2010 FDOT/FTBA CONSTRUCTION CONFERENCE

Critical Structures Construction Issues

FLORIDA DEPARTMENT OF TRANSPORTATION
STATE CONSTRUCTION OFFICE

Specification 1-3: Definitions

- Contractor's Engineer of Record
- Specialty Engineer

CLASS OF CONTRACTOR'S ENGINEER VERSUS WORK TYPE

Work Type	Contractor's Engineer of Record	Pre-approved Specialty Engineer	Specialty Engineer
Re-design	Yes	No	No
VECP	Yes	No	No
Details of the permanent work not fully detailed in the plans (Example: Pot Bearing Design, non-standard expansion joints, MSE walls, other specialty items)	Yes	Yes	Yes
Design and details of the permanent work declared to be minor or non-structural including minor repairs	Yes	Yes	Yes
Design and details of the permanent work declared to be major or structural including major repairs	Yes	Yes *	No
Design and drawings of temporary works such as falsework, formwork, etc.	Yes	Yes	Yes

* The work must also be checked by another pre-qualified Specialty Engineer

Specification 5-1.4.5.4: Temporary Works

- This article was revised and now requires Contractors to submit shop drawings for temporary works that affect public safety to the EOR for review
- Public safety is affected when bridge construction impacts active roadways, pedestrian ways, railroads, navigable waterways, etc.
- A typical example of temporary works is the stabilization bracing for beams being erected over an active roadway

Specification 5-1.4.5.6: Beam and Girder Temporary Bracing

- This new article reminds Contractors that beam stability is critical on all projects and that it is their sole responsibility to see that beams are stabilized for wind, weight of forms, and other loads
- When public safety is affected, the Contractor must submit signed and sealed stability calculations for review of the Engineer
- The stability system design must comply with the AASHTO Guide Design Specifications for Bridge Temporary Works and the Construction handbook for Bridge Temporary Works

Specification 5-1.4.5.7: Erection Plan

- This new article requires Contractors to submit an erection plan for review of the Engineer on all projects
- Plans must be in accordance with specifications 450 (Precast Prestressed Concrete), 452 (Precast Segmental Construction), and 460 (Structural Steel)
- Erections plans are part of the shop drawing review process and as such must comply with the requirements of Spec. Section 5

Specification 5-1.5.4: Erection

- This new article requires Contractors to submit an erection plan that is signed and sealed by a Specialty Engineer on projects affecting public safety
- The Specialty Engineer is now required to personally inspect the erection system prior to loading and certify that it complies with the plan
- The Contractor must perform daily inspections of certain elements of the erection system and report findings to the Engineer

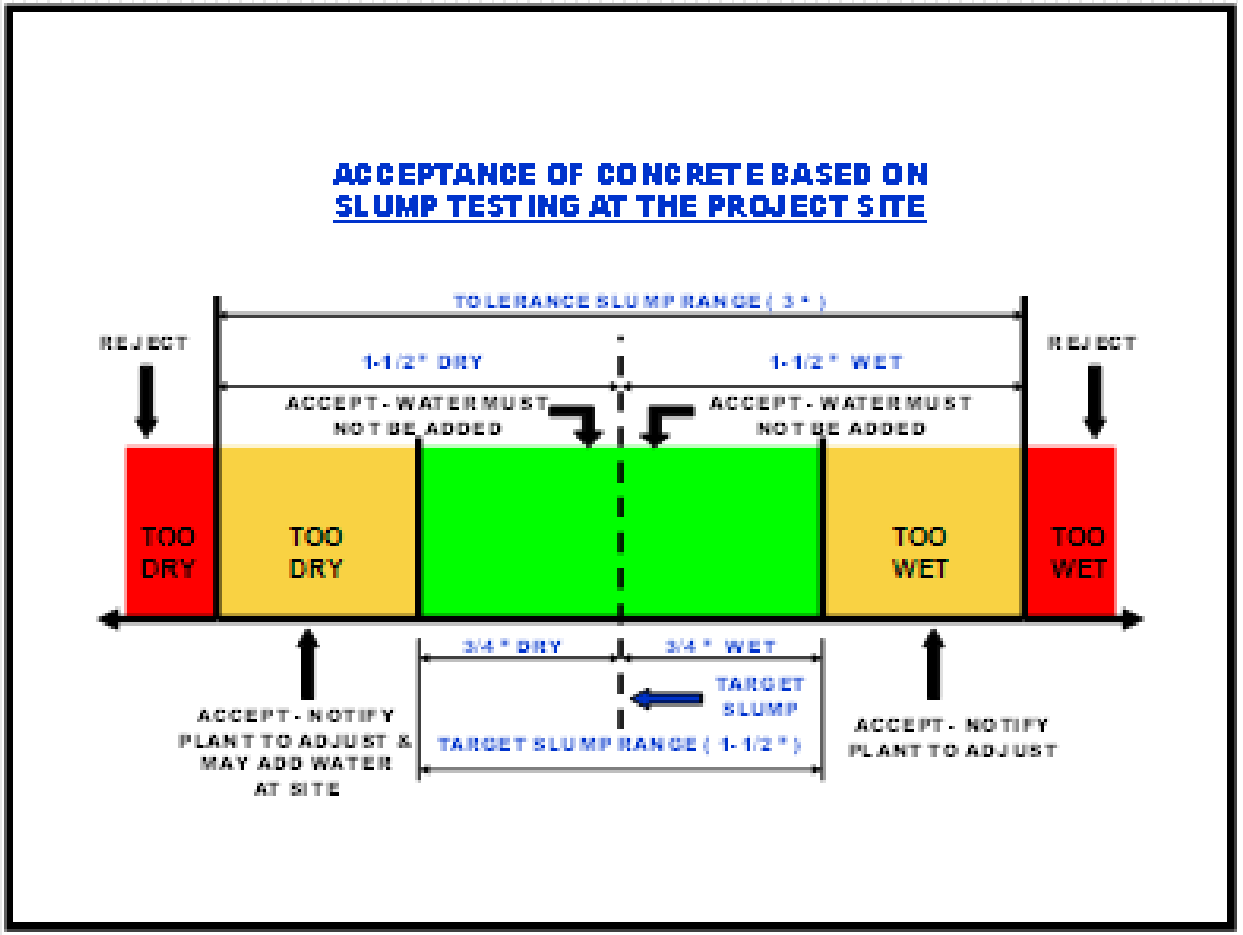
Specification 105−8.8: Supervisory Personnel

- For post-tensioned and movable bridges, Contractor supervisors must meet the experience requirements specified and be approved by the Engineer
- If approved individuals leave the project, they must be replaced with equally qualified personnel within a specified period of time
- Post-tensioning and grouting must be supervised by a Level II CTQP Qualified Technician and the crew must consist of two CTQP qualified technicians one of which may be the supervisor

Specification 346−3.3 Mass Concrete

- Mass concrete Specialty Engineer or employee must personally inspect the installation of the monitoring system and temperature control provisions
- The differential temperature must not exceed 35°F and the maximum concrete temperature must not exceed 180°F
- Monitoring must not stop until the differential temperature is consistently decreasing and the maximum temperature is also consistently decreasing
- If either temperature limit is exceeded, the Specialty Engineer must be consulted for the actions needed to reduce temperatures

Specification 346-7.7: Adding Water to Concrete at the Placement Site



Staying Aware of Concrete Consistency for Loads that are not Sampled for Acceptance

- It is possible for as many as 18 loads of concrete to be delivered between acceptance samples which means that the consistency of the concrete can change dramatically between tests
- A QC Technician should observe the consistency of the concrete for every load as discharge begins in order to visually confirm that the consistency still appears to be acceptable
- Perform a slump test for loads that appear to be too wet or too dry and stop concrete placement during the testing

Where to Take Concrete Samples When Using a Pump or Bucket

- **PUMP: Initial and acceptance samples must be taken at the discharge end of the pump hose**
- **BUCKET: Acceptance samples must be taken at the discharge end of the bucket unless the entire load can be discharged into the bucket within 25% of the total allowed transit time (typically 22.5 minutes)**
- **Transit time starts when water is added at the plant and ends when the entire load has been discharged into the member**
- **Samples may be taken from the back of the truck if the Contractor performs correlation testing that establishes how much the slump changes as a result of pump or bucket use and this process must be approved by the Engineer**

Specification 400−5.7: Stay-In-Place Metal Forms

There are now be 4 types of SIP form systems:

(1) Galvanized without polymer coating

(2) Galvanized with polymer coating on the form top only

(3) Galvanized with polymer coating on the form bottom only

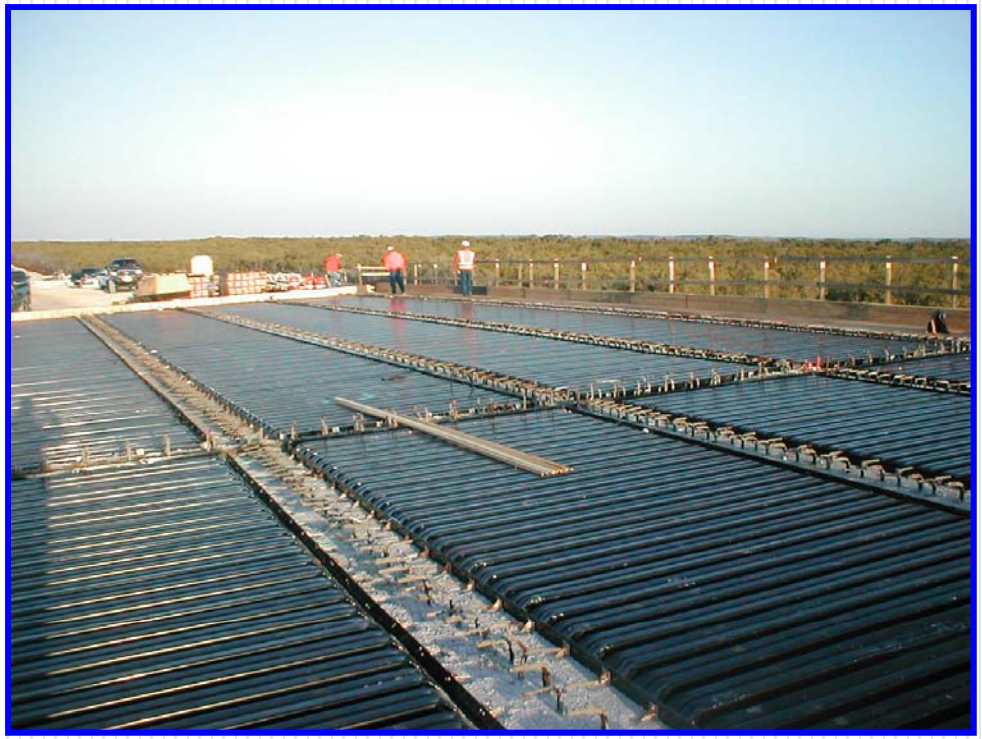
(4) Galvanized with polymer coating on both sides of the form

Type 1

Galvanized metal forms currently being used only in slightly aggressive environments without Styrofoam in flutes and which can be assembled by welding the support angles to the beam clips

Type 2

Same as Type 1 but with a polymer laminated coating on the top surface that protects the panels and other components from corrosion due to water accumulation in flutes when Styrofoam is used as a replacement for concrete in a slightly aggressive environment



Type 3

Same as Type 1 but with a polymer laminated coating on the bottom surface that protects the panels and other components from corrosion for use in moderately and extremely aggressive environments and without use of Styrofoam in the flutes

Coated Form Bottom

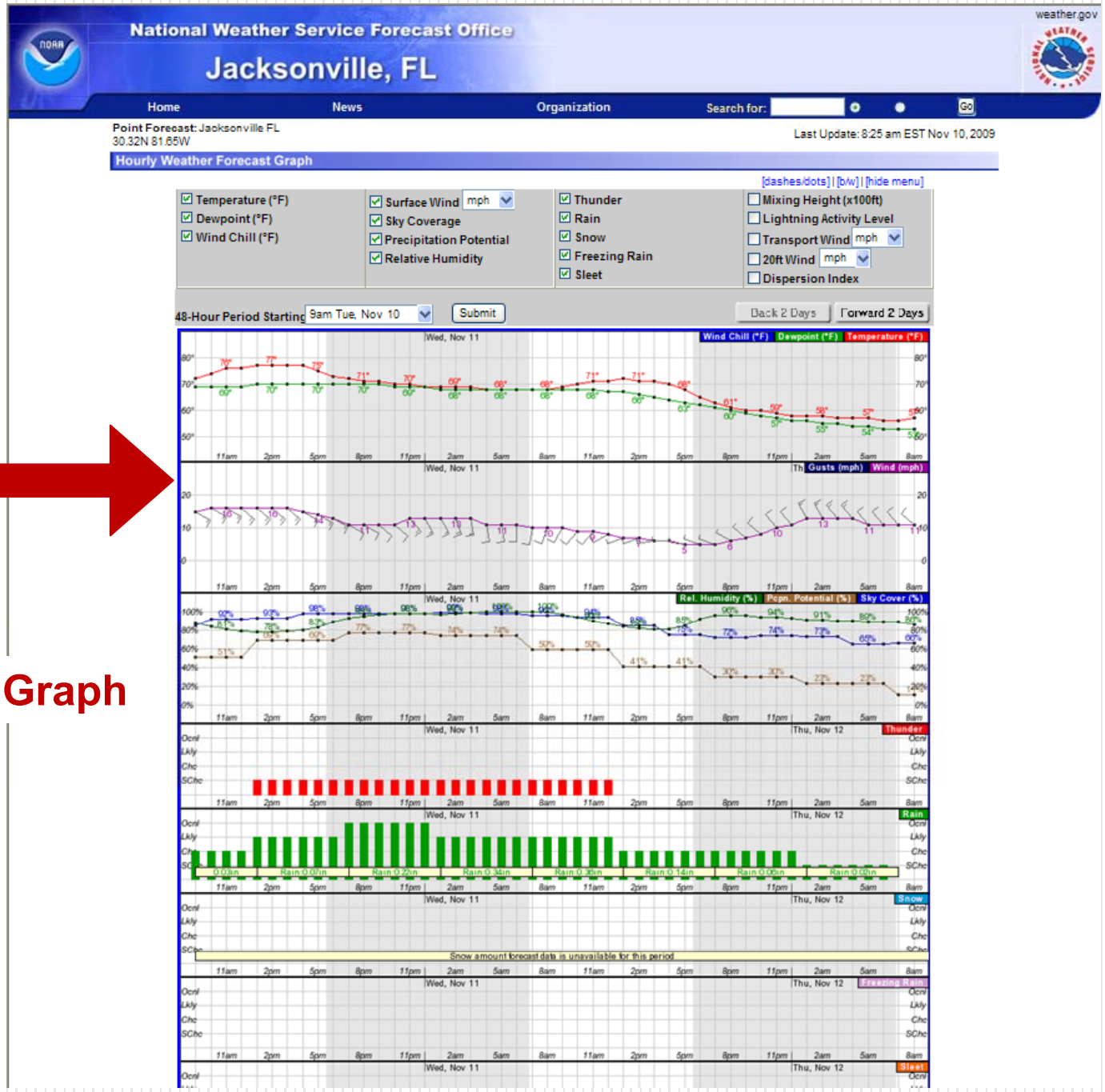
Type 4

Same as Type 3 but with a polymer laminated coating on the top surface that allows Styrofoam to be used as a replacement for concrete in form flutes

Specification 400−7.1.3: Wind Velocity Restrictions

- If average wind velocity during planned hours of concrete placement exceeds 15 mph, deck concrete may not be placed
- The Contractor must consult the National Weather Service (NWS) website for the city nearest to the project for weather forecasts
- The NWS website is: http://www.nws.noaa.gov
- If the wind forecast is for velocities in excess of 15 mph, a weather day may be granted if the deck placement operation is on the critical path and subject to approval by the Engineer

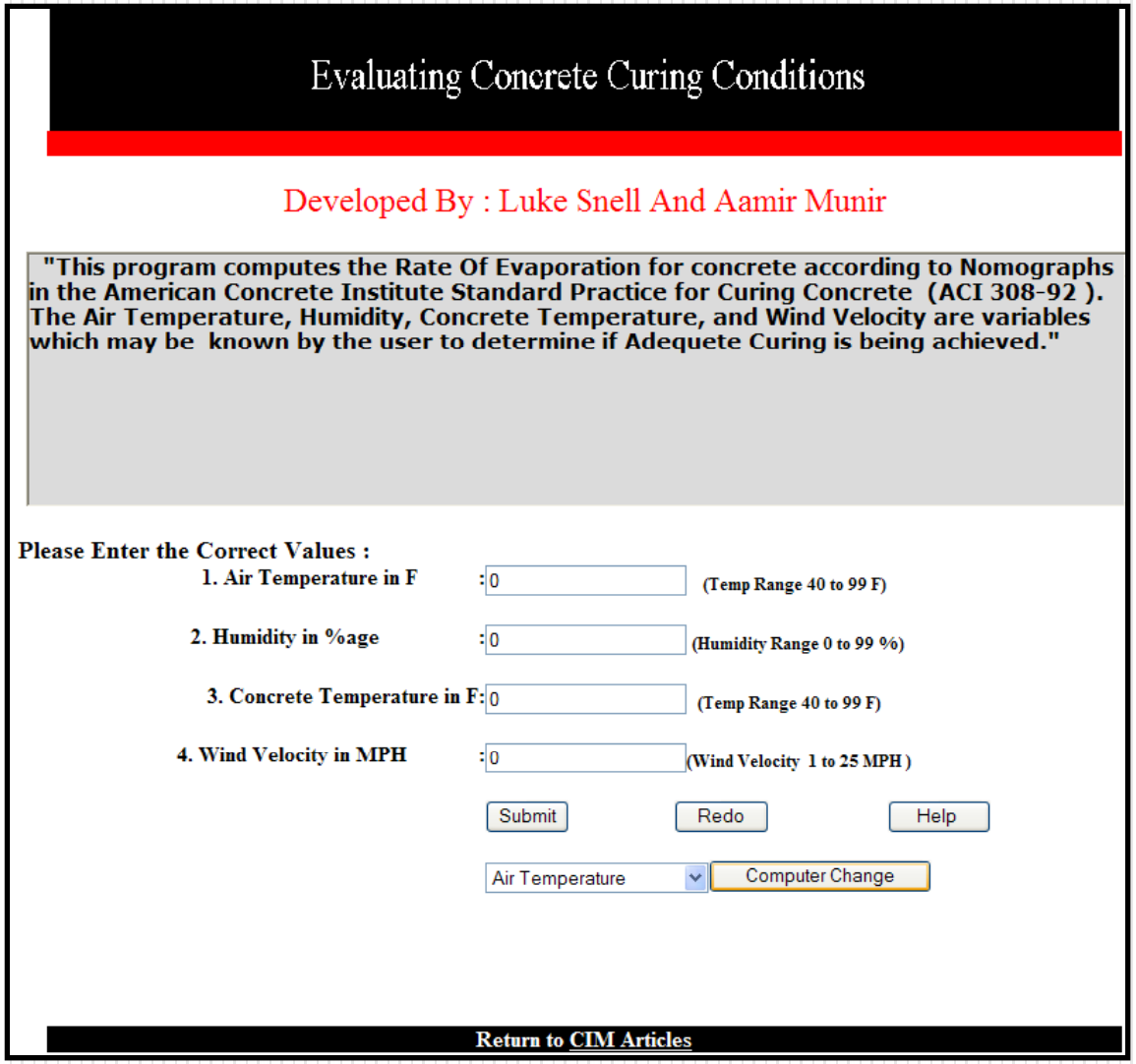
Hourly Weather Graph



Specification 400−16.1: Moisture Evaporation Monitoring and Control

- The Contractor must monitor the moisture evaporation rate of bridge decks and other components during concrete placement
- The evaporation rate can be determined by use of an ACI nomograph, by using a free internet based calculator, or by using an electronic device that automatically determines the rate
- If the rate exceeds 0.1 lbs/ft^2/hr, the Contractor must employ measures to prevent moisture loss which include application of evaporation retarder, a fogging machine, etc.

http://construction.asu.edu/cim/cimasu1/curing/curingfirstpage.htm



- **The table below shows that when the weather is dry and windy, evaporation rates will be high and this type weather happens most often in the non-summer months**
- **Summer nights have ideal weather conditions for concrete placement: mild air temp, high humidity and low wind velocities**
- **Other night placement advantages include: fewer traffic delays for concrete trucks, a dedicated concrete plant and easier working conditions for crew members**

Sample Weather Data for Various Florida Seasons with Corresponding Evaporation Rates					
Typical Florida Season	Ambient Air Temperature (°F)	Relative Humidity (%)	Concrete Temperature (°F)	Wind Velocity (mph)	Evaporation Rate (lbs/ft²/hr)
Windy Winter Day	65	25	80	15	0.34
Summer Day	90	65	95	10	0.19
Summer Night	72	90	85	5	0.08

Specification 400−16.4: Curing Bridge Decks with Membrane Curing Compound

- The application of curing compound is the single most important curing provision for decks
- The application rate is 1 gal / 150 ft^2 and the Contractor is required by specification to report on how the rate will be measured
- The compound must be applied within 120 minutes unless the Engineer authorizes an extension
- The application of compound to a surface that may be too wet affords far more protection then applying the compound to a surface that has become too dry which means it is too late to have maximum benefit

Specification 400−16.6: Curing Traffic Barrier Concrete

- Since application of compound is the only curing provision, the proper application rate and time to application are critical especially since the concrete has almost no bleed for keeping the surface moist
- The application rate is 1 gal / 150 ft^2 and the Contractor is required by specification to report on how the rate will be measured
- Compound application must begin within 30 minutes of concrete extrusion
- Special Class 5 coating may be used in lieu of curing compound but if used, curing compound must be immediately available as a backup

Specification 400−21: Disposition of Cracked Concrete

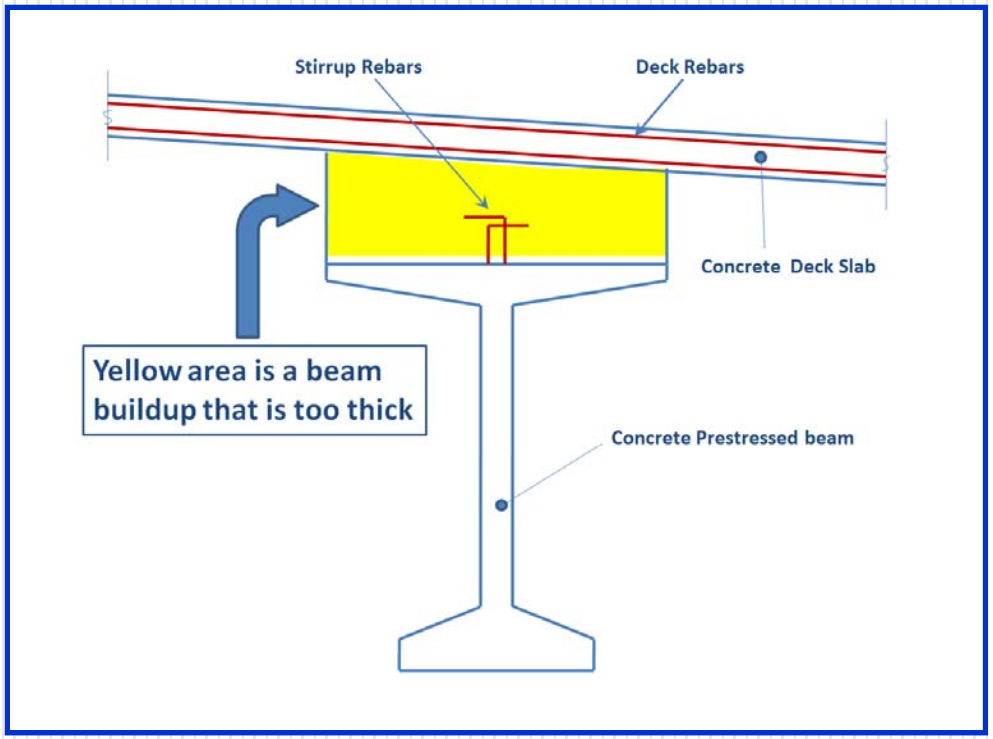
- A major change was made in 2007 and the severity of cracking is now taken into consideration for the correction of nonstructural cracks
- As the number of cracks within a specified area of concrete increases, the degree of repair effort increases and in some cases the crack severity may be high enough to warrant removal and replacement of the component
- This specification applies to all structural concrete, but for precast components, only after they are placed in their permanent position

Specification 450−16.2: Storage of Prestressed Beams – Measuring Camber

- Contractor is required to measure sweep and camber each month while the beam is in storage at the prestressed plant and this will actually be done by the beam producer
- Records of the sweep and camber measurements must be kept on file and made available to the Engineer if requested
- It is important for the Contractor to be aware of the camber values as they relate to the camber shown in the plans since if they differ beyond a certain value then adjustments will be required in the field

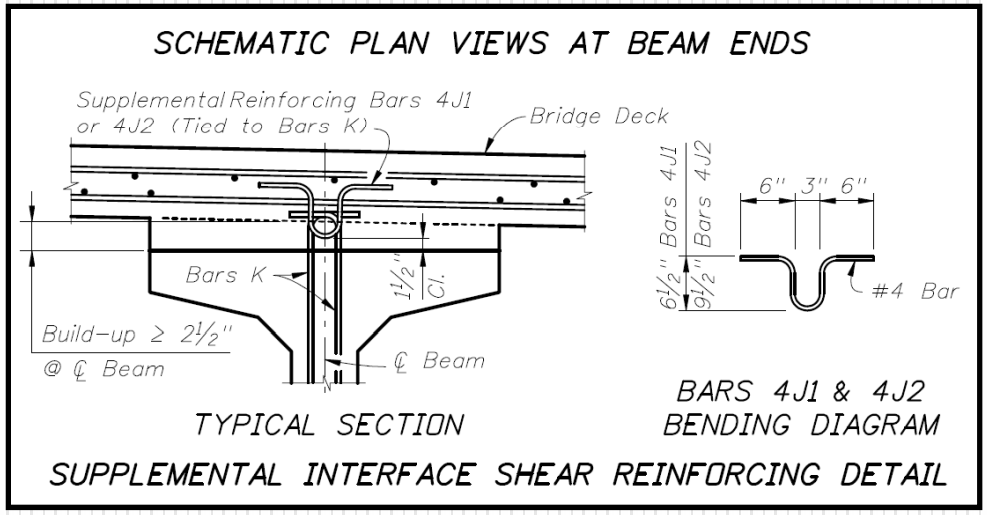
The Importance of Monitoring Camber

- Excessively thick buildups occur when the estimated camber is much larger than the actual
- Stirrup rebars do not extend into the slab
- The level of design stress transfer from beam to slab may be compromised and lateral impact resistance is reduced



The result of lateral impact to a beam that did not have stirrups extending from the beam into the deck

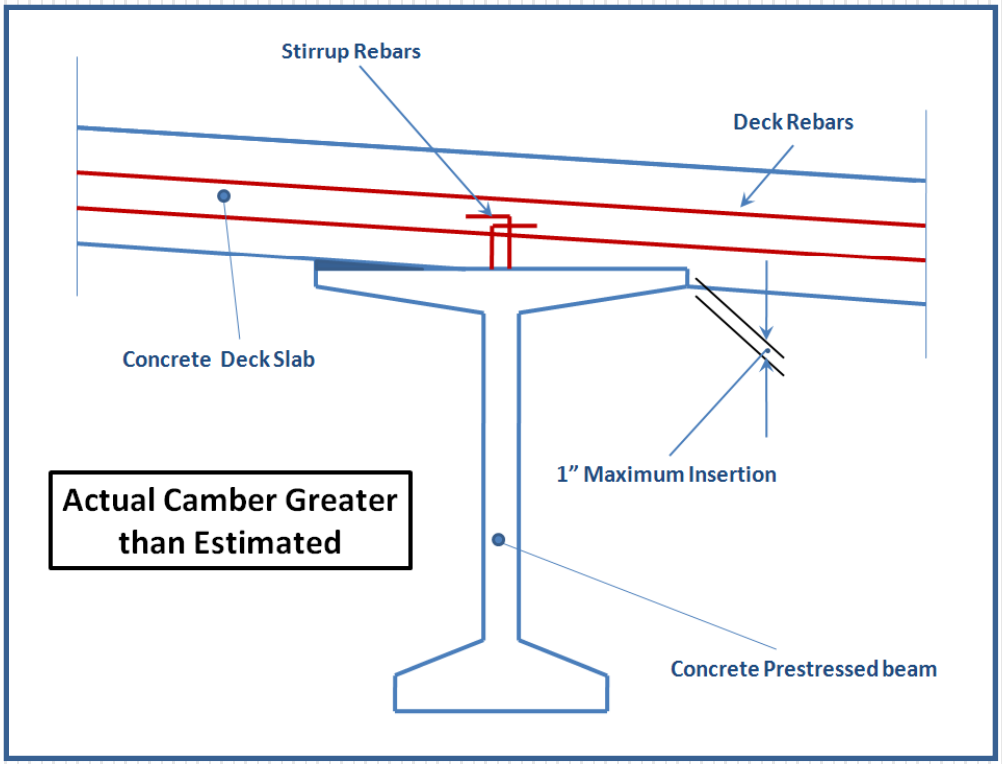
The Importance of Monitoring Camber



- When stirrup extension is unacceptable the legs can be bent up or U-bars can be added
- Either solution must have prior approval of the EOR

The Importance of Monitoring Camber

- Actual camber greater than estimated camber
- Beam must be cast within the deck which reduces the deck thickness over the beam
- Insertion must not exceed 1” because, if more, large aggregate in the concrete will not fit between the top of the beam and the bottom mat of rebars



Specification 460−7.5: Preparation of Bearing Areas and Setting of Beams

- Centerline of bearing tolerances are 1/16” transversely and 1/4” longitudinally which requires precision when setting beams
- In recent years there have been major problems with precision when setting bearings of curved multi-span steel beam superstructures that use pot bearings
- It is critical for Contractors to know the spacing geometry between the bearing centerlines of beams before they leave the fabrication plant so that these can be compared to the corresponding pot bearing centerlines in the field prior to placement of beams
- If these dimensions do not coincide closely once the beams are placed then adjustments will be needed which requires major effort and often results in less than desirable final beam positioning or damage thus causing reduced long term beam performance and durability

Specification 460−7.5: Preparation of Bearing Areas and Setting of Beams

- When bearings are out of tolerance and/or there are misalignments after beams are in place, the Engineer must be approve corrective actions prior to their implementation
- If misalignments are extreme the EOR may have to be consulted as well
- If anchor bolts are misaligned to a degree that existing blockouts need to be modified or repositioned then the Engineer must approve these adjustments prior to their implementation
- Elastomeric bearing pads that are overextended, as determined by the EOR, must be relieved

Specification 649-5: Mast Arm Installation - Bolting

- The specification was recently changed from the rigorous bolt tightening procedure used for steel beam connections to a procedure that is more structurally appropriate for mast arms
- Now mast arm bolts are brought to a snug tight condition and then the turn-of-nut procedure is used for final tightening: a Skidmore is no longer required
- The sign structure tightening procedure is the same except that a specified torque value is required for final tightening instead of turn-of-nut
- During tightening, clamping forces must be balanced and after tightening the surfaces of the plates must be in full contact: small gaps may be allowed with approval of the Engineer and these must be sealed

Specification 649-5: Bolting of Pole Base Plates

- The Standoff Height is the distance from the top of shaft to the bottom of leveling nut
- 1 bolt diameter is the maximum dimension allowed
- A recent spec revision makes the anchor bolt tightening procedure clearer and includes turn-of-nut

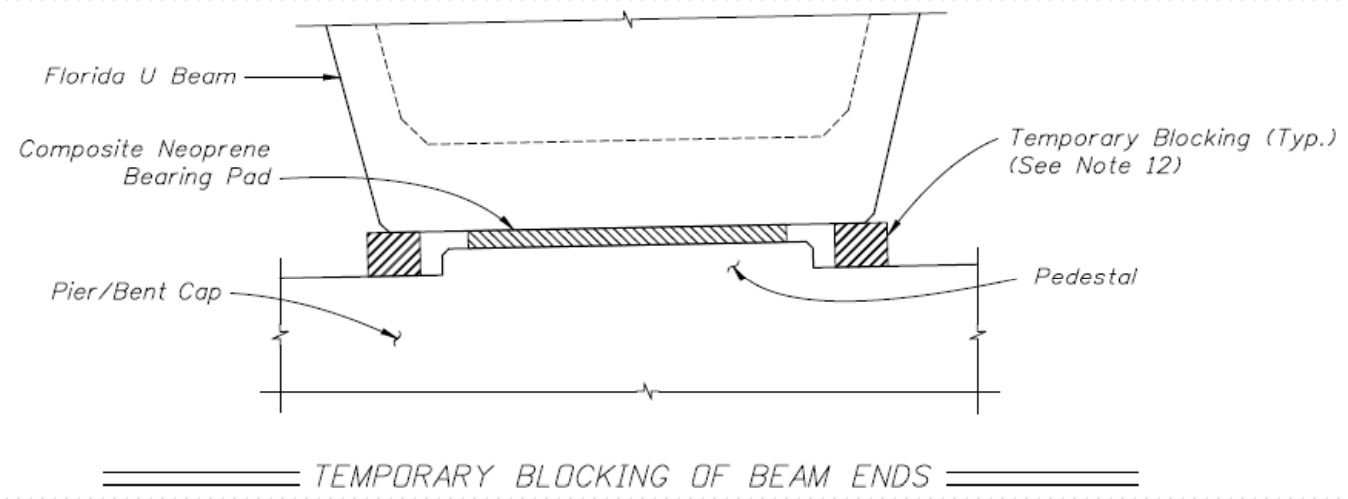
Specification 649-6: Screen Installation at Pole Bases

- Screens are now required and grout is not permitted unless called for in the plans
- The change was needed because grout had unacceptable performance and durability problems

Fascia Beam Rotation Issues

- Wide fascia beam overhangs can generate high transverse rotation forces in the fascia beam
- In order to counteract these forces the beam must be properly secured against rotation
- This can be provided with bracing between beams and in the case of FUBs, temporary blocking between beam and cap

Fascia Beam Rotation Issues



Note 12: Prior to deck placement, based on the deck forming system and deck placement sequence, evaluate and provide, if necessary, temporary bracing between the U Beams. Also, prior to deck placement, provide temporary blocking under each web at both ends of every beam. Ensure the temporary blocking is adequate to resist movements and rotations that occur during placement of the deck. Leave temporary blocking and bracing in place for a minimum of four days after the deck placement.

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