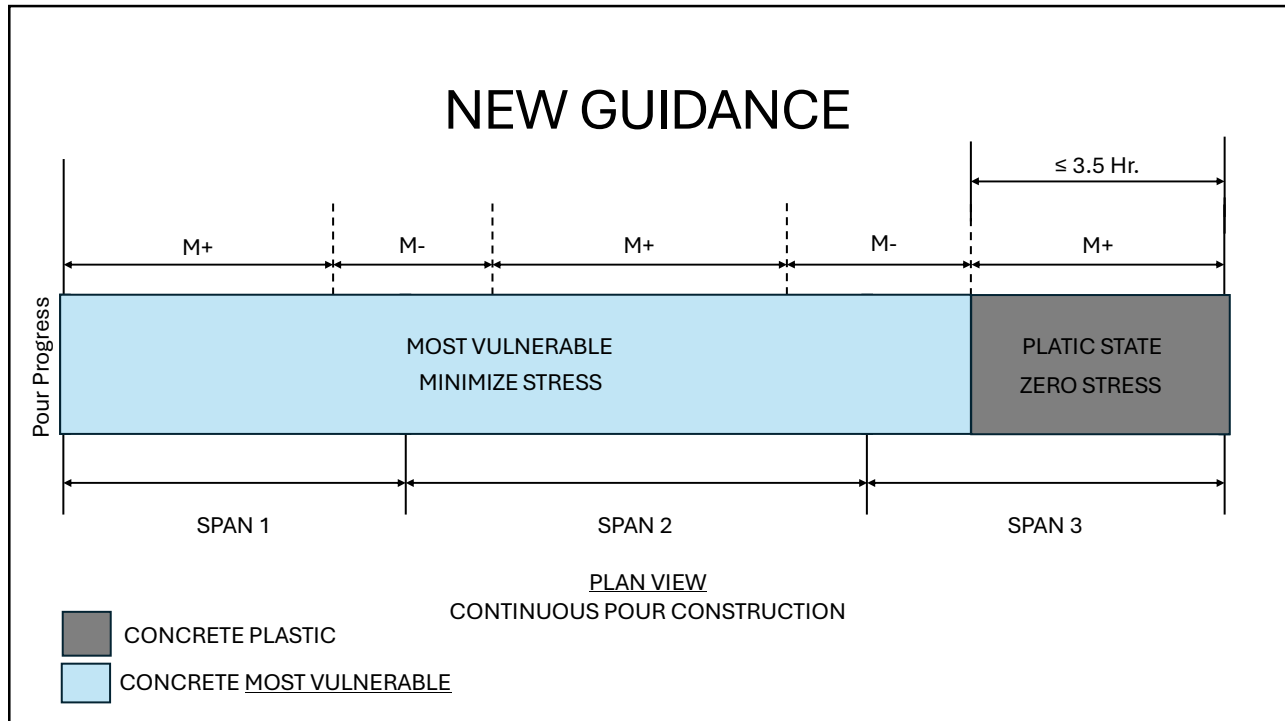
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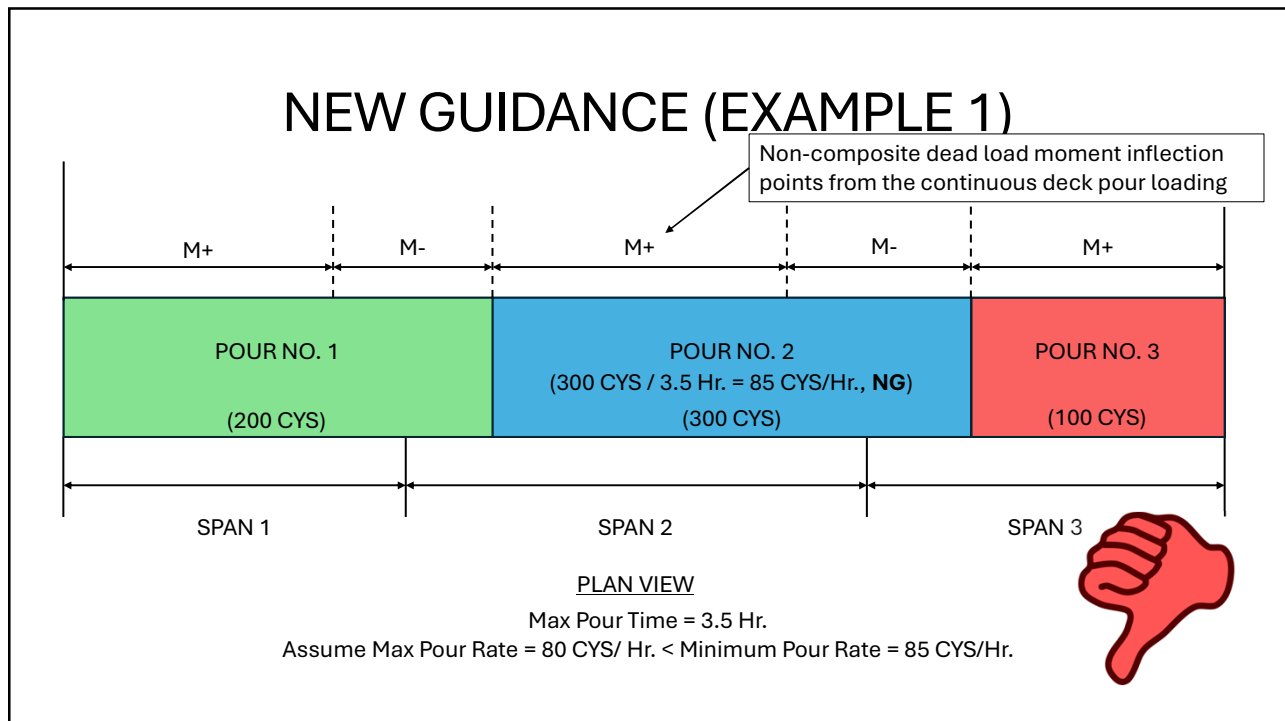
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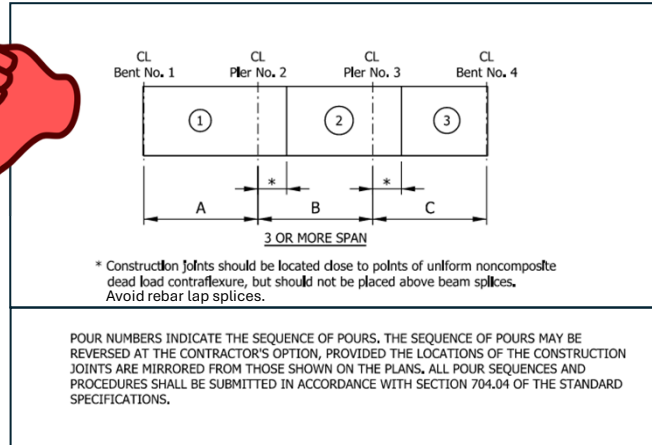
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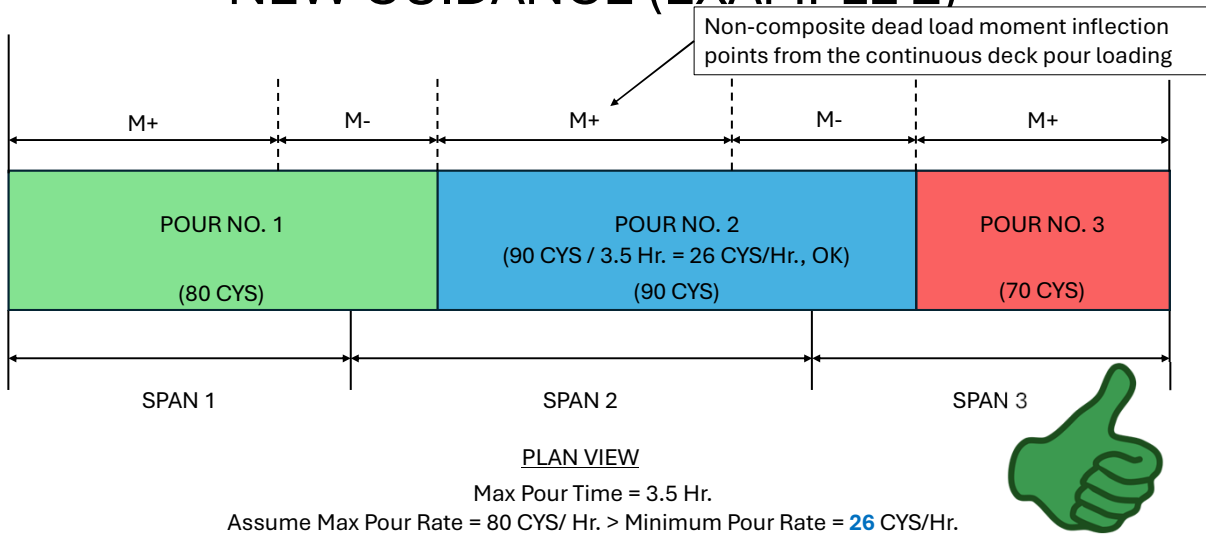
NEW GUIDANCE (EXAMPLE 1)

LARGEST POUR REQUIRES > 80 CYS/Hr. (NG)



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NEW GUIDANCE (EXAMPLE 2)

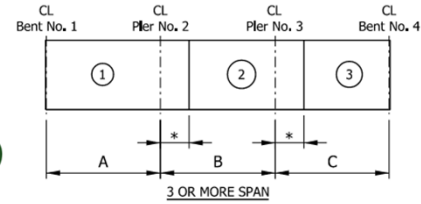


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NEW GUIDANCE (EXAMPLE 2)



LARGEST POUR REQUIRES ≤ 80 CYS/Hr. (OK)



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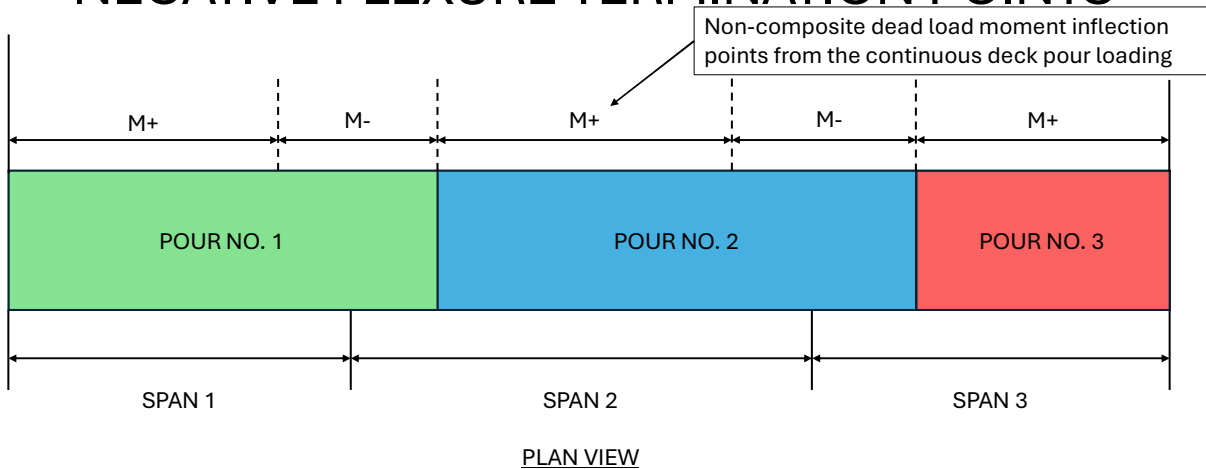
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- THE MINIMUM REQUIRED POUR RATE SHALL BE ²⁶ CYS/HR
- THE POUR NUMBER, AS SHOWN ON THE POUR SEQUENCE ABOVE, WITH THE LARGEST VOLUME OF CONCRETE SHALL BE COMPLETED WITHIN 3½ HOURS FROM THE TIME THE CONCRETE IS FIRST PLACED WITHIN THAT POUR REGION.

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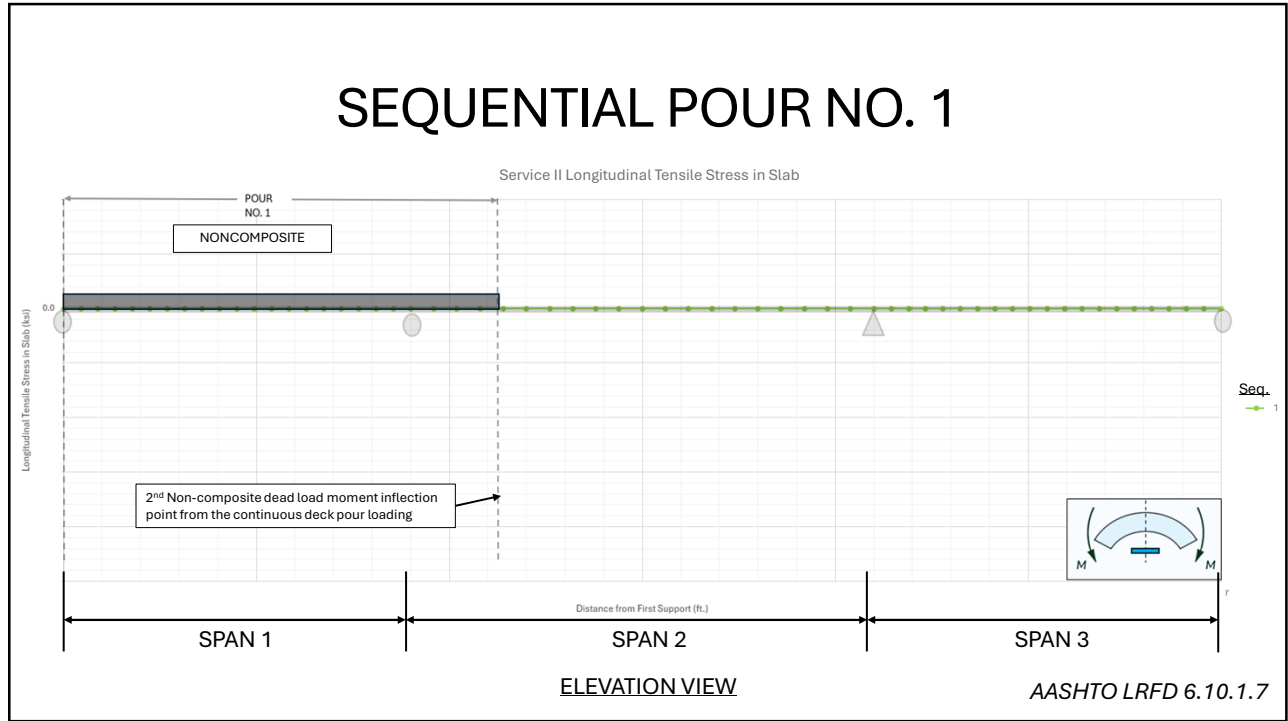
NEGATIVE FLEXURE TERMINATION POINTS



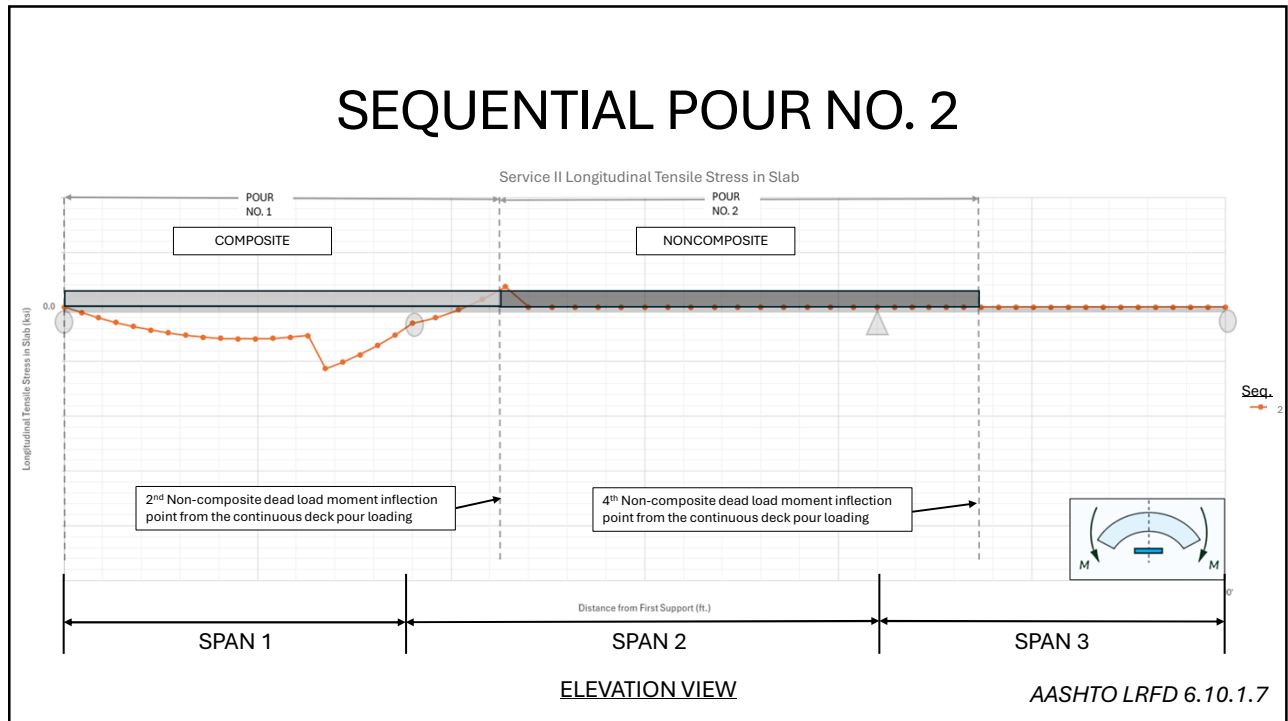
$$\text{Max} [\sigma_{\text{Serv.II}}, \sigma_{\text{Const.}}] > \phi f_r \rightarrow A_{s_long} \geq 1\% A_{g_deck} \quad (\text{LRFD 6.10.1.7})$$

$$\sigma = \text{longitudinal tensile stress in the concrete deck}$$

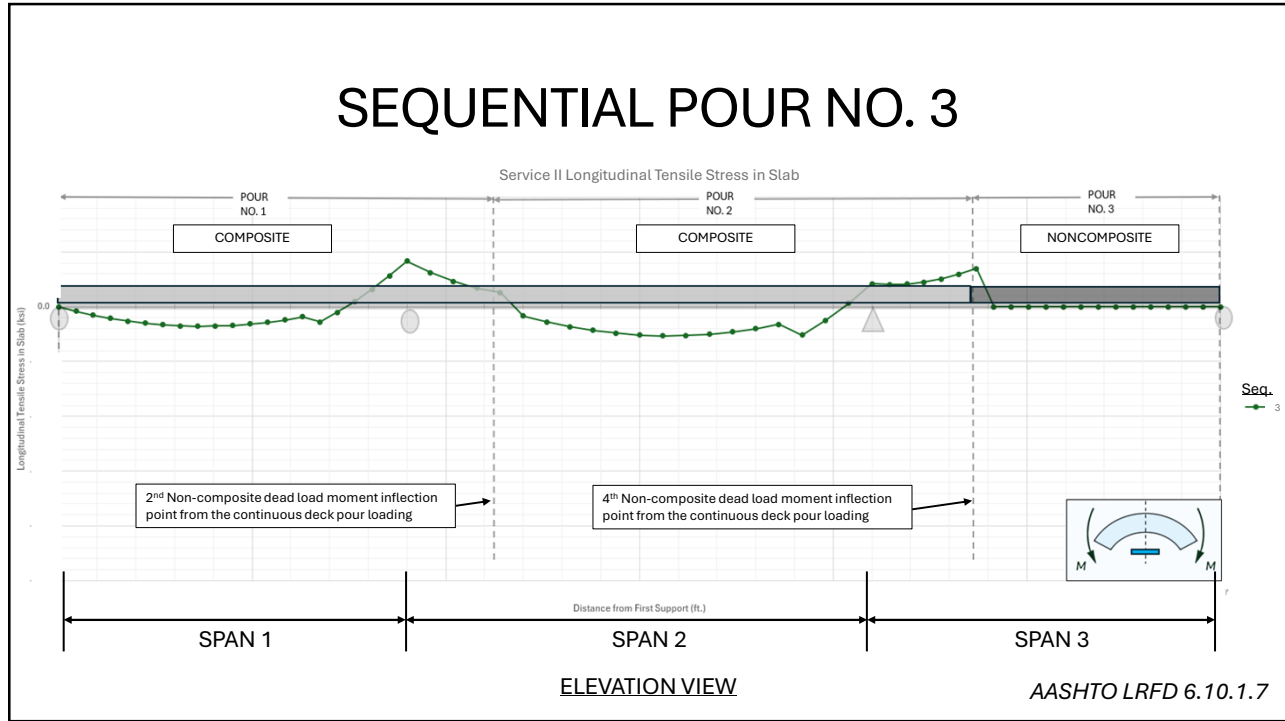
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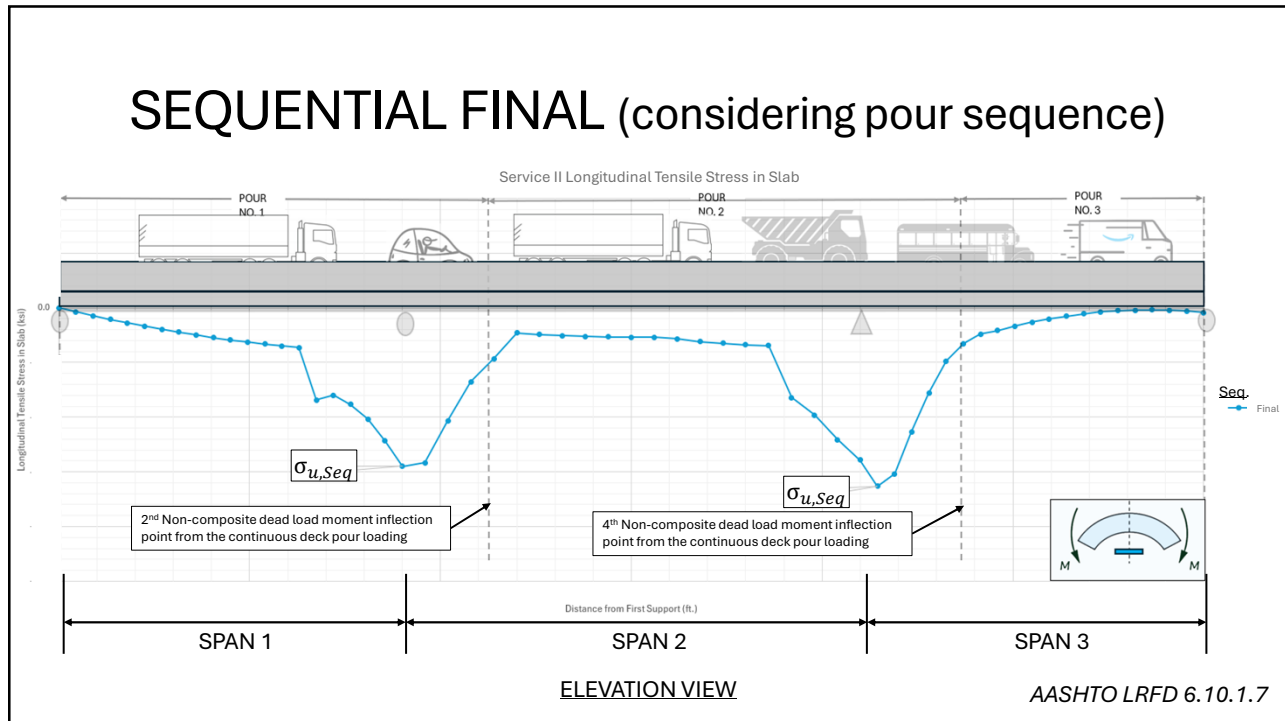
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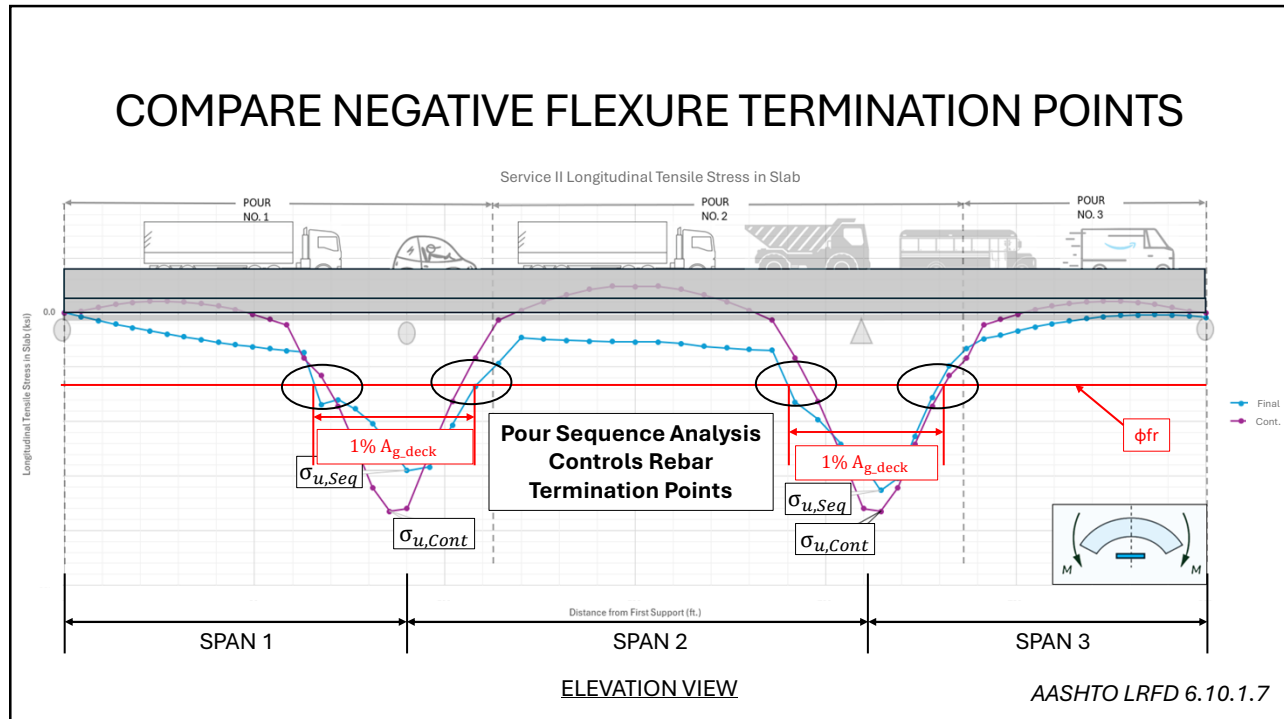
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CONCLUSION

1. Continuous bridge deck pours reduce contractor risk, reduce costs, and extend bridge deck life
2. Continuous pours recommended if largest pour can be completed ≤ 3.5 hr. with ≤ 80 CYS/hr
3. Determine rebar termination points using Service II & construction loading controlling analysis: sequential or continuous bridge deck pour

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