2018 Transportation Conference

Hosted by ACEC-IA | IOWA DOT | FHWA

September 12, 2018

Concurrent Session B 1

Iowa DOT Bridge Office Update

Mike Nop

25 minute presentation

Futuristic

If you see this symbol on a slide it means this could become policy.

IOWA DOT

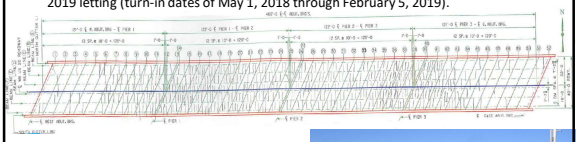
Deck Pour Monitoring Note

Added April, 2018.

CADD Note E75

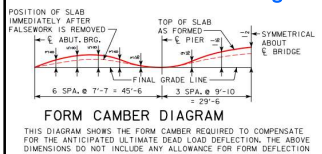
RESEARCHERS FROM IOWA STATE UNIVERSITY WILL BE OBSERVING PLACEMENT OF DECK CONCRETE FOR THIS PROJECT. CONTRACTOR IS REQUIRED TO CONTACT BRENT PHARES AT (515)294-5879 THREE (3) DAYS PRIOR TO DECK CONCRETE PLACEMENT…

Place the following note on all bridge plans with deck/slab pours (PPCB, Steel Beam, and CCS bridges) with the following letting dates: July 17, 2018 letting through April 16, 2019 letting (turn-in dates of May 1, 2018 through February 5, 2019).



CCS Bridge Deflections

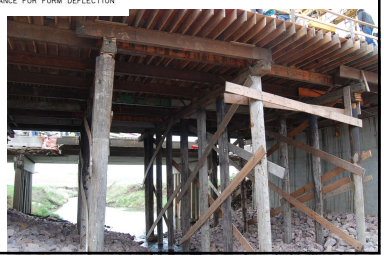
Futuristic



FORM CAMBER DIAGRAM

THIS DIAGRAM SHOWS THE FORM CAMBER REQUIRED TO COMPENSATE FOR THE ANTICIPATED ULTIMATE DEAD LOAD DEFLECTION. THE ABOVE DIMENSIONS DO NOT INCLUDE ANY ALLOWANCE FOR FORM DEFLECTION OR FALSEWORK SETTLEMENT.

We are taking a look at the way we do camber diagrams for longer CCS bridges. Does it make sense to camber a CCS bridge deck based on the long term deflection, immediate elastic deflection, or somewhere in-between?



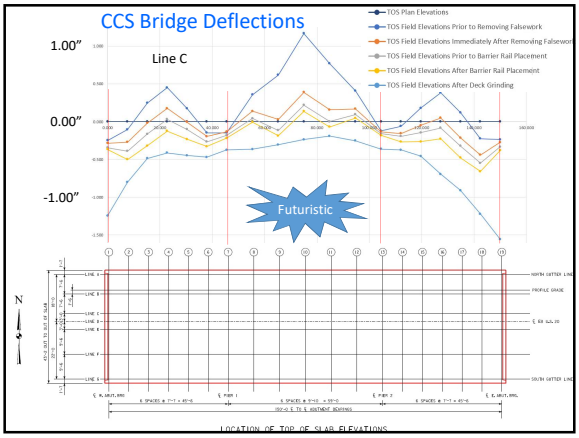
Deck Pour Section and Sequences

Futuristic

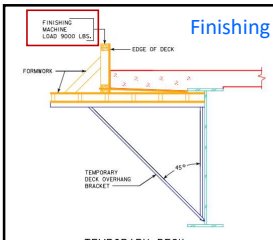
BDM 5.2.4.1.2 Deck Pours

- PPCB deck pours - automatically allow end to end deck pours in the note so long as plasticity of the concrete is maintained.
- Steel beam deck pours -
  - Engineer shall check the standard section/sequence pour.
  - Engineer will likely need to check an end to end pour, assuming concrete plasticity.
    - ✓ Include an end to end pour in the note if it works.
    - ✓ Specifically exclude an end to end pour in the note if it doesn't work.
  - Engineer of record shall analyze any alternate pours submitted by the contractor. Contractor shall pay for the cost of additional analysis and any required plan modifications for camber, deflection and haunch.

CCS Bridge Deflections



Finishing Machine Load



TEMPORARY DECK OVERHANG BRACKET DETAIL

Loading was modified on July 1, 2018.

Construction Loading

Increased finishing machine construction load from 6 kips to 9 kips on one side.

Standard Sheet 4305A

Construction Loading – Steel Beams

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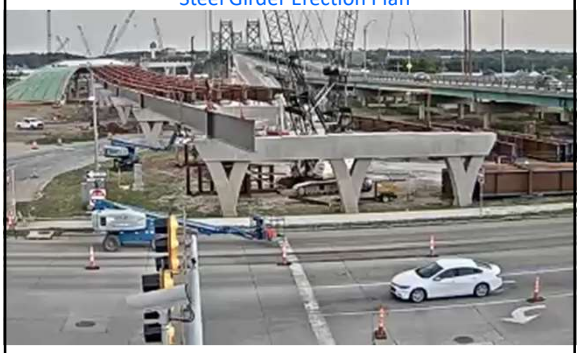
BDM 5.5.2.2.6 Construction

- Dead load of forms: 0.010 ksf
- Dead load of edge rail and walkway applied at the edge of the deck form: 0.075 klf
- Construction live load: 0.050 ksf
- Live load of finishing machine located along the edge of the deck form to maximize the design condition: 9 kips
- Wind load for 100 mph wind at elevations not exceeding 30 feet above ground level: 0.050 ksf. At higher elevations the load shall be adjusted upward.

BDM 5.5.2.2.6 Construction

- Strength I, structure with construction dead load and live load
- Strength III, structure with construction dead load and wind
- Strength IV, structure with construction dead load
- Strength V, structure with construction dead and live load and wind

Steel Girder Erection Plan



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PPCB Temporary Bracing

BDM CADD Note E202

The contractor shall be responsible for ensuring stability of prestressed concrete beams during erection and construction up through the concrete bridge deck reaching its full 28-day strength. The contractor shall provide sufficient temporary anchor bracing at beam ends and temporary intermediate bracing as needed to ensure prestressed beam stability. Partially or fully installed permanent bracing as shown in these design plans shall not be assumed sufficient to brace prestressed beams during erection and construction. Temporary bracing shall not be welded to prestressed beam stirrups.

Cadd note added on July 1, 2017.

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Steel Beam Temporary Bracing

CADD Note E204

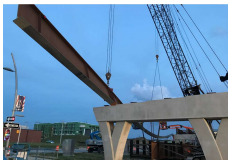
The contractor is to provide sufficient temporary bracing to minimize lateral deflection and rotation of exterior steel beams during deck placement. Lateral deflection and rotation of exterior beams may result in thin decks and an upwards shift in bar mats which can decrease concrete cover. Partially or fully installed permanent bracing as shown in these design plans shall not be assumed sufficient to minimize lateral deflection and rotation of exterior beams during deck placement. Temporary bracing shall not be welded to the steel beams or its attachments including the studs.

Cadd note added on July 1, 2017.

Steel Girder Erection Plan

The contractor, in accordance with the Special Provision, shall provide a GEP submittal for review when one or more of the following conditions is applicable:

- Shoring towers and/or strong-backs are used by the contractor.
- Erection is from floating equipment.
- The girder system includes lateral bracing.
- Girder radius of curvature is less than 20 times the span length.
- The bridge is over or adjacent to a railroad.



Requirement added on July 1, 2017.

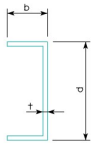
Rolled Steel Beam Standards - Permanent Bracing (RS40-081)

AASHTO LRFD 6.7.4.2

Diaphragms or cross-frames for rolled beams and plate girders should be as deep as practicable, but as a minimum should be at least 0.5 of the beam depth for rolled beams and 0.75 of the girder depth for plate girders.

DIAPHRAGM MEMBER OPTIONS

DIAPHRAGM LOCATION	BEAM SIZE	ROLLED SHAPE OPTION		BENT PLATE OPTION			
		DESIGNATION	CONN. BOLTS	d (IN)	b (IN)	t (IN)	CONN. BOLTS
INTERMEDIATE	W30	C15x33.9	3 - $\frac{7}{8}$"Φ	15	4	$\frac{3}{4}$	3 - $\frac{7}{8}$"Φ
INTERMEDIATE	W33 & W36	MC18x42.7	4 - $\frac{7}{8}$"Φ	18	4	$\frac{3}{4}$	4 - $\frac{7}{8}$"Φ
INTERMEDIATE	W40	W21x50	4 - $\frac{7}{8}$"Φ	21	4	$\frac{3}{4}$	4 - $\frac{7}{8}$"Φ
INTERMEDIATE	W44	W24x62	5 - $\frac{7}{8}$"Φ	24	4	$\frac{7}{8}$	5 - $\frac{7}{8}$"Φ
ABUTMENT	ALL	C12x20.7	3 - $\frac{7}{8}$"Φ	12	4	$\frac{3}{4}$	3 - $\frac{7}{8}$"Φ
PIER	W30	C15x33.9	12 - $\frac{7}{8}$"Φ	15	4	$\frac{3}{4}$	12 - $\frac{7}{8}$"Φ
PIER	W33 & W36	MC18x42.7	12 - $\frac{7}{8}$"Φ	18	4	$\frac{3}{4}$	12 - $\frac{7}{8}$"Φ
PIER	W40	W21x50	12 - $\frac{7}{8}$"Φ	21	4	$\frac{3}{4}$	12 - $\frac{7}{8}$"Φ
PIER	W44	W24x62	12 - $\frac{7}{8}$"Φ	24	4	$\frac{7}{8}$	12 - $\frac{7}{8}$"Φ



Updated on August 18, 2017.

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Rolled Steel Beam Standards - Temporary Bracing (RS40-177)

Temporary bracing systems (TBS) shall be added between permanent diaphragms in order to supplement permanent braces, stabilize beams, and reduce the deck thickness loss during the deck placement. Maximum spacing between adjacent TBS or between TBS and permanent diaphragm is 5 feet. TBS shall consist of a compression strut pipe, a tie bar, and hangers (or clips)…

Above each of abutment, pier, and intermediate diaphragm, a TBS shall be used consisting of a beam tie and hangers (or clips)…

Added on August 18, 2017.

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Rolled Steel Beam Standards - Temporary Bracing/Fatigue

BDM 5.5.2.4.1.15 currently requires that shear connectors be omitted in the region of the girder equal to the depth of the girder each side of the centerline of pier.

If the finishing machine is located directly above the exterior girder then the contractor may want to shoot additional studs on the exterior girder in the negative moment region as support for the screed rail. Checking fatigue at the toe of the weld of the stud in the base metal of the girder would then be required.

Added on August 18, 2017.

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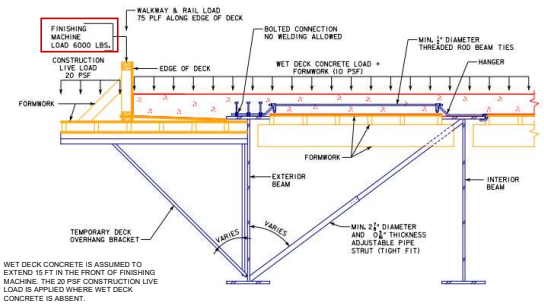
Rolled Steel Beam Standards - Temporary Bracing (RS40-177)



TEMPORARY DECK OVERHANG BRACKET AND BRACING SYSTEM DETAILS BETWEEN DIAPHRAGMS

Added on August 18, 2017.

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Designating Tensile Stress Regions in Steel Beam Plans

Futuristic

AASHTO LRFD 6.6.2.1 Member or Component Designations and Charpy V-Notch Testing Requirements

Primary members or components, or portions thereof, subject to a net tensile strength under Strength Load Combination I shall be designated on the contract plans. Unless otherwise indicated on the contract plans, Charpy V-notch testing shall be required for primary members or components that are subject to a net tensile stress, or for portions thereof located in designated tension zones, under Strength Load Combination I…

Net Tensile Stress – The algebraic sum of two or more stresses in which the total is tension.

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Rolled Steel Beam Standards - Temporary Bracing (RS40-177)

If the finishing machine is located directly above the exterior beam, temporary bracing systems are not required for bridge lengths 180' and greater…

Added on August 18, 2017.

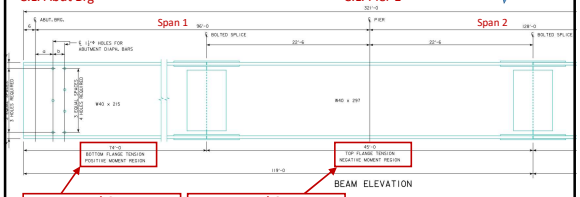
Designating Tensile Stress Regions in Steel Beam Plans

BDM 5.5.2.4.2 In order to promote proper welding and weld inspection for CWPG bridges, the designer shall provide on the "Girder Elevation" detail the location of tension and compression areas for both the top and bottom flanges of the girder. The location of tension and compression flanges along the length of the span is to be based on the dead load inflection points in the member. These locations will normally correspond with the locations of the bolted field splices.

Futuristic

320' RS40 Bridge: 96'-128'-96'

C.L. Abut Brg C.L. Pier 1



74'-0 Bottom Flange Tension Positive Moment Region

45'-0 Top Flange Tension Negative Moment Region

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Strip Seal Expansion Joints

Added July 1, 2018.

BDM 5.8.3.2.2

By default, the bid item estimate reference note for steel extrusions explicitly excludes D.S. Brown from consideration. Including this default language is intended to ensure contractors do not consider D.S. Brown as an approved equal when the designer specifically excludes D.S. Brown from the table of approved expansion devices on OBS SS 1026a1. Designers must remove this portion of the estimate reference note if they include D.S. Brown as an option in the table of approved expansion devices on OBS SS 1026a1.

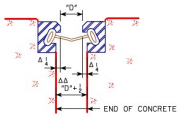
Item Reference Note

2413-1200000 Steel Extrusion Joint with Neoprene

Includes all necessary hardware and accessories including the anchorage system, temporary erection material and the 3/8" barrier plates with their anchorage system. Excludes installation of neoprene gland. Skew or expansion conditions do not allow the use of the DS Brown Joint for this installation.

TABLE OF APPROVED EXPANSION DEVICES		
MANUFACTURER	TYPE OF STEEL EXTRUSION	NEOPRENE GLAND
WATSON-BOWMAN & ACME CORP.	A	SE-300 OR SE-400
APPROVED EQUAL		

MINIMUM OPENING FOR GLAND INSTALLATION = 1½"
MAXIMUM GLAND INSTALLATION TEMPERATURE = 90° F.



EXPANSION OPENING DETAIL

Standard Sheet for Drilled Shafts in Rock Sockets

Futuristic

More than likely notes are simply getting passed from one project to the next so we may as well consider developing a standard sheet.

The note for drilled shaft capacity varies somewhat from plan set to plan set, for example:

- <Nothing included.>
- The total required design bearing for each shaft is 697 tons.
- The total required factored axial resistance for each drilled shaft is 878 tons.
- The drilled shafts are designed to support a maximum factored axial load (Strength 1 combination including impact) of 2238 kips at the bottom of the shaft. The factored bearing resistance is 4038 kips.
- The drilled shafts are designed to support a maximum factored axial load (Strength 1 combination) of 2026 kips including 960 kips of superstructure loads and self-weight and 1066 kips of downdrag.

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Jacking Beams for Bearings

Added July 1, 2018.

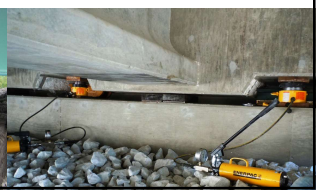
BDM 5.7.5

We want designers to think more about making provisions for jacking bearings for the following two reasons:

- Long term – bearing repair or replacement
- Short term – installation adjustments based on temperature for expansion bearings

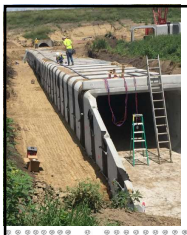
Consider:

- Jacking locations
- Jacking forces (bridge should be closed to traffic)
- Permissible overall and differential raise heights
- Secondary bridge elements affected by jacking (expansion joints, barrier cover plates, conduit, etc.)



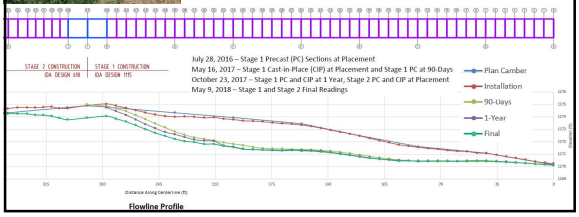
Precast Box Culvert Settlement

Futuristic



Precast box culverts are typically included in projects with 6" or less of settlement. On the recent US20 2-to-4-lane widening project a number of precast boxes were used where settlement exceeded 6".

1115 and 618 Ida (Stages 1 and 2)
12'x8'x487' Precast RCB
Stage 1 Max Fill Height = 37'
Stage 1 Estimated Settlement = 19"
Stage 1 Measured Settlement = 27.5"



Semi-integral Abutment Details

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Common applications for semi-integral abutments:

- bridge length and skew restrictions preclude the use of integral abutments,
- end span limits for steel girders with integral abutments are exceeded,
- shallow bedrock precludes use of steel piling for integral abutments (or may require costly rock coring to make steel piling work with integral abutments),
- drilled shaft foundations at abutments preclude the use of integral abutments,
- wide bridges of 120 feet or more which benefit from the lateral flexibility of expansion bearings on semi-integral abutments,
- ABC, particularly for lateral slides and modular units, and
- high abutments.

Bridge Skew, degrees	Maximum Bridge Length, feet	
	PPCB Bridges	CWPG Bridges
0 to 60	575	400

Possibly come out on October 1, 2018.

CIP Cantilever Retaining Wall Design

BDM 6.7.4.1.1

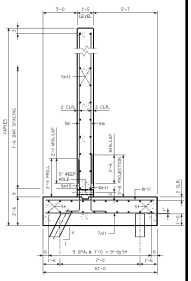
In general, structures that can move away from the retained soil mass will mobilize active earth pressures whereas restrained structures should be designed for at-rest earth pressures. In lieu of determining the required movement at the top of a wall to reach the minimum active earth pressure, designers shall conservatively assume at-rest conditions apply. Walls which deflect horizontally into the retained soil should be designed to resist passive earth pressure.

AASHTO LRFD C3.11.1

Walls that can tolerate little or no movement should be designed for at-rest earth pressure. Walls which can move away from the soil mass should be designed for pressures between active and at-rest conditions.

AASHTO LRFD C3.11.5.2

For typical cantilevered walls over 5.0 ft high with structural grade backfill, calculations indicate that the horizontal movement of the top of the wall due to a combination of structural deformation of the stem and rotation of the foundation is sufficient to develop active conditions.



Added July 1, 2018.

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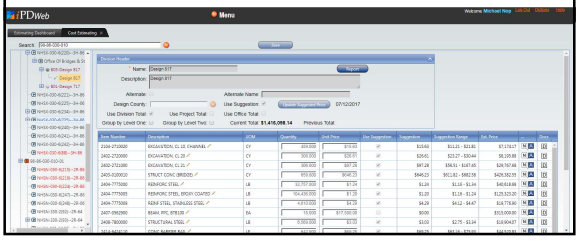
iPDWeb Cost Estimating

iPDWeb Instructions for OBS are available at the following web address:

https://iowadot.gov/bridge/automation-tools/final-design-software#446761470-miscellaneous-programs

A more comprehensive document will likely come out in a few months. This document will primarily address workflow issues including history of estimates in the life of a project, when are estimates required, how to submit an estimate, who reviews and approves estimates, folder structures and naming conventions, good practices, examples, etc.



Questions or Comments?

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Software Design Applications

Applications are being updated for the 2017 8th edition of the AASHTO LRFD Specifications as time permits. Some new applications have also been posted.
https://iowadot.gov/bridge/automation-tools/final-design-software

- CIP REINFORCED CONCRETE BOX CULVERT PROGRAM
- STEEL GIRDER DESIGN MATHCAD® SHEETS
- T-PIER EXAMPLE USING RC-PIER®
- FRAME PIER EXAMPLE USING RC-PIER®
- SUPERSTRUCTURE APPLICATIONS
- SUBSTRUCTURE APPLICATIONS
- MISCELLANEOUS PROGRAMS

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Wrapping Up

BDM Policies and Software Applications

- Please report errors, omissions and unclear policies.
- Feel free to suggest changes and improvements.
- Contact me at Michael.Nop@iowadot.us or call 515-233-7935.

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