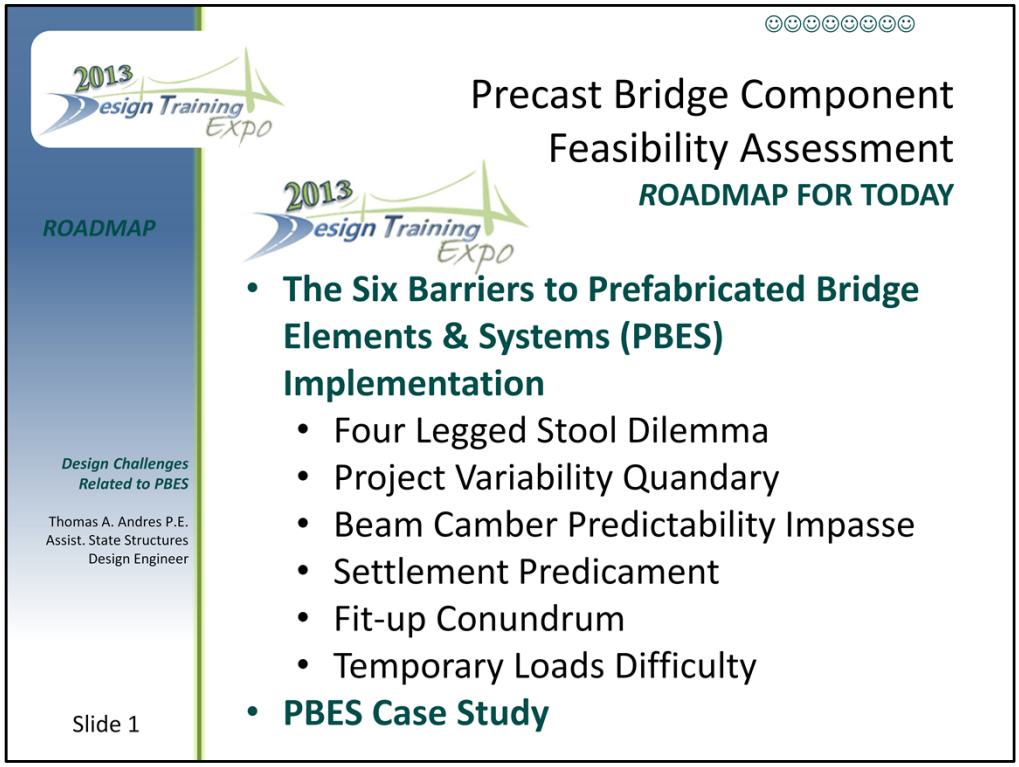


Good afternoon. Let's go ahead and get started. We have a lot of information to cover in this session. It is a pleasure to be with you today. My name is Tom Andres. I work in the Structures Design Office in Tallahassee where I oversee the Bridge Plans Review Group.

The title of this training session is: "Precast Bridge Component Feasibility Assessment ". Utilizing Prefabricated Bridge Elements & Systems or "PBES" is an important aspect for accelerating bridge projects. The purpose of this talk is cover some of the unique features of PBES in order to ensure successful project implementation.

Our roadmap for today is as follows:

-☺-First we are going to talk about the six barriers to PBES implementation. These are:

-☺-Barrier #1: The Four Legged Stool Dilemma

-☺-Barrier #2: The Project Variability Quandary

-☺-Barrier #3: The Beam Camber Predictability Impasse

-☺-Barrier #4: The Settlement Predicament

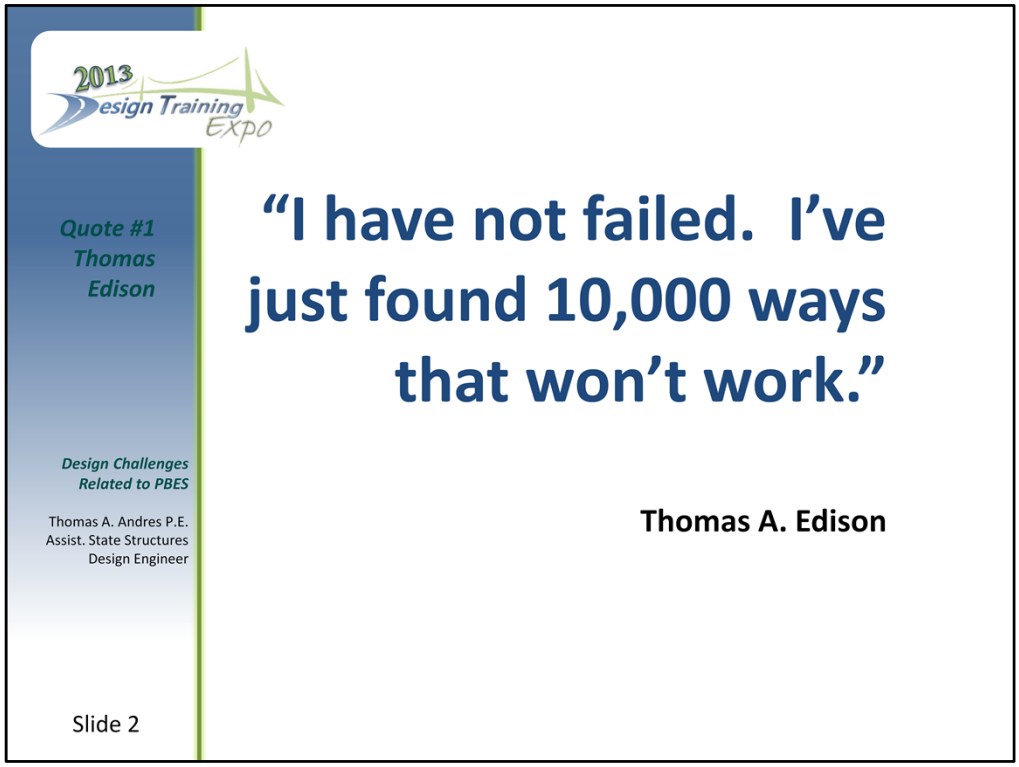
-☺-Barrier #5: The Fit-up Conundrum

-☺-And lastly, Barrier #6: The Temporary Load Difficulty

For each of these barriers, I plan to give you an overview of the challenge and

then offer some strategies for overcoming the particular obstacle.

-☺-Then together we will discuss a project example that poses several PBES challenges to successful implementation.



Before I get started, let me repeat a famous quote from a "ultra determined", master tinkerer, and inventor which changed our world.

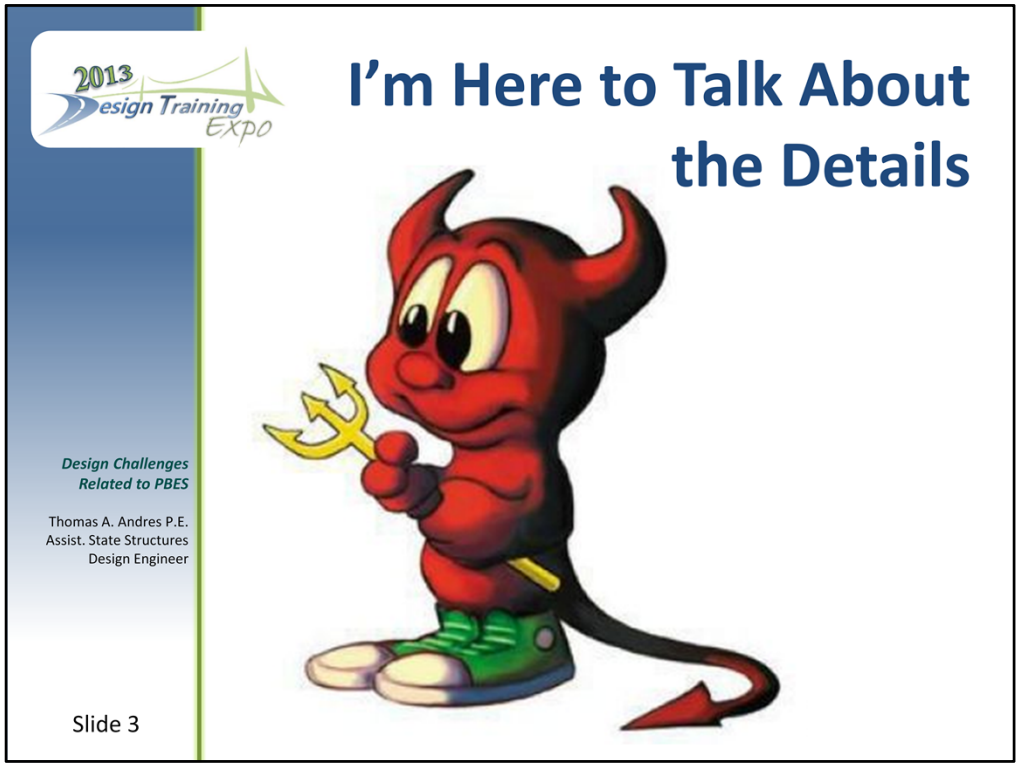
Thomas Edison was famous for saying "I have not failed, I've just found 10,000 ways that won't work."

Edison had another famous quote that said that "genius" was 1 percent inspiration and 99 % perspiration.

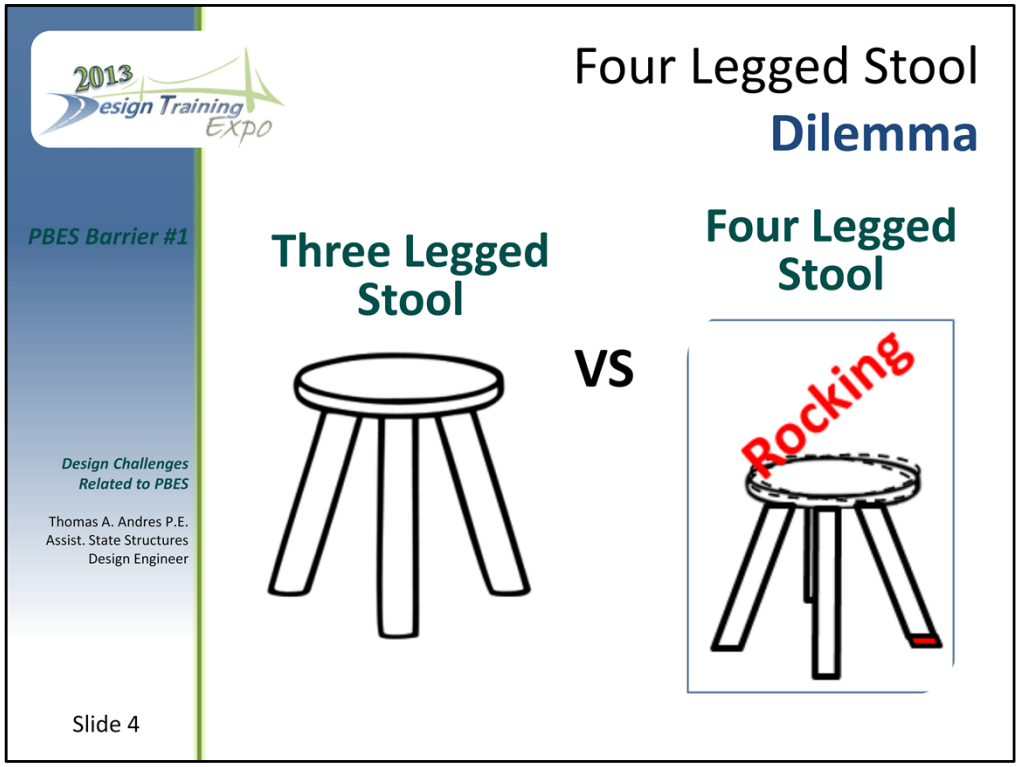
These quotes, I think, says a lot about the man that not only invented a practical filament for the light bulb – lighting up a single lab room, he also developed a patent on one of the first electrical distribution systems which allowed for full implemention of his original invention, the light bulb – which ultimately lit up the world.

Today's talk will mainly focus on implementation strategies for PBES by "learning from the past" in order to take PBES technologies out of the lab into the wider world.

This talk begins by focusing on the barriers to PBES implementation, and then concentrates on ways to overcome these barriers.



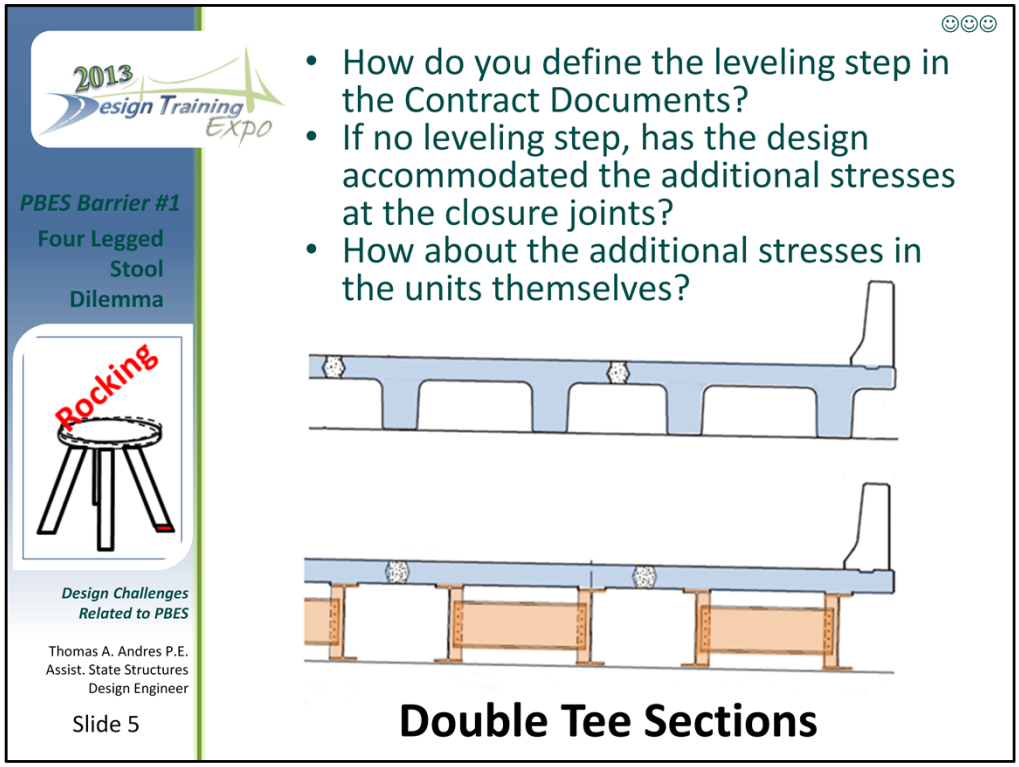
Also when it comes to successfully implementation of Prefabricated Bridge Elements & Systems or "PBES", the devil is in the details. Hopefully today's discussion will help you think about some of detailing issues that will ensure a successful project.



So let's go ahead and get started. The first Barrier to PBES Implementation: The Four Legged Stool Dilemma.

This issue comes up a lot when discussing PBES implementation strategies.

Of course, a three legged stool is perfectly stable. A stool with more than three legs is prone to rocking.



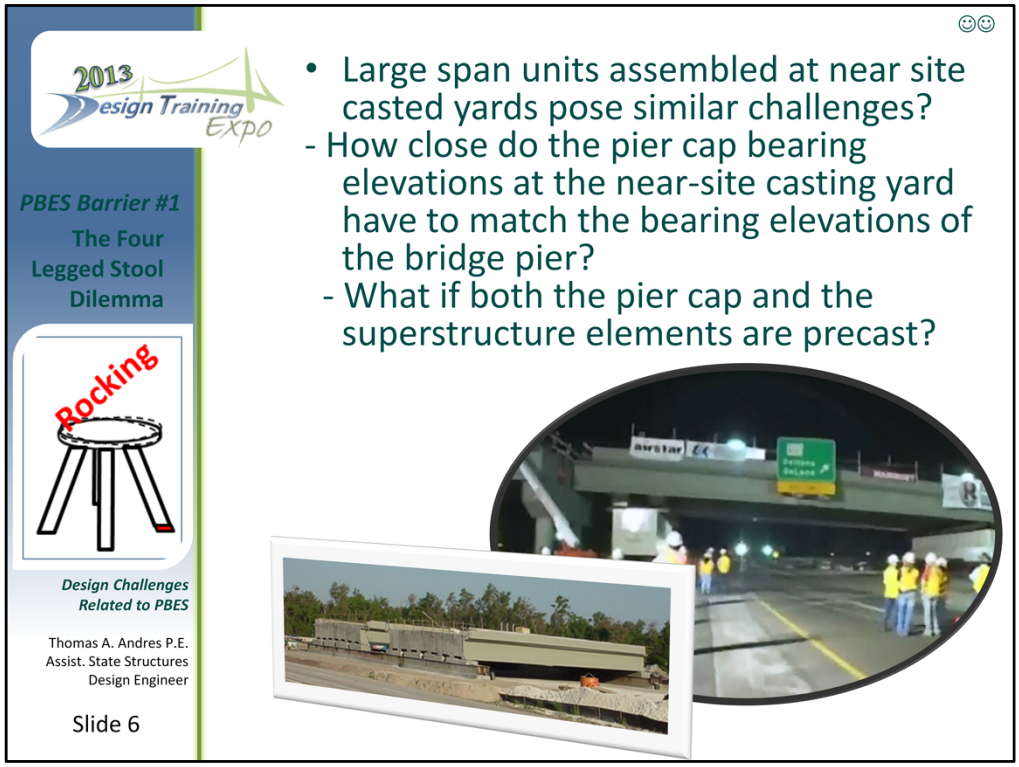
Many PBES components have inherent "four legged stool" challenges. Certainly double-tees – are one example. Here you can see a stiff, concrete pretensioned double tee on the top and a less-stiff, rolled steel girder double-tee section on the bottom. Certainly both systems are prone to rocking if there is no leveling step. Albeit the steel option may be less prone to rocking and more prone to slab cracking due to any non-uniform bearing than the stiffer concrete option.

So a few quick questions come to mind when you have PBES systems with four or more bearing points:

-☺-How do you define the leveling step?

-☺- If no leveling step, has the design accommodated the additional stresses in the closure pour?

-☺- How about the additional stresses in the units themselves?



Other structure types that are prone to rocking include full or partial spans that are cast at near-site casting yards and then rolled into place using Self-propelled-modular-transporters.

The two photos here show the near-site casting yard and span move on the Graves Avenue Project at I-4 near Orlando.

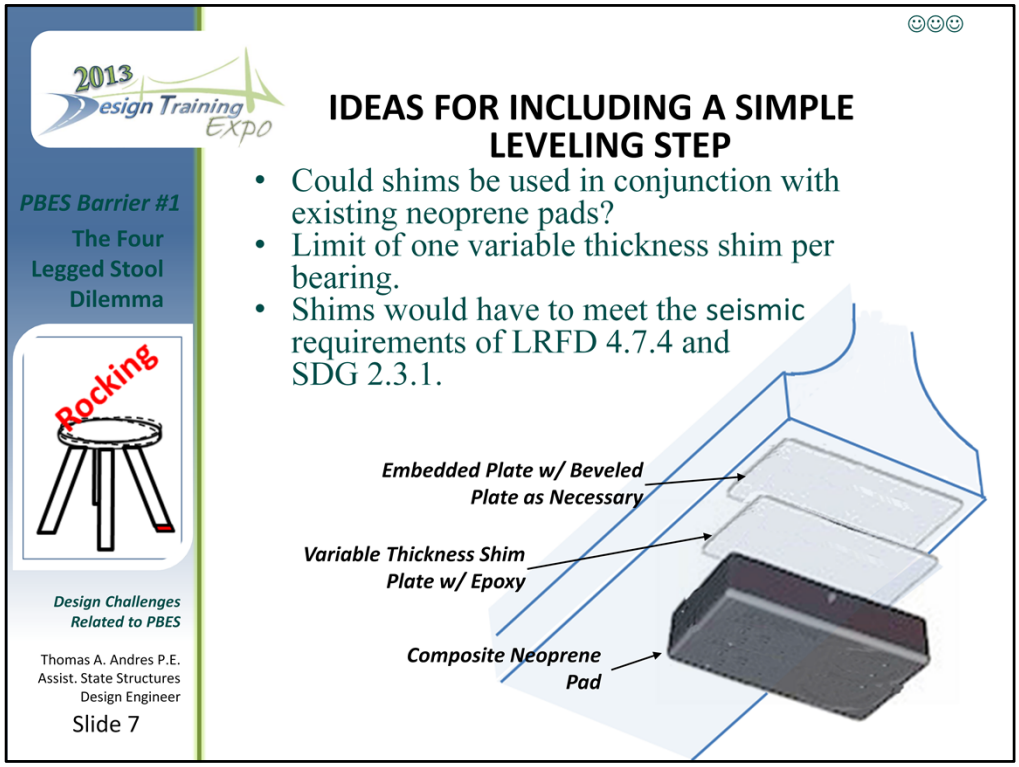
A few questions come to mind:

-☺-How close do the pier cap bearing elevations at the near-site casting yard have to match the bearing elevations of the bridge pier?

How are the elevations in the near site casting yard controlled against potential settlement of the shallow shoring system? More on that issue later.

-☺- If the production pier cap is also precast, the challenges related to leveling of the span are slightly different. Again not only is the relative differences between bearing elevations important, but also how parallel adjacent supports are to prevent warping of the span.

I would argue that in spite of your best intentions to match the relative bearing heights - that including a leveling step is a much more practical way of solving the “four legged stool dilemma”.



So let's think about a possible leveling step to prevent rocking of the precast elements.

-☺- -☺- What about allowing a single shimming element to be stacked between the composite pad and an embedded plate.

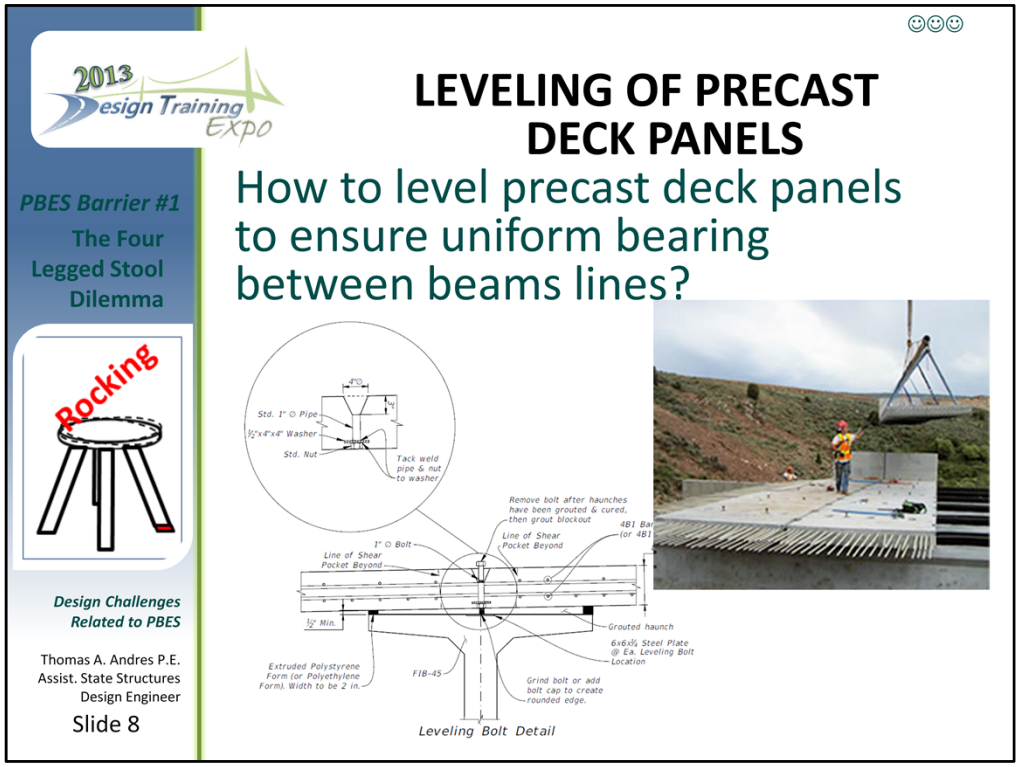
-☺- An epoxy adhesive may be necessary to ensure that all seismic requirements are met.

The leveling step may include requiring the Contractor to have various thickness shims on hand then using feeler gauges during the precast component placement stage to determine shim thickness and placement requirements. Then after the shims, epoxy adhesive and precast element are in place, attempt to rock the element with the crane and check again with feeler gauges to ensure uniform bearing.

The question I leave you with is whether this level step still requires some overdesign of the bearings and beam elements to compensate for non-uniform bearing?

Let me just say this. If a design-build firm were to propose this detailed

leveling step, we would probably be okay with no –over-design provisions, but if there were NOT a leveling step, we would have big issues.



-☺- -☺- Before we leave this topic, let's consider the potential dilemma involved in ensuring uniform bearing for the case of full depth deck panels being placed onto beams. Of course once you have grouted the beam build-ups you have locked-in the beam stresses.

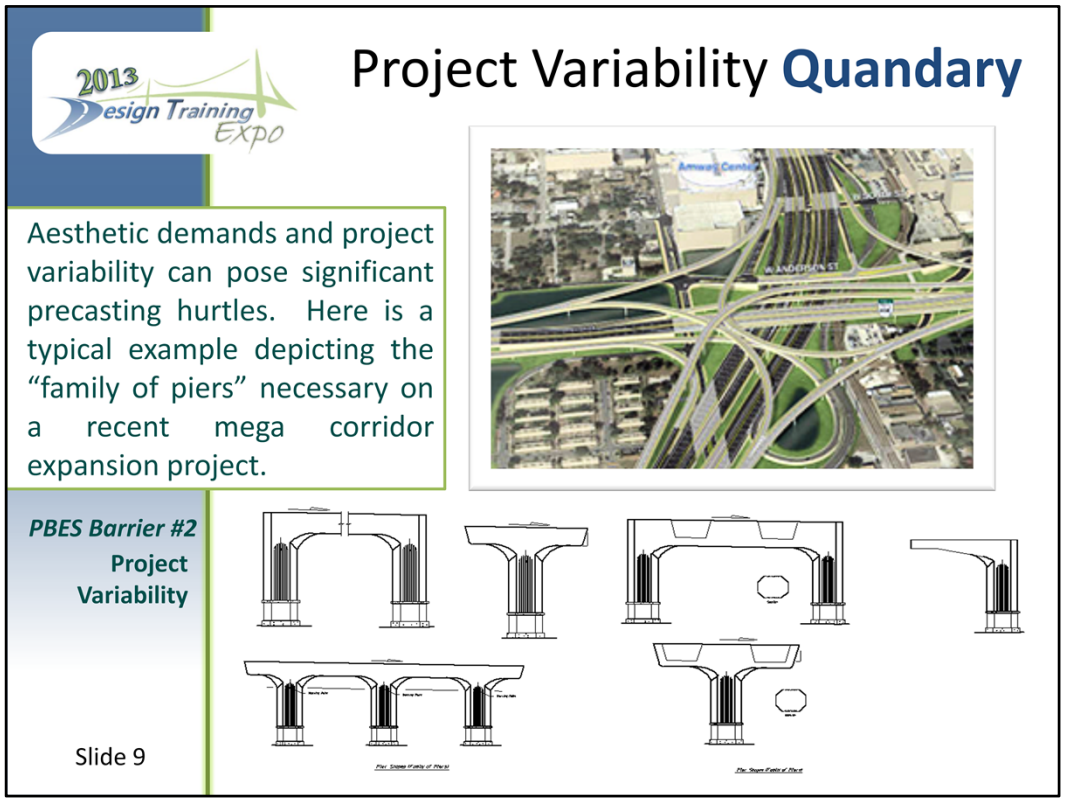
Based on details from other states that have utilized continuous deck panels placed on top of multiple beam lines, typically the leveling process works like this: all the leveling bolts are required to be well lubricated and able to be turned by hand - and then are required to be torqued the same across each panel +/- 20%.

The reason is that by torqing each leveling bolt within 20% of each other ensures that each beam is picking up an equal share of the precast deck panel load.

I should note that we have tested this leveling process as part of a recent mock-up in our lab there in Tallahassee and as you might suspect, achieving equal torque is very difficult because as you adjust one bolt, you affect all of the adjacent ones – so you tend to either have a fully loaded bolt or a fully unloaded bolt.

The main point here is that the design assumptions have to be consistent with what is actually achievable in the field – and I think we still lack the

project experience with this bridge type necessary to answer this fundamental question.

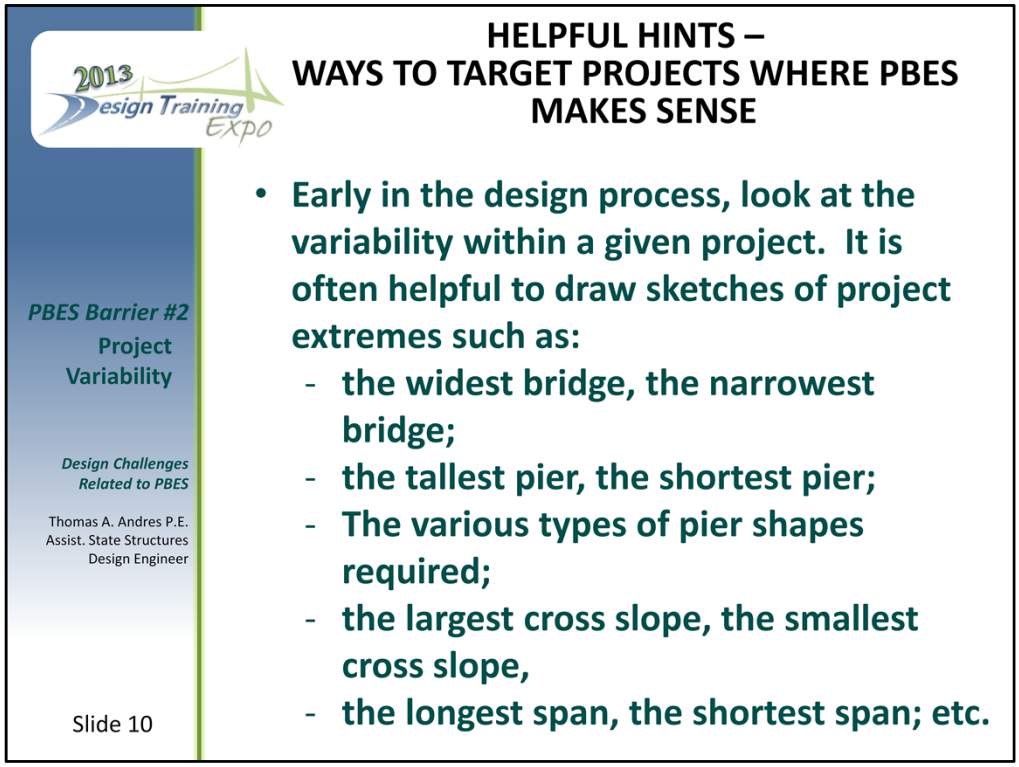


Okay switching gears.

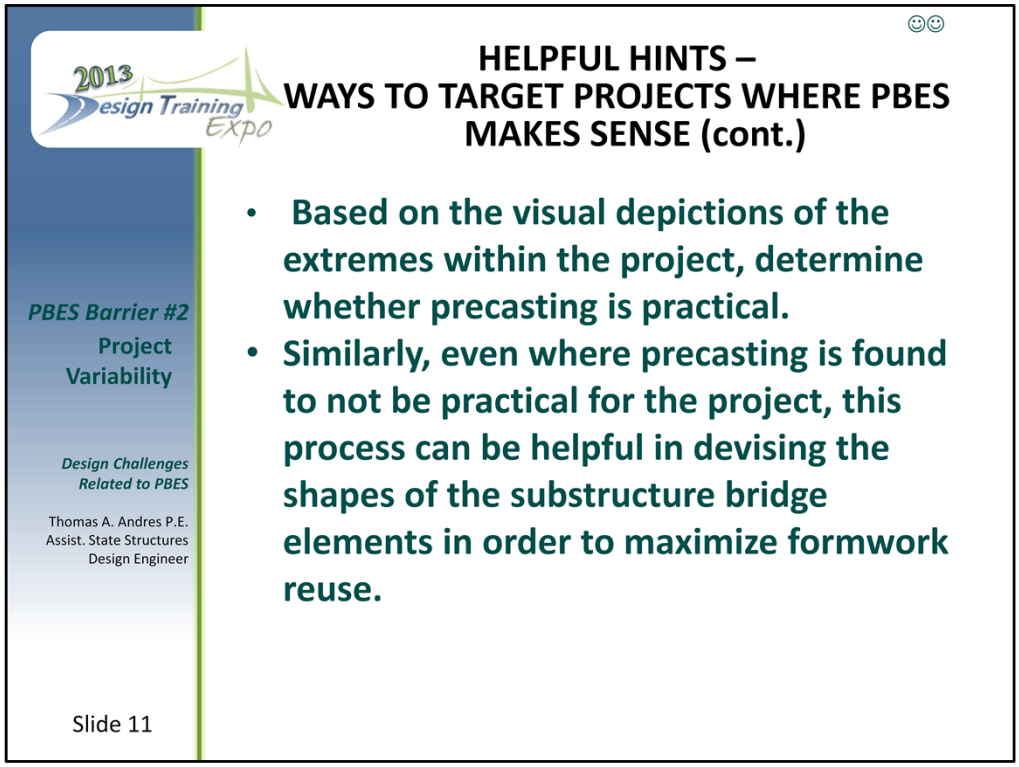
PBES Barrier #2 – the Project Variability Quandary

Our biggest challenge given our current work mix continues to be how to best utilize PBES solutions to accommodate variability within a given project. In this real interchange project example, complex geometric constraints necessitated both integral and non-integral hammerhead piers, multi column piers of variable widths, "C" shaped piers, and both integral and non-integral straddle piers.

Precasting all substructure components for such a highly variable project would be difficult and expensive. Also lifting weights of some of the larger elements would drive the crane size and overhead cost up. Integral piers pose additional challenges – most require at least some CIP concrete and temporary shoring to make the integral connections.



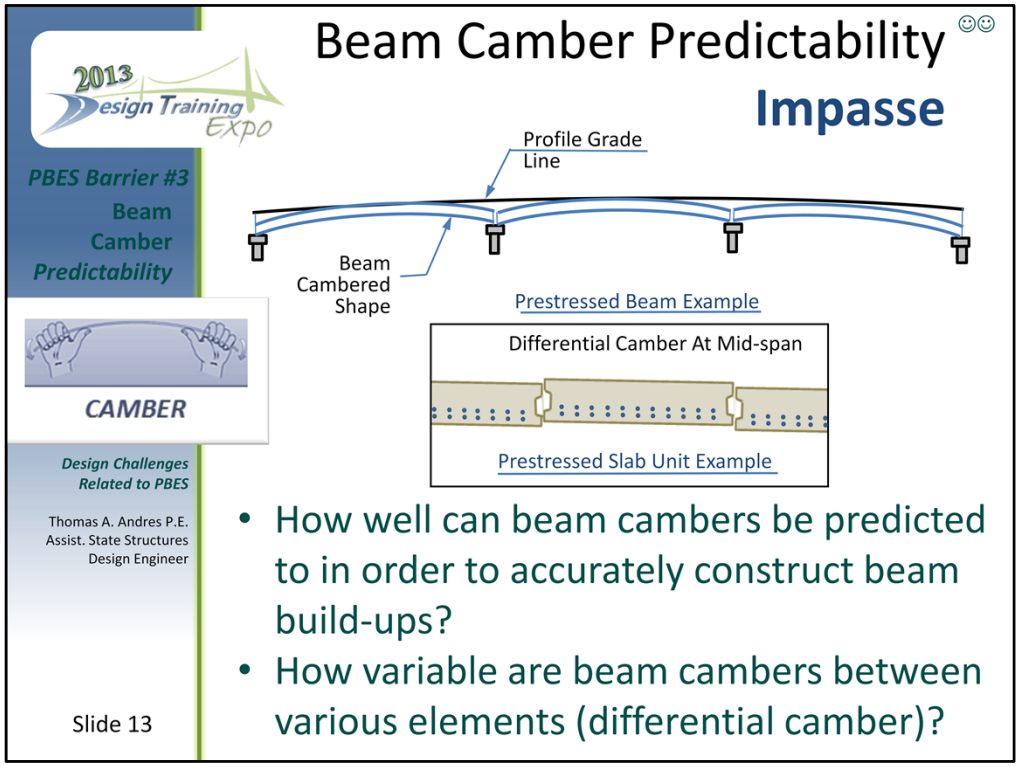
On the quandary of project variability, there are no easy answers. We do strongly suggest, that the extremes of the project be looked at during the BDR stage or as early, as possible, in the design. Show the widest bridge, the narrowest bridge; the tallest pier, the shortest pier; the various types of pier shapes required; the largest cross slope, the smallest cross slope; the longest span, the shortest span; etc.



-☺- Once the extremes are established, it is easier to determine whether precasting makes sense.

-☺- I should point out that even if precasting is **NOT** deemed to be feasible, this process is a useful step in determining substructure pier shapes which maximize formwork reuse. I refer you to Chapter 13 of the Detailing Manual for more information.

This is just a simple slide depiction of a water pier which appears to be perfect for pracasting using column sections of various heights and a precast cap element maybe using rebar couplers and epoxy at the match-cast joints.
-☺- As you look at the various piers heights within the project, everything looks doable, albeit some of the taller piers may require two column elements, not one, due to lifting weight considerations.
-☺- Everything looks fine until the shortest pier is looked at. The shortest pier is a problem because it requires a special form and also requires a different transfer template; a transfer template ensures that the rebar cast into the CIP pier footing will line-up with the rebar in the precast element. Lastly the grout recess in the footing will be different. The point here is that these special cases need to also be considered when determining whether or not to employ PBES.
Again this just underscores the importance of looking at the project extremes and outliers – it is sometimes the outliers that sways the final decision.

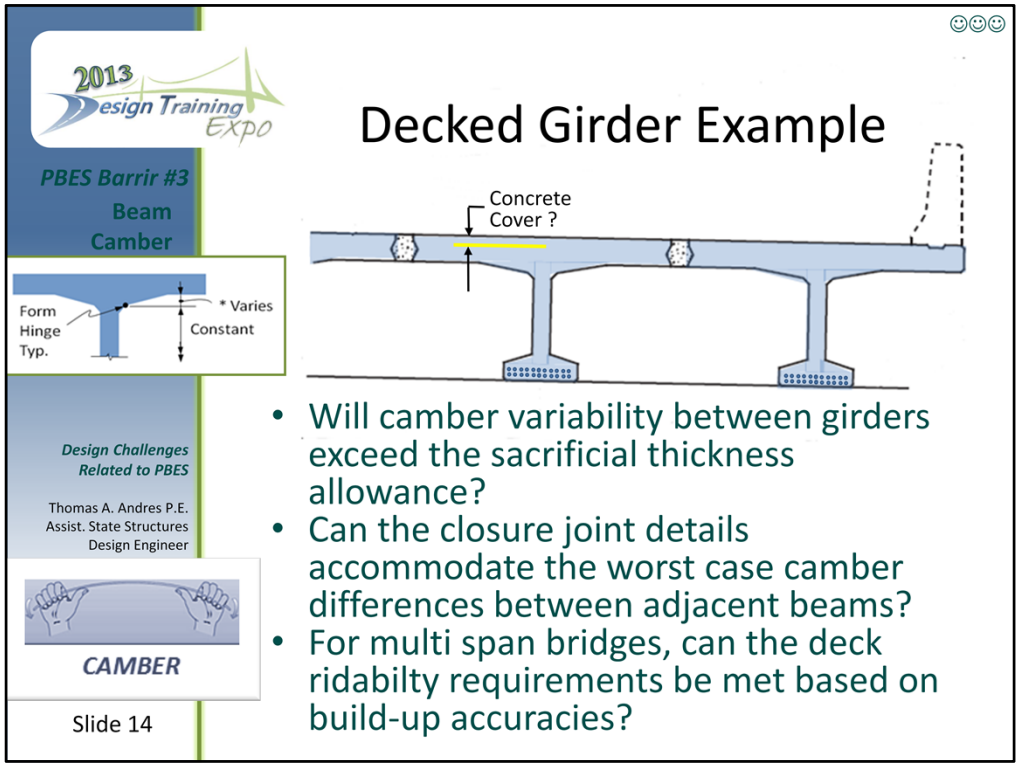


Okay switching gears.
PBES Barrier #3 – The Beam Camber Impasse

There are two primary challenges associated was pretensioned beam camber:

-☺- The first is being able to predict the camber accurately so the build-up of the beams in the longitudinal direction can be determined – see the top sketch showing the three-span beam option.

-☺- The second challenge is being able to predict camber variability within a given span – see the bottom sketch showing a prestressed slab girder cross section at mid-span.



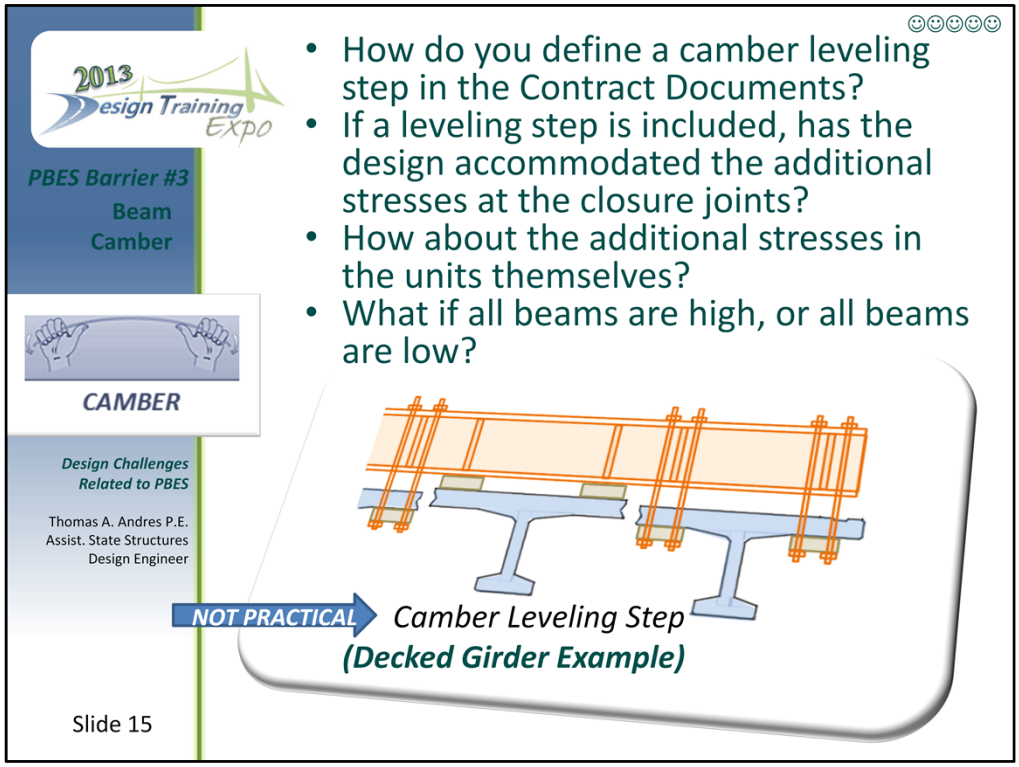
There are a lot of PBES components that are pretensioned and therefore are subject to camber.

Here is an example of a decked girder system. This system has huge advantages from a structural efficiency standpoint and the system virtually eliminates deck forming, but this system is simply not practical, given our current precast yard casting methods which do a poor job creating cambers which are predictable and repeatable.

-☺-The camber variability between girders will likely exceed any practical sacrificial thickness allowance.

-☺-It would be difficult to detail the closure joint to accommodate the worst case camber differences between adjacent beams.

-☺-and lastly, for multi span bridges, deck ridabilty requirements are difficult to meet because of build-up inaccuracies.



I have seen attempts to include a camber leveling step using strong backs to force the high units down and the low units up. But some basic questions come to mind:

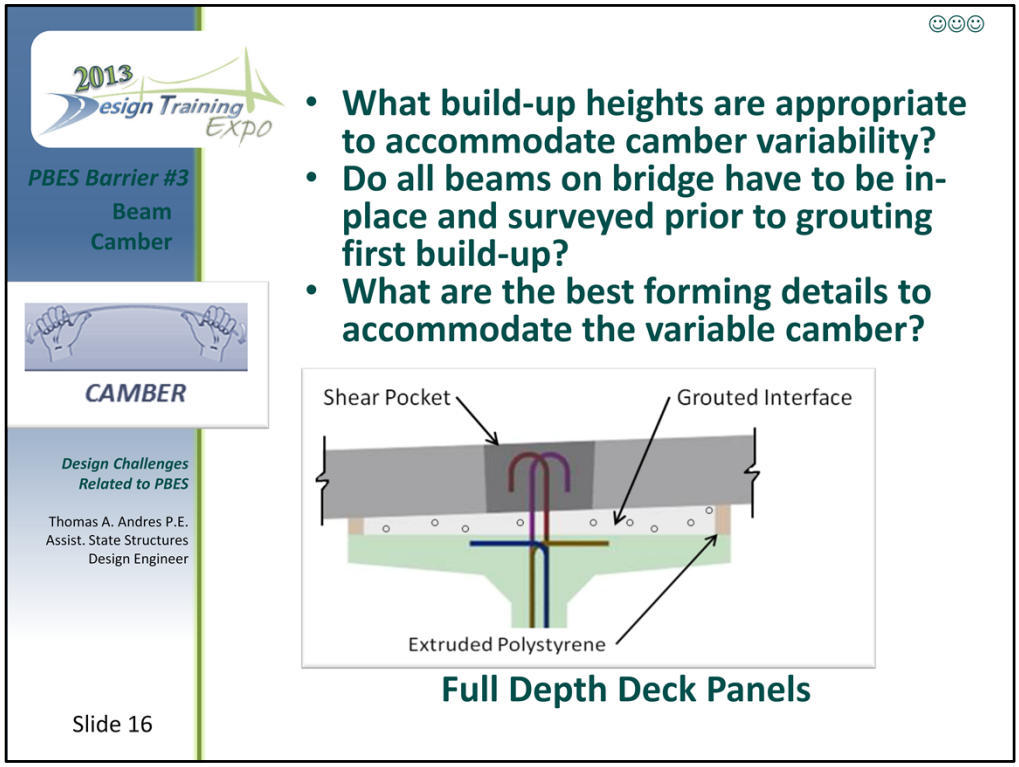
-☺-How do you define a camber leveling step in the Contract Documents?

-☺- If a leveling step is included, has the design accommodated the additional stresses at the closure joints?

-☺- How about the additional stresses in the units themselves? What about torsion at the fascia girders?

-☺- What if all beams are high, or all beams are low?

-☺-Defining a leveling step is not a practical solution for the reasons mentioned above.



Certainly full depth-deck panel placed on pretensioned girders have to account for camber variability.

Detailing questions include:

-☺-What build-up heights are appropriate to accommodate camber variability?

-☺- Do all beams on bridge have to be in-place and surveyed prior to grouting first build-up?

-☺- What are the best build-up forming details to accommodate variable camber?

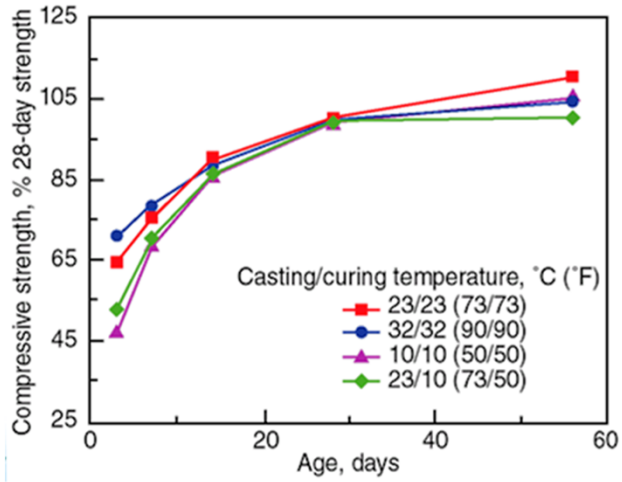
PBES Barrier #3
Beam
Camber

Design Challenges
Related to PBES

Thomas A. Andres P.E.
Assist. State Structures
Design Engineer

Slide 17

INFLUENCE OF CASTING/CURING TEMPERATURES ON STRENGTH GAIN



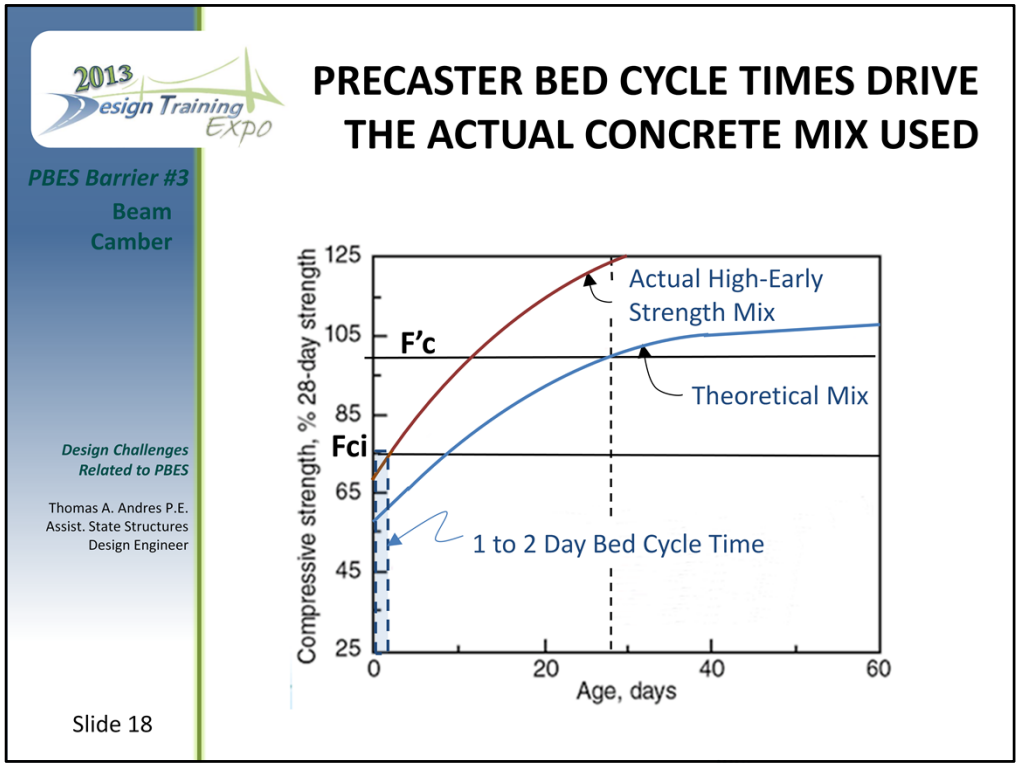
REF: Burg, Ronald G., *The Influence of Casting and Curing Temperature on the Properties of Fresh and Hardened Concrete,* Research and Development Bulletin RD113, Portland Cement Association, 1996, 20 pages.

Certainly factors that influence camber include casting and curing temperatures.

Here you can see the strength gain curves for different casting and curing temperatures.

Notice that the largest differences in strength occur early-on in the first few days. If the precaster is detensioning the strands using a 1-to-2 day cycle - say, one can see that the difference in strength and therefore member stiffness can vary by as much as 20% based on a temperature change of 40 °F.

So beams cast in the winter months may have more camber and smaller build-ups than beams cast in the summer for the same mixes. That said, it is fairly common for precast yards to have different mixes to adjust for seasonal temperature ranges so that bed production rates are maximized. These variables make camber predictions more difficult.



And certainly another factor influencing camber is concrete mix design. It is the release strength, not the 28 day strength which typically controls the mix design. Therefore the designer assumes one strength-gain curve to determine cambers and build-ups , but the actual strength gain curve is different. As you know, programs apply correction factors to approximate the real strength gain curve when predicting camber. Interesting enough, when we switched from Florida Bulb Tees and AASHTO beam shapes to our new Florida I-Beams, the actual cambers were about half of the predicted values. This of course, is because the beams are inherently more efficient and so the correction factors for the old beam shapes don't really work on the newer beams.

PBES Barrier #3
Beam
Camber

Design Challenges
Related to PBES

Thomas A. Andres P.E.
Assist. State Structures
Design Engineer

Slide 19

STEAM CURING
-STRENGTH AT 18 HOURS

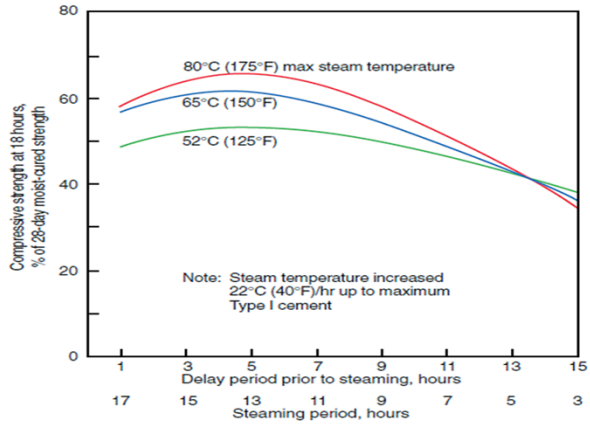


Fig. 12-10. Relationship between strength at 18 hours and delay period prior to steaming. In each case, the delay period plus the steaming period totaled 18 hours (Hanson 1963).

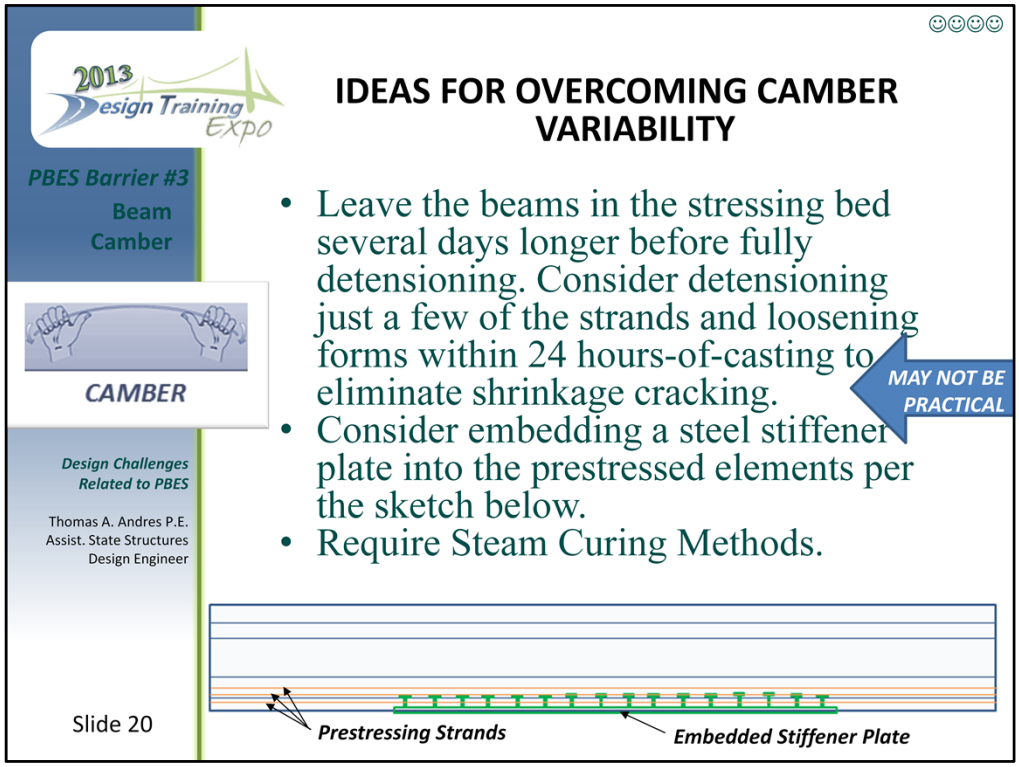
REF: Hanson, J. A., *Optimum Steam Curing Procedure in Precasting Plants, with discussion, Development Department* Bulletins DX062 and DX062A, Portland Cement Association, 1963, 28 pages and 19 pages, respectively.

Strength gain can also be achieved by using steam curing with less additional cement needed to achieve 1-2 day cycle times. This allows the actual mixes used by precasters to behave closer to the theoretical mixes assumed during design. Also the controlled temperatures during curing will likely make cambers more predicable and repeatable.

This particular chart shows the percent of 28 day strength at 18 hours using different steam curing temperatures and based on various delay periods prior to initiating the steam.

As the chart shows, obtaining 50-60 % of the 28 day compressive strength within 18 hours is fairly easily achievable using steam curing.

Also using careful temperature selection, one can achieve the 28-day strength in 3 days.



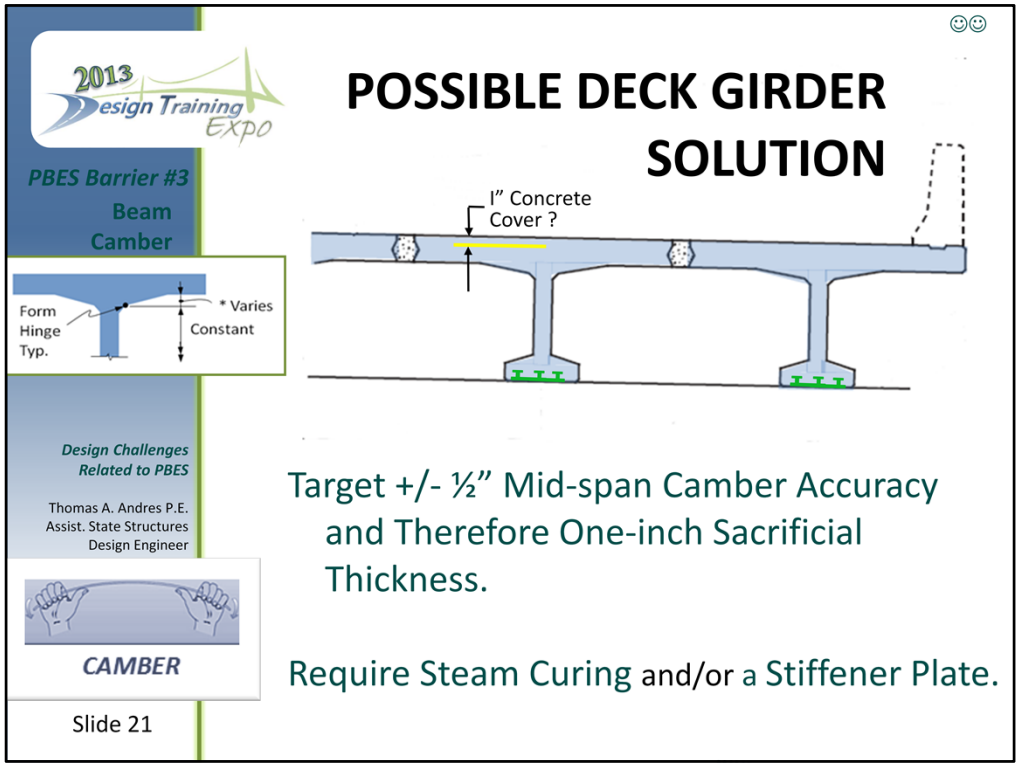
A few ideas for making camber more predictable include the following:

-☺- Leave the beams in the stressing bed several days longer prior to fully detensioning. Consider detensioning just a few of the strands and loosening forms within 24 hours-of-casting to eliminate shrinkage cracking.

-☺-Consider embedding a steel stiffener plate into the prestressed elements per the sketch at the bottom of the slide.

-☺- Require steam curing methods.

-☺-Leaving the beams in the bed, may not be practical just because of delays in casting yard production rates.

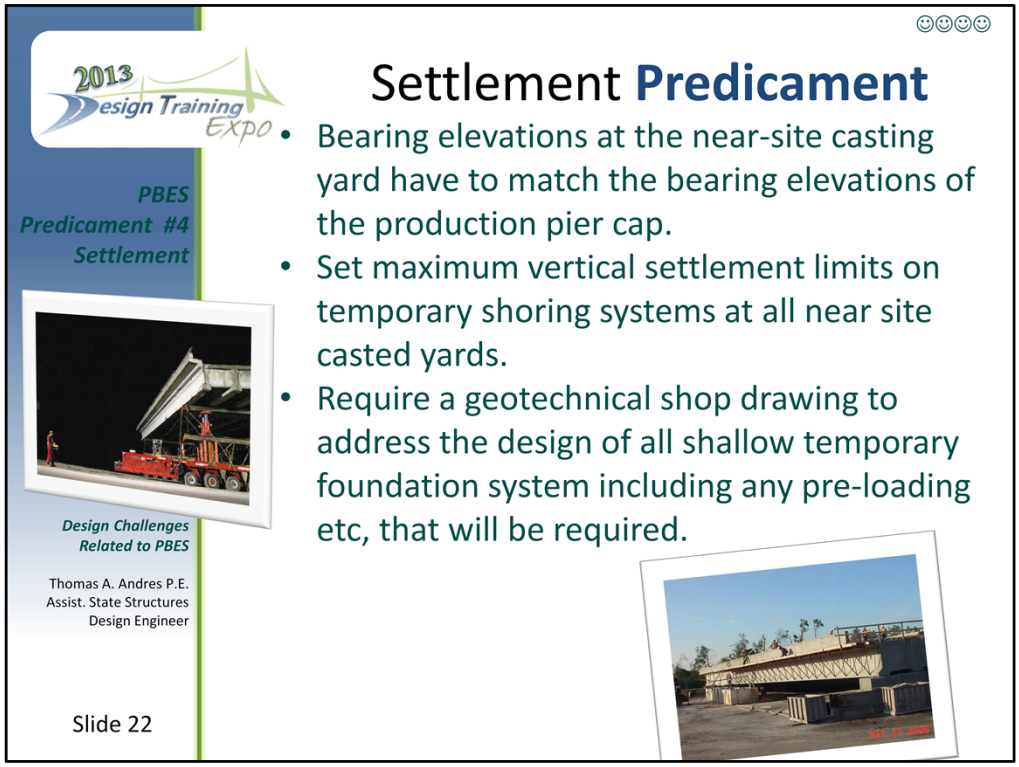


Let's go back to the deck girder example described earlier.

-☺☺-What if we were to target mid-span camber accuracy of +/- ½ inch – with a one inch sacrificial thickness, several stiffening methods would likely be necessary such as: requiring steam curing or adding a stiffener plate

It is really a question of the benefits of utilizing a deck girder solution versus the added costs associated with overcoming the camber predictability impasse to ensure that deck ridability requirements can be achieved.

What is interesting, but not surprisingly is that northern states which routinely employ steam curing find deck girders as a good solution. The point here that when you attend national conferences that recommend ABC solutions, you must understand the conditions in which such solutions will or will not work.



Okay switching gears. Barrier #4 – Settlement.

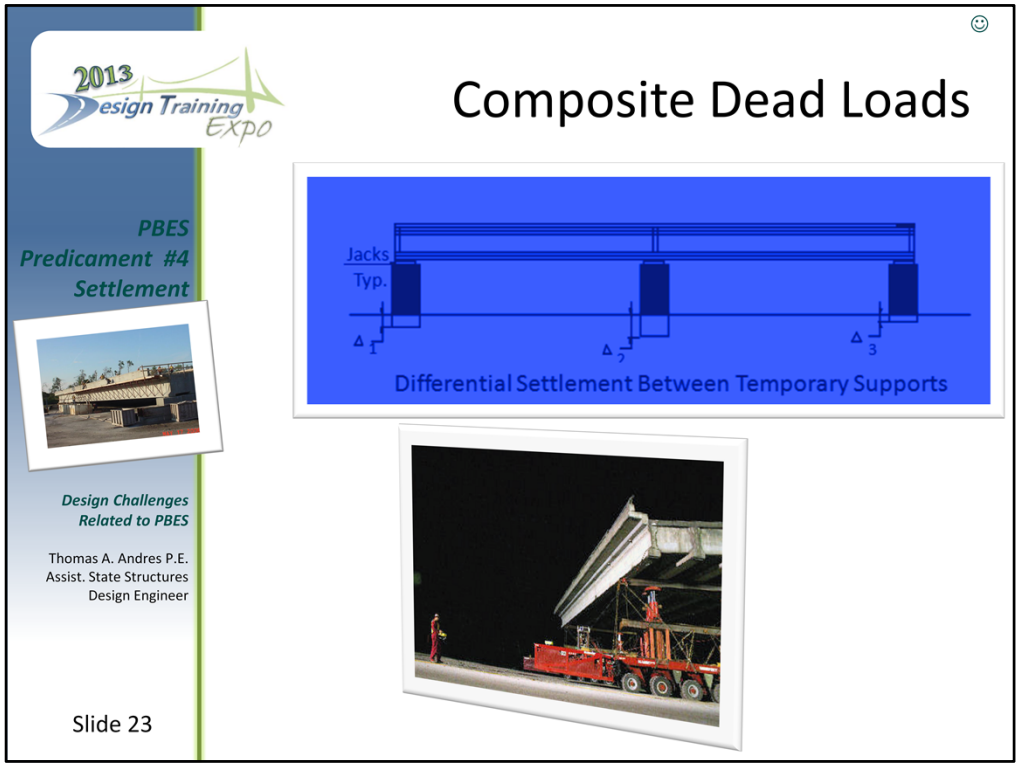
-☺☺-If you are casting spans at a near site casting yard that are to be rolled into place using SPMTs, you have to be sure that the temporary supports match the relative geometry of the bridge substructure, right?

Here there is also a concern related to the settlement of the temporary supports.

Unfortunately Florida does not have the advantage of having pre-consolidated soils due to glacier ice flows or subsurface rock that many other sates do – therefore we really have to pay attention to temporary shoring founded on shallow foundations.

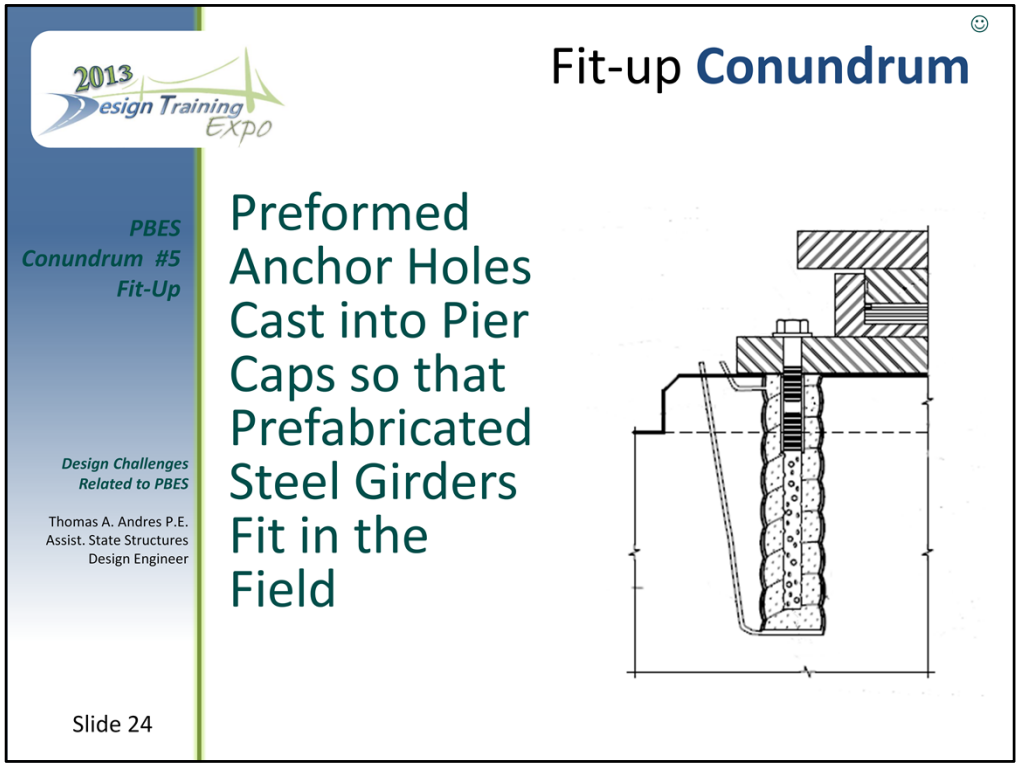
-☺-The issue here is that when the deck is cast on of the beams, especially for the first time, that the shallow temporary supports will settle when they are loaded.

- ☺- So you have to address this issue as a designer, and add the appropriate shop drawing requirements into the contract documents to control settlement and to be able to make adjustments.



-☺-Before we leave this settlement predicament discussion, I want to address composite dead load design by using mid-span shoring which makes the issue of settlement a little trickier because the mid-span shoring creates a continuous span which is more sensitive to any differential settlement that may occur. In this case, you may want to require a monitoring and jacking provision in your specs depending on the site and the subsurface conditions.

Of course, this problem becomes less of an issue as you cast multiple spans on a large project, say provided that the geometry of the supports are checked and adjusted periodically.



-☺-When I think of fit-up, I think of preformed anchor holes, which as you know are required to be cast into all piers and bents on structural steel projects to ensure proper fit-up of the prefabricated steel because it is unrealistic to assume that the piers and anchor bolts could be perfectly located.

I remember when this was not an FDOT requirement back in the eighties and the issue was a potentially serious one if the Contractor had to drill into the top of the cap to install repositioned anchor bolts – not a good idea on a hammerhead pier cap.

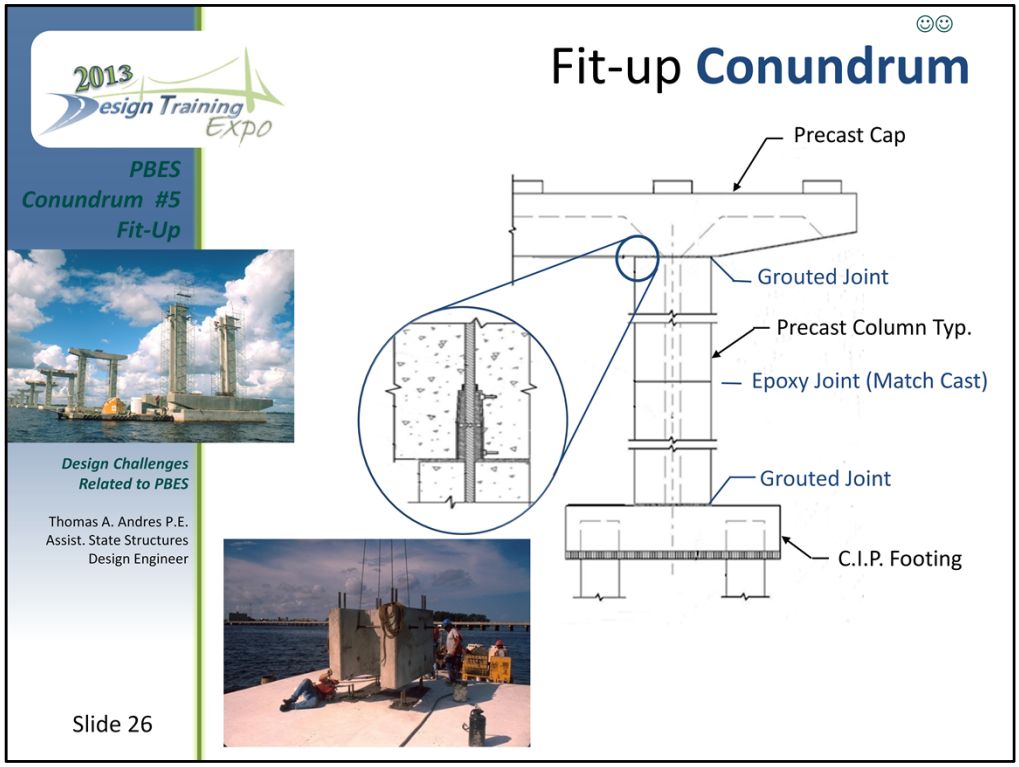
The point here is that these sort of fit-up issues have to be anticipated by the designer in advance and details should be used which facilitate fit-up.

-☺-That's why on segmental projects, you typically see a closure pour between the C.I.P. concrete elements and the precast concrete elements, for instance.

Here you can see construction of a two-box segmental bridge which utilizes a cast-in-place integral pier.

Notice the shoring being constructed to support the first precast segment on the right hand side of the bridge. After the first segment is positioned on the shoring, and the ducts and rebar are placed in the closure pour, the closure pour is cast and then connected by stressing either with P.T. bars or tendons.

The left hand side of the bridge span is complete with the temporary shoring still in place.



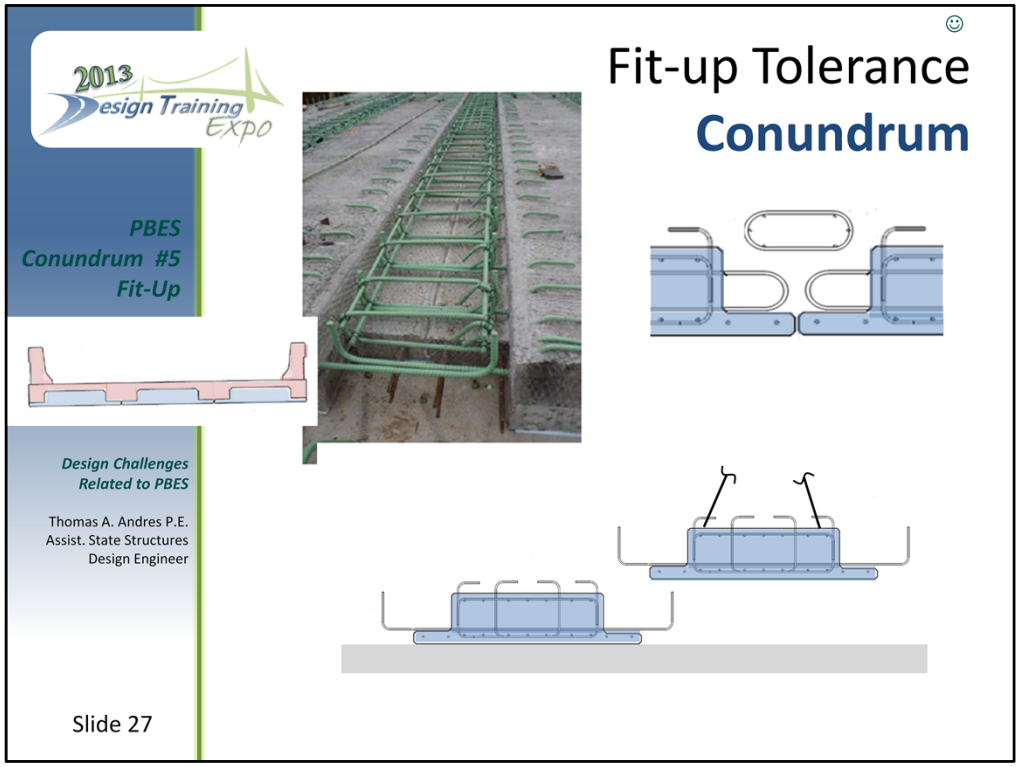
-☺- Fit-up issues have to be anticipated by the designer in advance and the details should be specified which facilitate fit-up.

That is why on this precast pier example which utilizes rebar couplers to make the connections - that:

All match cast joints are shown to be epoxied.

All non-match cast joints are shown to be grouted.

-☺-That is why interfacing precast elements with C.I.P. elements require a transfer template so that all of the grouted couplers line up



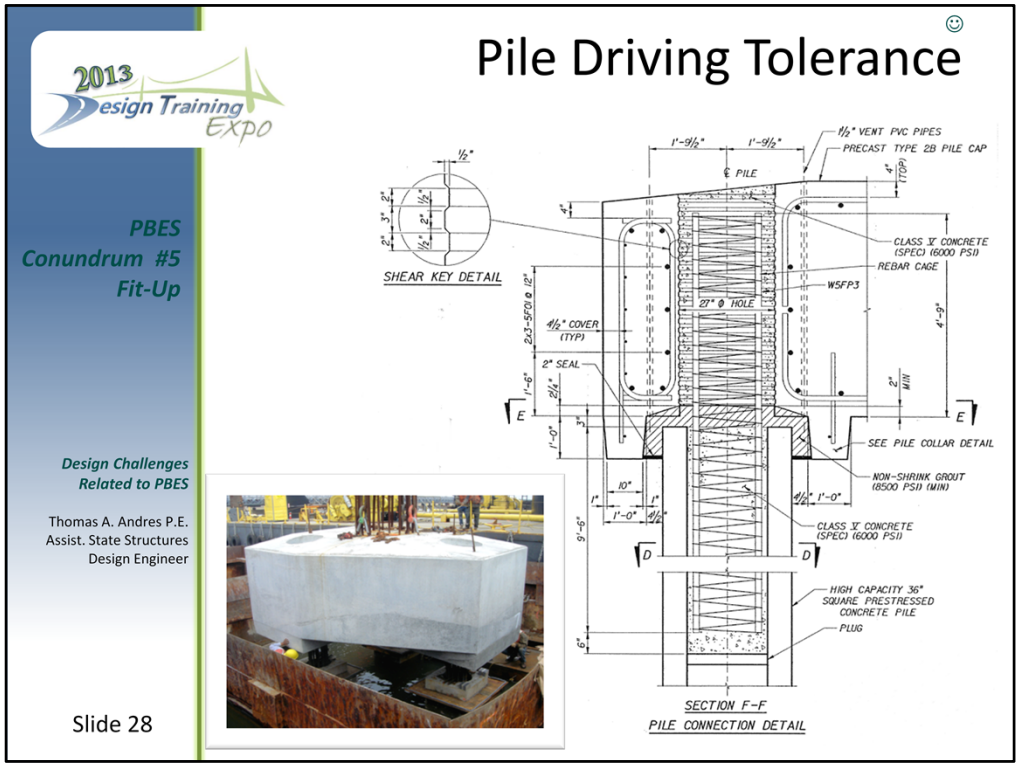
Another common fit-up issue found in PBES applications has to do with rebar conflicts.

Here you can see a very successful prestressed unit section developed in Minnesota which eliminates the cracking in the concrete topping at the joints – this is really slick solution.

However as the slide shows, the rebar detailing makes unit placement difficult because of potential conflicts with the tails of the rebar overlap. So the units must be placed far enough apart so that the rebar does not conflict, and then then the unit is slid horizontally into place.

-☺-One way to improve the detail is to utilize 180 degree hooks and a stirrup which connects the two together by laps and by threading rebar through.

The point here is that it is important to visualize each member's placement with the crane, most precast members are lowered vertically into place – and details need to be provided which accommodate beam placement with no conflicts.



Here is a successful pier cap-to-pile connection detail which does appear to accommodate the +/- 3 inch pile placement tolerances – right?

A few other things to note about the detail aside from the pile tolerance issue Include:

First of all, it looks to be a moment splice – for a water project – most likely a ship-impact job.

Concreting is preformed from the top – there are no hidden pockets hidden from view.

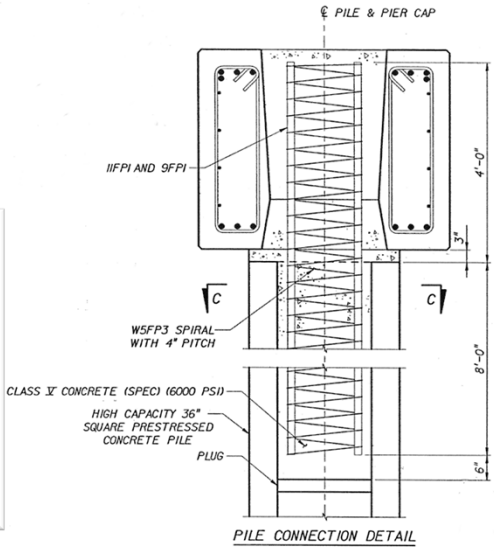
Also note the PVC vent pipes which avoids trapped air during concreting.

-☺-Also note that there is no steel to corrode at the corrugated interface surface – the shear key.

Also note that the detail provides a direct bearing point from the top of pile to bottom of cap.

Precast Bent Cap Moment Splice Detail

PBES Conundrum #5 Fit-Up



Slide 29

Here is a successful bent cap-to-pile connection detail which accommodates the +/- 3 inch pile placement tolerances – right?

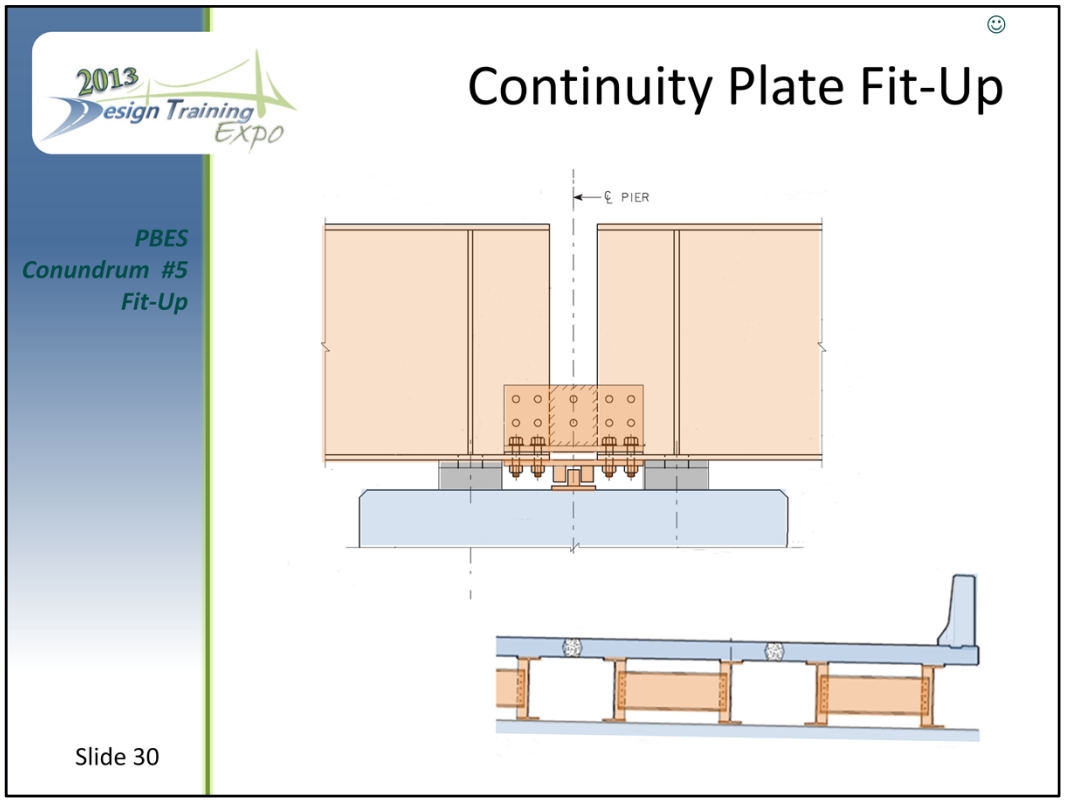
A few other things to note about the detail aside from the pile tolerance issue include:

The piles appear to be centered directly under the pedestals and beam lines.

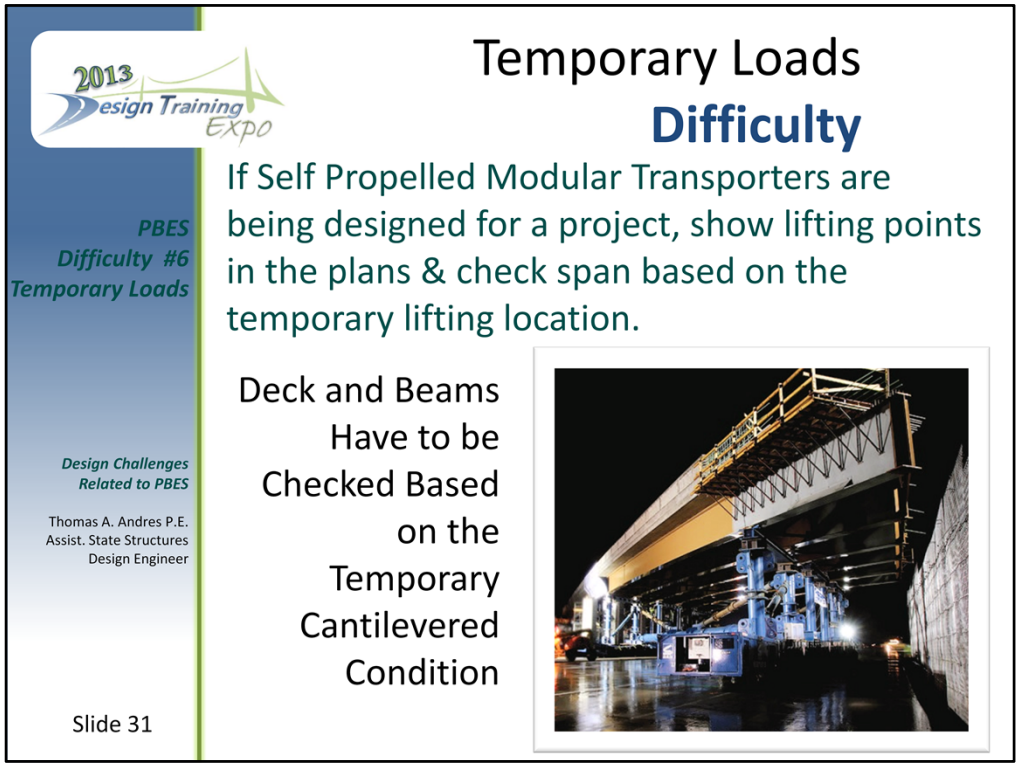
The designer chose to use C.I.P. pedestals which are cast monolithic with the connection concrete.

Per the picture, the pedestal steel is bent in the field after the plug form and circular cage is inserted.

Also note that the detail provides a direct bearing point from the top of pile to the bottom of cap.

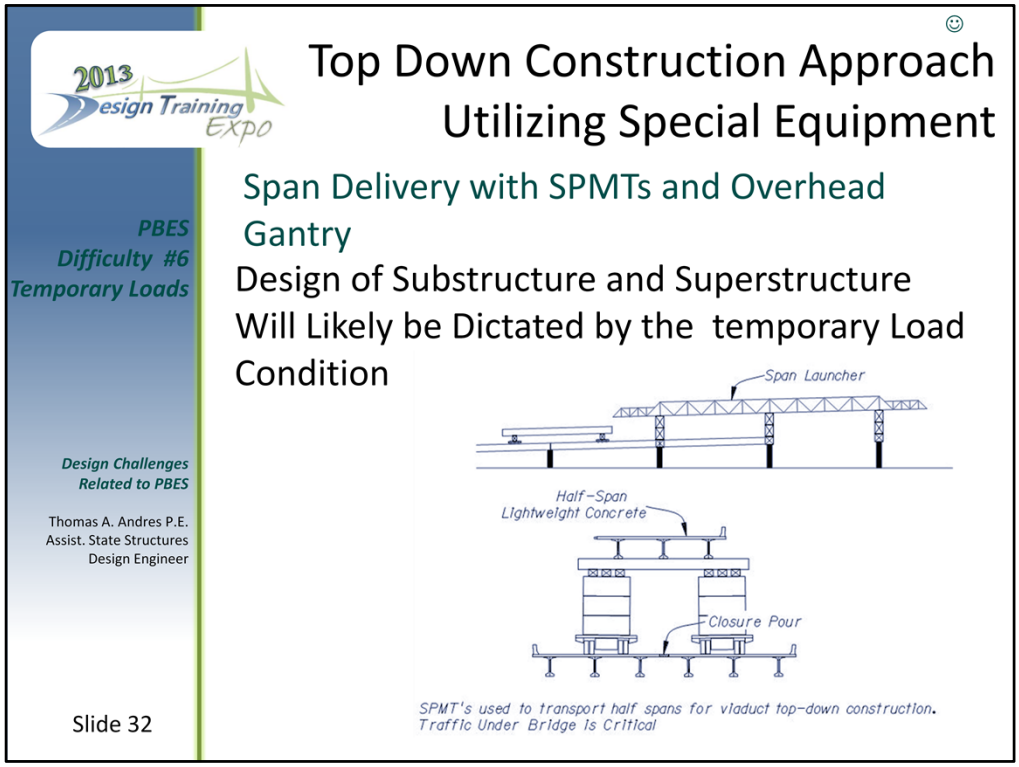


-☺-Here is a draft detail that I was asked to review a few years ago.
This is a rolled steel double tee with a precast deck, where the beams were designed to be continuous for live load.
The main fit-up issue is with the bolted continuity plate connection.
How do you ensure fit up with-out preassembling the whole bridge in the proper relative alignment on the side of the road.
And how close do the near site casting yard supports have to match the bridge pier supports?
If the geometry of the bridge was fairly straight, one could sub-bore the holes in advance and than maybe ream them out once the beams are placed in their final location.
Horizontal curves are more difficult – they may require bent connection plates, etc.
Bottom line here is to try to avoid details which require the full pre-assemble of the span, if at all possible.



Okay switching gears.

There can be many aspects of Prefabricated Bridge Elements & Systems and Accelerated Bridge Construction where the design may be dictated by temporary load conditions. Handling stresses and the special equipment loading impose temporary loads which may control the design. Here is one example and I will cover a few more on the next series of slides. What about the design of prefabricated spans which are constructed at a near site casting yard and rolled into place using a Self-Propelled-Modular-Transporter. Here it is important to include the assumed SPMT support locations in the plans. And of course the EOR needs to check the deck and beams for the temporary cantilevered condition.

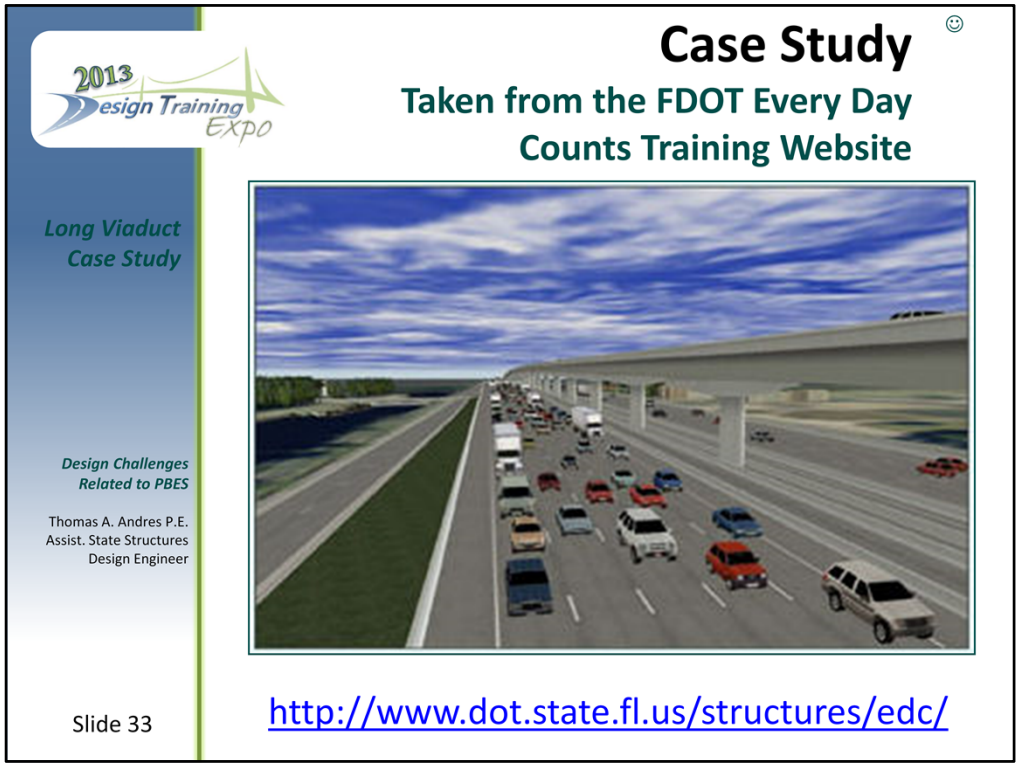


-☺-Certainly this top-down construction scheme which delivers partial spans across newly constructed viaduct to an overhead span launcher or gantry is a good example in which the temporary load conditions will likely control the design of the bridge.

Here the designer has to determine the various equipment weights, and equipment sizes in advance of the bid so that wind loading on equipment and equipment loading and element self-weight etc. can be applied to the structure.

Therefore it is important to show the design assumptions in the plans with the necessary contract language stating that if the Contractor proposes something heavier or bigger from a wind area standpoint, that his Specialty Engineer has to strengthen the bridge as necessary, etc.

More on this top-down concept in a very similar case study exercise described in the next few slides.

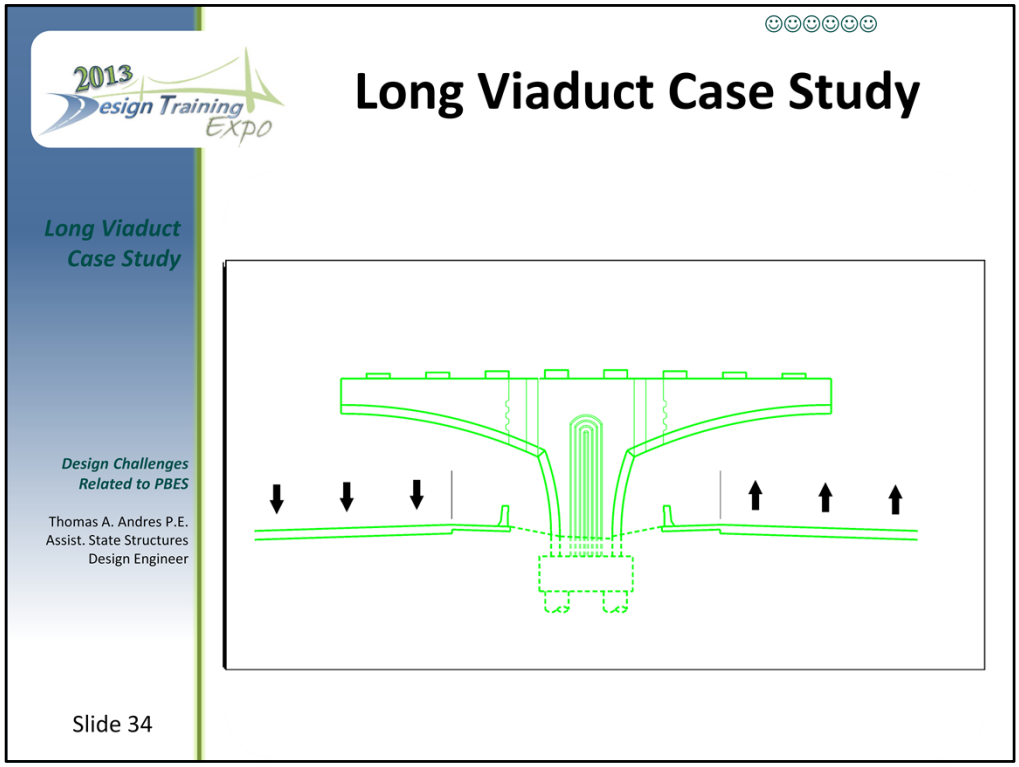


Okay enough about identifying the barriers to PBES and then coming up with possible solutions to overcome the barriers.

-☺-Let's use the rest of our time today working through a specific case study. This case study combines two training case studies posted on our EDC website – it involves a 10 mile managed lane viaduct to be constructed in the median of an existing interstate.

Our challenge is to develop criteria and design features that we can impliment to assure a successful project based on what we have learned today.

Our first goal is to design the project such that a production rate of one mile of viaduct per months is constructed. I realize, that there may be ramps and connections that may take longer, but for the purpose of today's, exercise, we are going to concentrate on the viaduct part - and a rate of one mile per month constructed is the goal.



Okay so let's describe our rapid bridge construction approach. The first challenge relates to traffic restrictions of the underlying interstate. A single lane closure is only allowed during off-peak hours. Two lanes may be closed at night. So let's start from there. Based on crane lifting weights a hybrid cast-in-place/precast hammerhead pier type is chosen. So the first step for each pier is to install the foundation and then the cast-in-place pier column is constructed during the day in situ. Precast pier wing elements, two sections per side are constructed at a near site casting yard using match casting.

-☺-Okay next the two short wing sections are lifted into place using a strong back.

-☺-Next the wing sections are blocked and partially stressed to the CIP pier head using P.T. bars – similar to span-by-span construction.

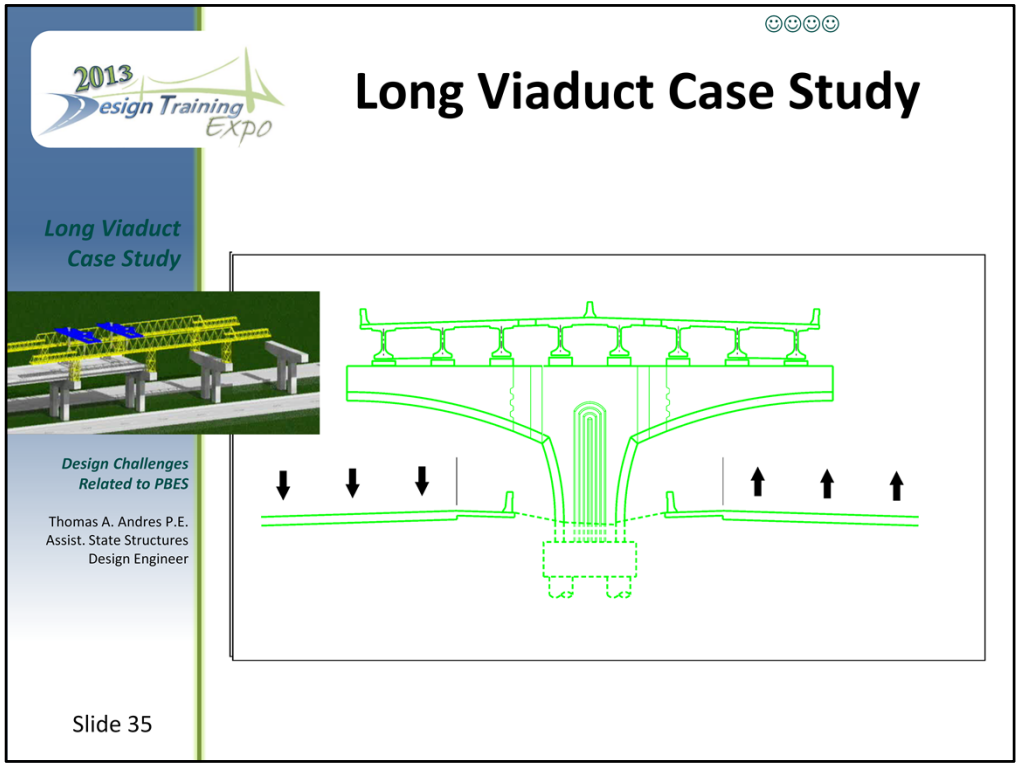
-☺-Then the closure pour is placed and the beam pedestals cast. Note that the first three steps in the construction sequence can be executed with little or no traffic disruptions.

-☺-Then at night, two inside lanes are closed, and several right side pier wings are placed and stressed similar to segmental balanced

cantilever construction.

-☺-Then on anther night, the two inside lanes on the other side are closed and the left side pier wings are placed, as well as the full length tendons stressed.

-☺-So here is the finished pier.



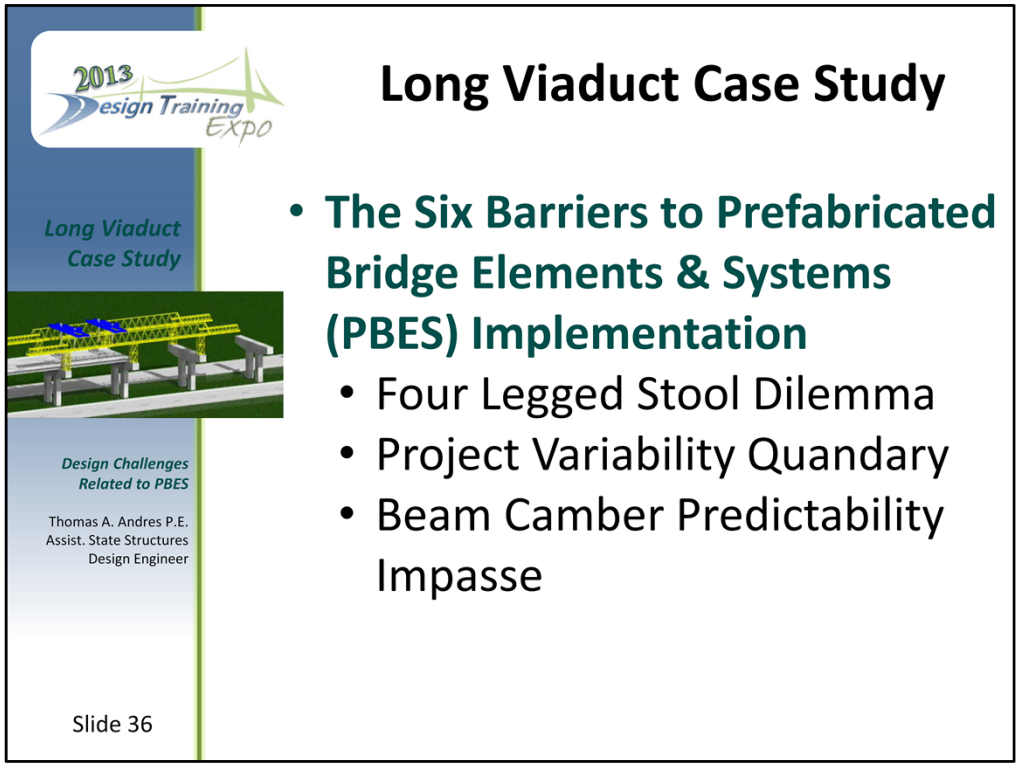
So that takes care of the substructure. Now let's assume the superstructure is cast in three sections at a near site casting yard. Let's assume that the spans are shored such that they are composite for dead loads.

-☺- Let's assume that span sections are delivered from the previosly completed spans using SPMTs to an over span launcher which puts them into place.

-☺- Here you can see the left span section being placed.

-☺- Here you can see the center span section being placed.

-☺-And here is the completed bridge once the longitudinal deck joints are poured. The really kool thing about this concept is that the SPMTs can straddle the joints, so that the joints are not on the critical path. So how many spans per day do you think you can place? 2?, how about 3 or 4? I would say that you could place them as fast as you can launch the gantry, or more likely as fast as you can construct the foundations and substructure, right?

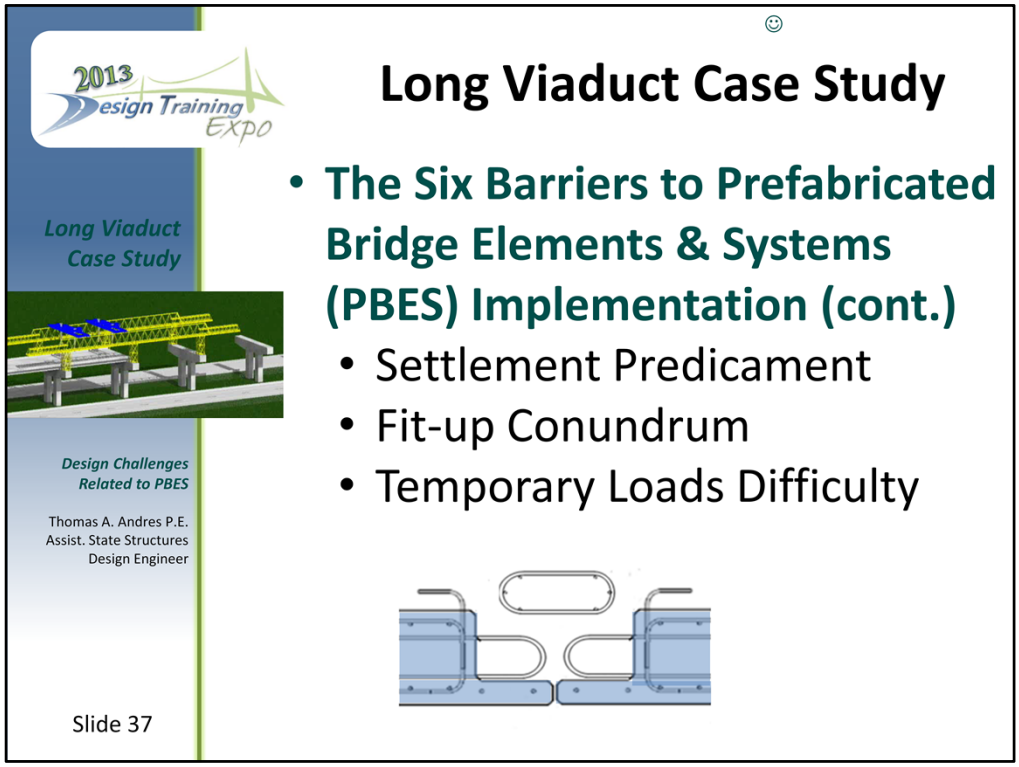


Okay, now you have an overview of the case study being proposed. What are some of the things, you as the designer would likely need to consider for this project based on what we have learned today?

On Barrier #1, certainly the partial spans are going to act like a four legged stool, so a leveling step is needed with variable width shims sized using feeler gages as the beam launcher places each span section. The shims are installed and adhered to the embedded steel plates in the bottom of the beam with epoxy. Any other Four Legged Stool issues that need to be addressed?

On Barrier #2, project variability, the things I would look at are ways to construct the bridge over any major arterials, say? Can you self launch the beam launcher through these areas? Could you switch to lighter steel span sections in these areas and still use the launcher? How would you tie in the various ramps etc. Essentially I would look at ways to address the non-viaduct non-uniform portions of the project.

On Barrier #3, you probably would not have much to worry about on this one since the deck is cast at an off-site yard and there would NOT be much additional camber after that – for this project, the ½" deck planing could more than likely address all ridabilty concerns.



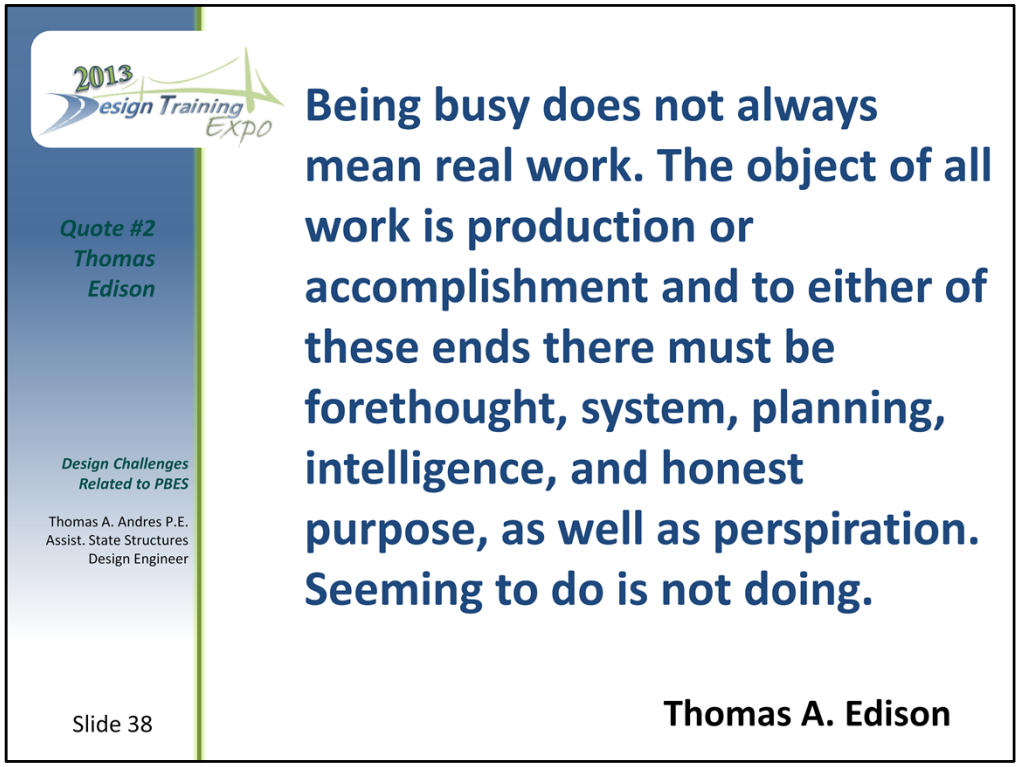
On barrier #4, the settlement barrier, certainly you would want to make sure that settlement of any shallow temporary shoring at the near site casting yard is being monitored and adjusted with jacks, etc. to ensure that all design assumptions for composite dead loads are met, right?

On barrier #5, the techniques for constructing the hammerhead wings are the same as for balanced cantilever construction – so no problem there. You would want to include the segmental specification for the match casting, erection manual, geometry control etc, right? Certainly if you wanted to use steel span at the arterials, you would include preformed anchor bolts. I haven't mentioned what to do with the deck over the pier. There are several choices. You could provide closure pours to allow the deck to be made continuous and use steel temporary deck plates to traverse these areas until these pours were made. You could put a deck joint at each pier? Certainly you would want to detail the longitudinal joints between bridge segments such that there were no rebar conflicts

-☺-you may want to use a detail that we described earlier modified for the 8-inch deck thickness.

Lastly, let's look at barrier #6, temporary loads. Here we have got a lot of design issues. The assumed beam launcher and SPMT loads would need

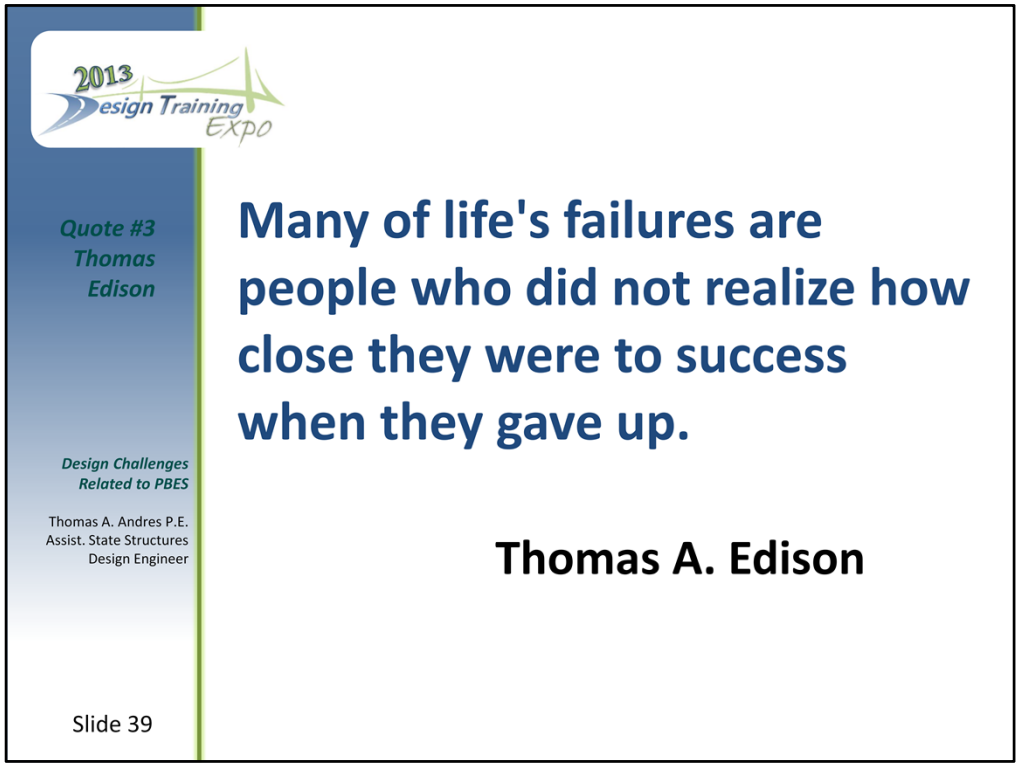
to be given in the plans. Of course these loads would control the design of the substructure. They would also likely control the design of the superstructure. The lifting points of the spans to be rolled-in would have to be given in the plans and the deck and beams would need to be checked for the temporary cantilever condition.



Here is another quote by Thomas Edison.

This is a very mid-western attitude – As most of you know, Edison was born in Ohio, and grew up in Michigan.

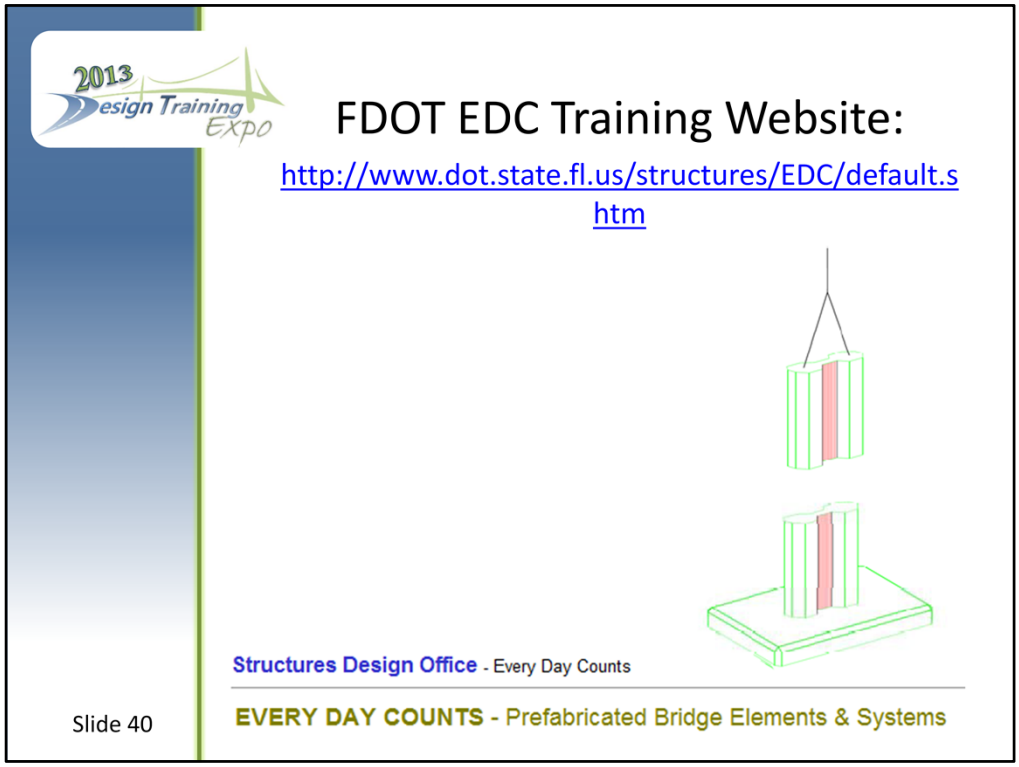
But I think Edison lived the talk – he certainly accomplished a great deal during his lifetime.



I will leave with one more quote from Thomas Edison which I think shows his determined attitude.

And in closing, I will say that accelerated bridge construction and PBES strategies can be very powerful on the right project, for the right reasons.

But it is important to understand how PBES design challenges are different than for conventional projects – and know how to to beat address these challenges to ensure successful project.



-☺-If you want to learn more about some of the issues that I have discussed today, here is the link to the FDOT Every Day Counts Training website. It is essentially a series of training video case studies.

If you haven't been to it, I certainly invite you to visit the site –see what things you can take from it that work for you.

So in summary,

We have outlined some of the barriers to implementing Prefabricated Bridge Elements & Systems,

But we have also discussed some of the practical ways of overcoming some of these barriers,

And we spent some time working through a case study which included various PBES components, and accelerated bridge construction methods to determine the considerations that the EOR would need to include in the Contract Documents in order to ensure a successful project.

Hopefully today's discussion will help you think about some of detailing issues differently in the future to help ensure a successful job.

Thank you for your attention.