Overview of New Practices & Policy

Deck Issues

Topics

- Stakeholder Responsibilities
- Deflection Control Measures
- Changes to Plan Requirements
Stakeholder Responsibilities

**Designer**

The Designer is responsible for designing a superstructure that maintains minimum cover & deck thickness throughout placement.

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Stakeholder Responsibilities

**Contractor**

The Contractor is responsible for designing falsework & finishing machine support that minimizes deflection during placement.

Note: The Contractor assumes responsibility for maintaining minimum cover and deck thickness when deviating from plan requirements.
Deflection Control Measures

Construction

Design

Deflection Control Measures
Construction

Issue:
Place concrete in a manner that minimizes differential deflections across the transverse section.

Specification Change #1: CMS 511.10 & 511.19
For structures with a skew angle greater than fifteen (15) degrees and up to fifty (50) degrees, load and finish the concrete at the skew angle.
Deflection Control Measures
Construction

Current Typical Method of Placement

Deflection Control Measures
Construction

Revised Method of Placement
Deflection Control Measures
Construction

Issue:
Place concrete in a manner that minimizes differential deflections across the transverse section.

Specification Change #2: CMS 511.10 & 511.19
For structures with a skew angle greater than fifty (50) degrees, load the concrete at the skew angle and finish the concrete at fifty (50) degrees. The furthest the concrete shall precede the finishing machine is 20 ft.

Revised Method of Placement
Deflection Control Measures  
Construction

Issue:
Reduce the potential for web distortion ("oil-canning") under overhang bracket loading.

Specification Change #3: CMS 508.02
Locate the lower contact point of overhang falsework within 8 inches (200 mm) of the top of the rolled beam or steel girder's bottom flange.
Deflection Control Measures

Construction

Issue:
Reduce potential for unanticipated girder deflection during deck placement.

Specification Change #4: CMS 513.26
Permanently fasten all cross frames and lateral bracing before deck placement begins.
Deflection Control Measures
Design

Issue:
Reduce potential for deck thickness loss due to web distortion ("oil-canning") under overhang bracket loading.

Policy Change #1: BDM 302.4.1.7
For steel girder web depths > 78", specify Item 508.02 "as per plan" and specify the lower contact point of overhang falsework in the plans.
Deflection Control Measures
Design

Issue:
Reduce potential for deck thickness loss due to web distortion ("oil-canning") under overhang bracket loading.

Policy Change #2: BDM 302.2
For steel girder web depths > 78", determine amount of girder twist from "oil-canning" ($\phi$) and associated screed rail deflection ($\delta_{left}$ & $\delta_{right}$) and deck thickness loss.
Stiffen web as necessary by reducing transverse stiffener spacing, thickening web or providing design for temporary web bracing in the plans.
Deflection Control Measures
Design

Issue:
Reduce potential for deck thickness loss due to girder warping between crossframes under the overhang load.

Policy Change #3: BDM 302.2
Designers shall determine amount of girder twist from girder warping between crossframes ($\phi_w$) and associated screed rail deflection ($\delta_{\text{left}}$ & $\delta_{\text{right}}$) and deck thickness loss.

Reducing crossframe spacing and stiffening flanges of main members can reduce the effect of girder warping.
Deflection Control Measures

Design

Issue:
Minimize global deformation (i.e. “frownie face” 😞) across the transverse section of NEW steel or prestressed superstructures.

Policy Change #4: BDM 302.2
Layout the transverse section such that the tributary deck load carried by the fascia member does not exceed 110% of the average tributary deck load carried by interior members.

A Line Girder Analysis of the superstructure is acceptable and twist ($\phi_g$) due to global deformation may be neglected.
Deflection Control Measures

Design

Issue:
Minimize global deformation (i.e. “frownie face” 😞) across the transverse section of EXISTING steel or prestressed superstructures.

Policy Change #5: BDM 302.2
Layout the transverse section such that the tributary deck load carried by the fascia member does not exceed 115% of the average tributary deck load carried by interior members.

A Line Girder Analysis of the superstructure is acceptable and twist ($\phi_g$) due to global deformation may be neglected.
Deflection Control Measures

Design

Issue:
If global deformation cannot be minimized, reduce the potential for deck thickness loss due to global deformation across transverse section.

Policy Change #6: BDM 302.2
When the tributary deck load carried by the fascia member does not meet the previous requirements, perform a Refined Analysis of the superstructure to determine twist due to global deformation ($\phi_g$) and associated screed rail deflection ($\delta_{\text{left}}$ & $\delta_{\text{right}}$) and deck thickness loss.
Tributary Areas – Example
New Steel Superstructure

\[ A = 5.3 \text{ ft}^2 \]

\[ A = 6.0 \text{ ft}^2 \]
**Tributary Areas – Example**

*New Steel Superstructure*

A\(=\) 5.3 ft\(^2\)  
A\(=\) 6.0 ft\(^2\)  
A\(=\) 7.0 ft\(^2\)

\[\checkmark 5.3 \text{ ft}^2 < 6.0(1.10) = 6.6 \text{ ft}^2 < 7.0 \text{ ft}^2\]

**Deflection Control Measures**

**Design**

**Issue:**
Reduce potential for deck thickness loss on prestressed I-Beam superstructures due to insufficient lateral bracing during deck placement.

**Policy Change #7: BDM 302.5.2.6**
Designers shall analyze the diaphragms for the overturning loads applied by the overhang brackets during deck placement. Additional diaphragms or temporary bracing details may be required.

“Oil-canning” and warping effects associated with steel superstructures may be neglected.
Issue:
Design a superstructure that maintains minimum cover & deck thickness throughout placement.

Policy Change #8: BDM 302.2
The total loss of deck thickness from the three sources of girder twist ($\phi_o$, $\phi_w$ and $\phi_g$) shall not exceed $\frac{1}{2}$ in.
Deflection Control Measures

Design

Issue:
How should global deformation ($\phi_w$) for a structure with complex geometry (e.g. curvature, skews > 50°, multiple skews, etc.) be determined?

Policy Change #9: BDM 302.2
For structures with complex geometry, the designer should consider a more detailed analysis of the pour sequence to determine if the sequence itself leads to potential cover loss in excess of $\frac{1}{2}$“ at specific locations throughout the deck.
Deflection Control Measures
Design

Issue:
Reduce potential for unanticipated girder deflection during deck placement.

Policy Change #10: BDM 302.4.2.3
Slotted holes shall not be used in crossframe connections. Crossframe connections shall be fully welded or designed to prevent slip during the deck placement operations.

Deflection Control Measures
Design

Issue:
What is the maximum pouring width for a wide skewed bridge?

Policy Change #11: BDM 302.2
The paving width as measured along the skew should be kept less than 120’. Introducing longitudinal construction joints may be required.

Contact the ODOT Office of Construction Administration if a paving width > 120’ can not be avoided.
**Changes to Plan Requirements**

- Deflections - Screeds
- General Notes

**Changes to Plan Requirements**

**Deflections - Screeds**

For Line Girder Analysis:
Divide deck load evenly to all beams/girders to determine deflections used to establish screed elevations.

- Assumes all beams deflect uniformly (i.e. as a unit).
- Accounts for the influence of crossframes on overall girder deflection.
- Limited to transverse sections with balanced tributary loads to main members.
Changes to Plan Requirements
Deflections - Screeds

For Refined Analysis:
Use the deflections from each beam/girder to establish individual screed elevations.

- Allows the Designer to anticipate girder twist due to global deflections ($\phi_g$).
- Screed elevations can be adjusted to account for differential deflections between girders due to global deflections.

Changes to Plan Requirements
General Notes

All assumptions that a Designer makes regarding Contractor means, methods and equipment that affect the design provided in the plans should be included in the General Notes.

Examples Include:
- Special pouring sequences
- Finishing machine loads
- Locations of overhang brackets
- etc.
Summary

An itemized summary is provided at the back of the seminar handout and is available for download at our website:

www.dot.state.oh.us/se/skew/skew.htm

Questions

Email Questions to:
OSE@dot.state.oh.us