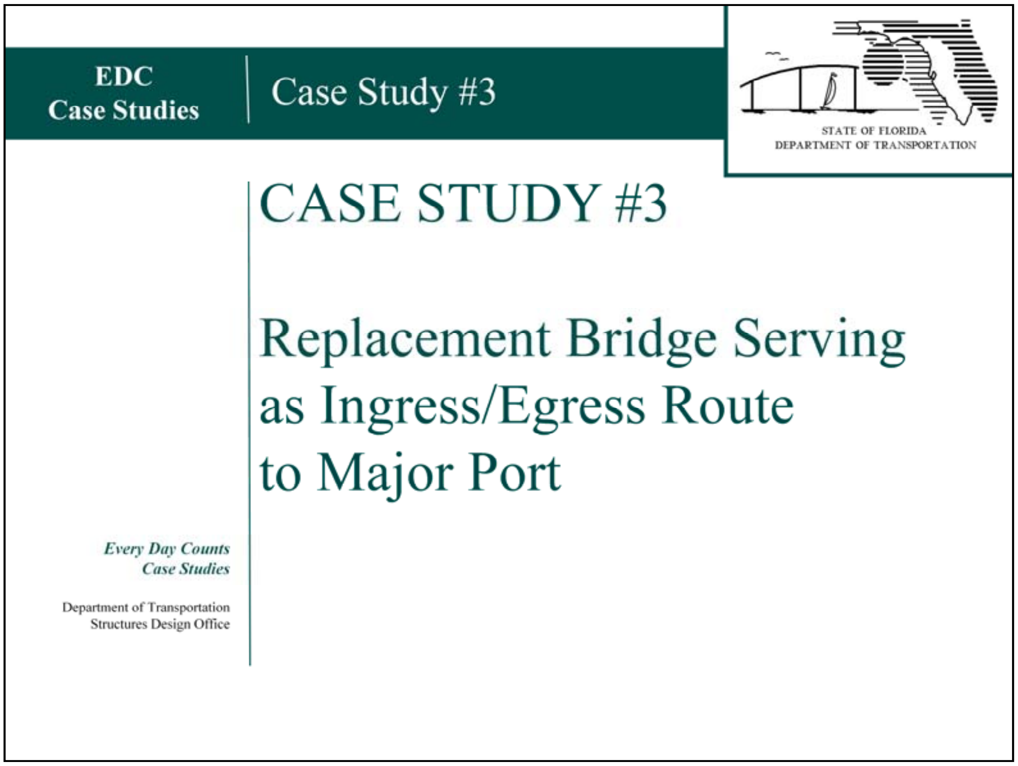
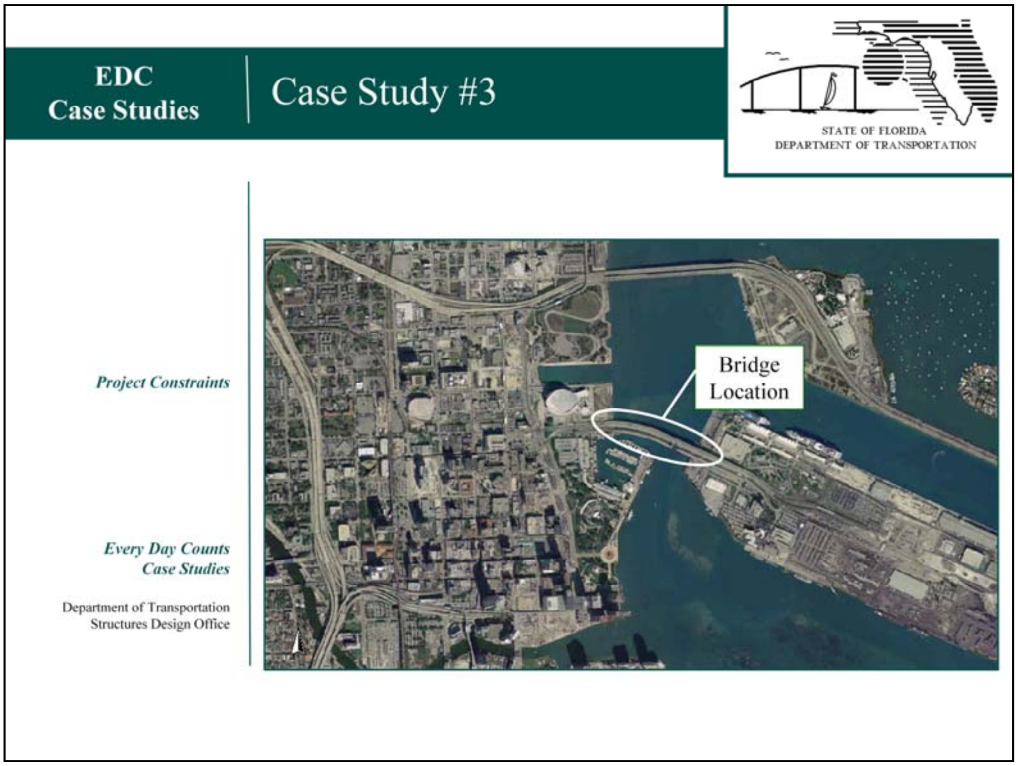


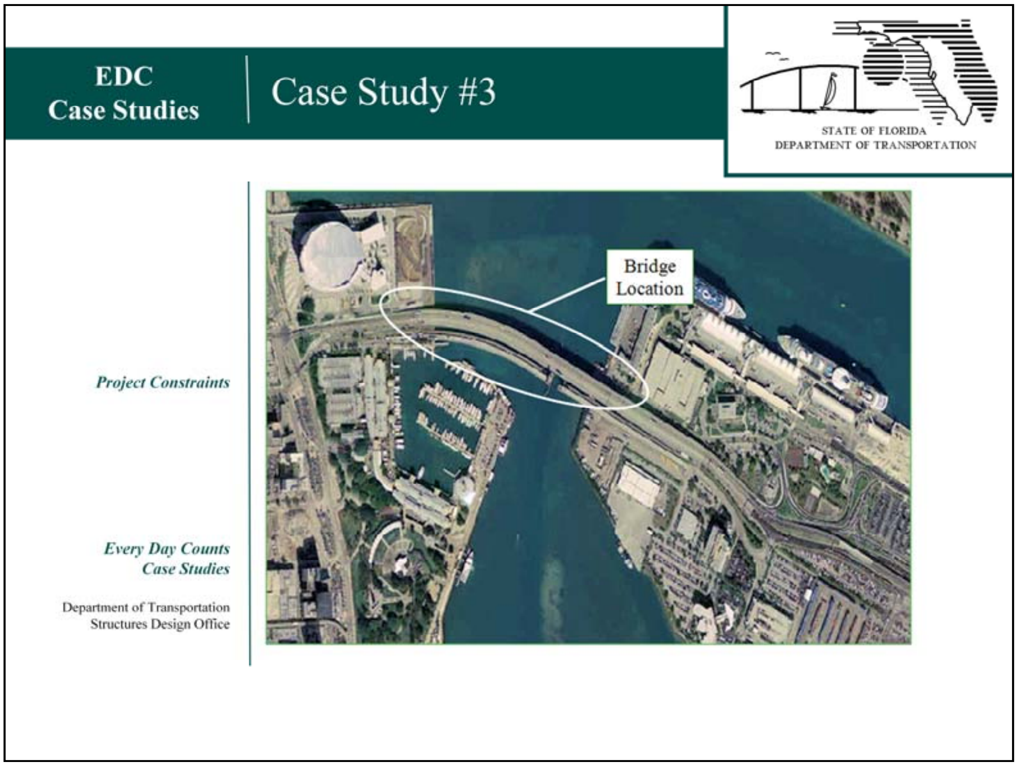
- The purpose of this presentation is to demonstrate the sort of factors influencing the decision to employ Prefabricated Bridge Elements and Systems for rapid project delivery. Bridges showcased in these case studies are not real FDOT projects, but the sites have been chosen because of their unique design constraints and ability to illustrate various accelerated bridge construction considerations. For each case, particular constraints will be assumed and then possible prefabricated ABC approaches will be explored.
- This case study features a replacement bridge serving as an ingress/egress route to a major sea port.
- Similar to other case studies, the challenge with this location is to minimize user costs – essentially commerce traffic into and out of the port – while expediting the construction and demolition of the existing bridge.
- Cruise ship travelers into and out of the port requires consideration, as well.



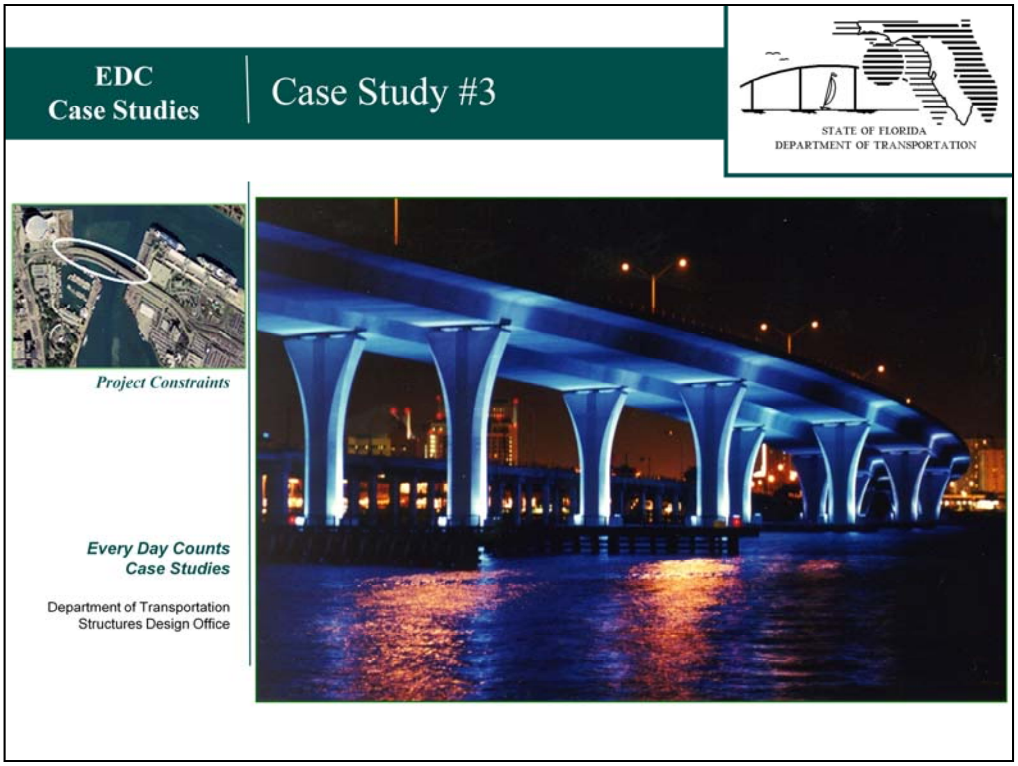
➢ As shown in the picture, since the port facility is on an island, this case study ASSUMES the bridge is the only access into the port.

➢ Note that there is significant commercial truck traffic into and out of the port.

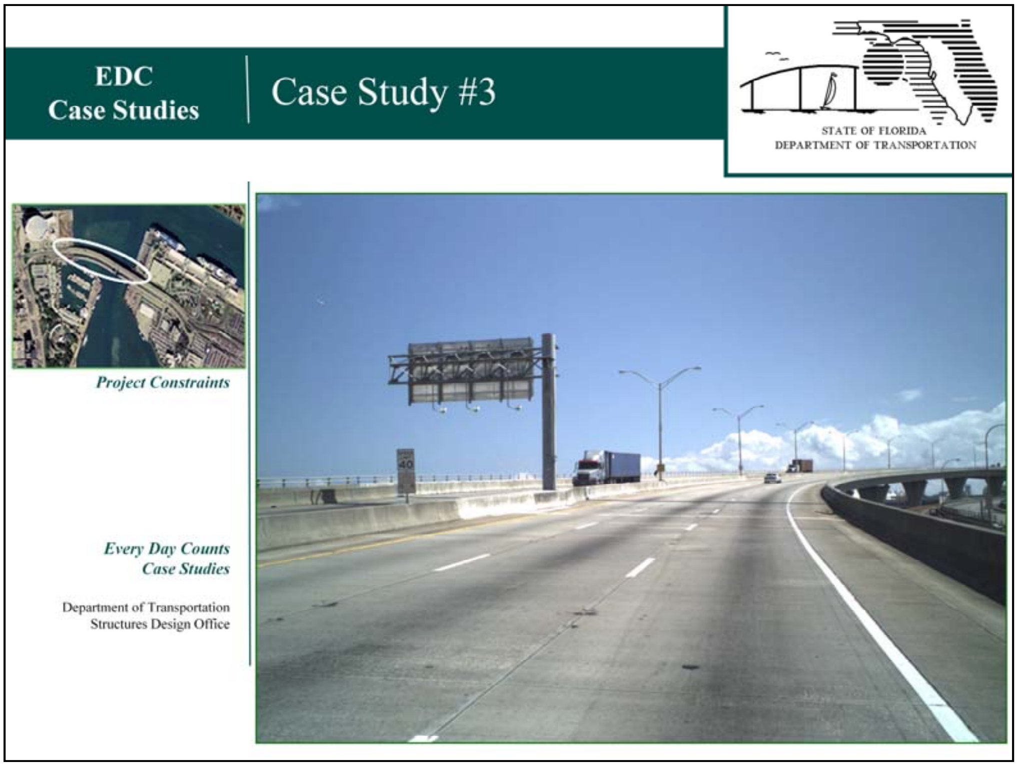
➢ In addition to transportation of goods, the island port also services major cruise lines, so construction on the bridge will affect passenger traffic to and from the ships.



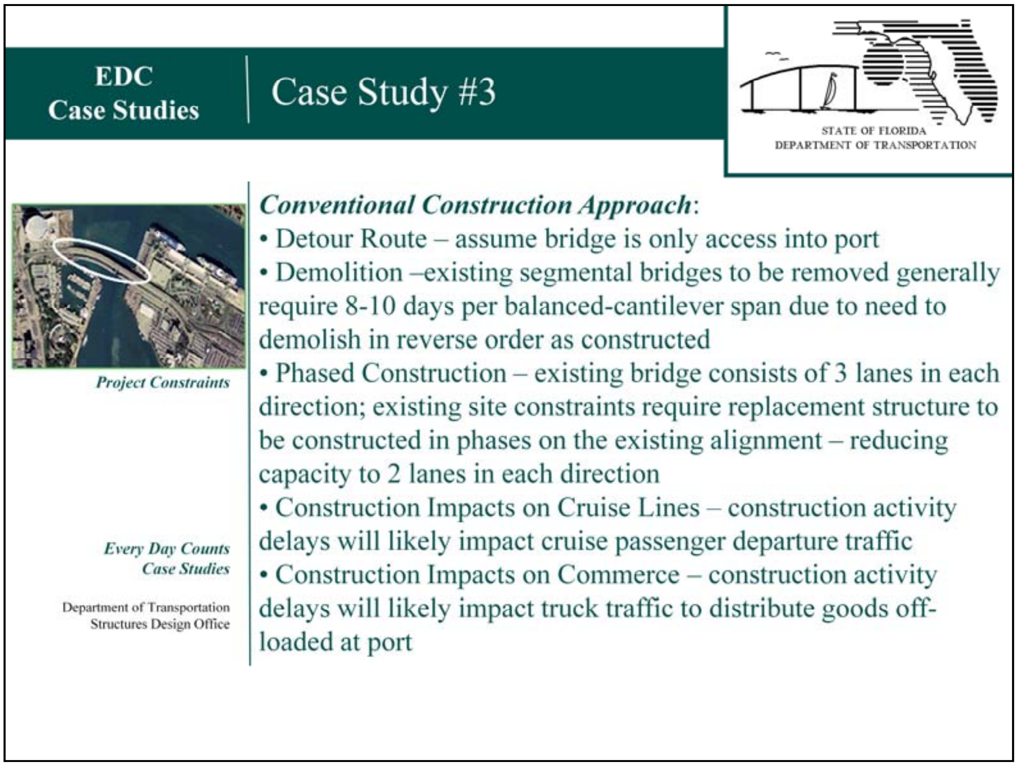
- Due to major right-of-way and other project constraints, the bridge cannot be easily re-aligned.
- So, the new bridge must be built on the same alignment with phased construction.



- This is a picture of the existing twin-box segmental bridge that was constructed in balanced-cantilever.
- The two boxes are attached with a longitudinal connection down the center.



➢ Here is a view on the bridge deck showing 3 lanes of traffic in each direction.



Some considerations for the conventional construction approach include:

➢ Access – assume the existing bridge is the only access to the port island

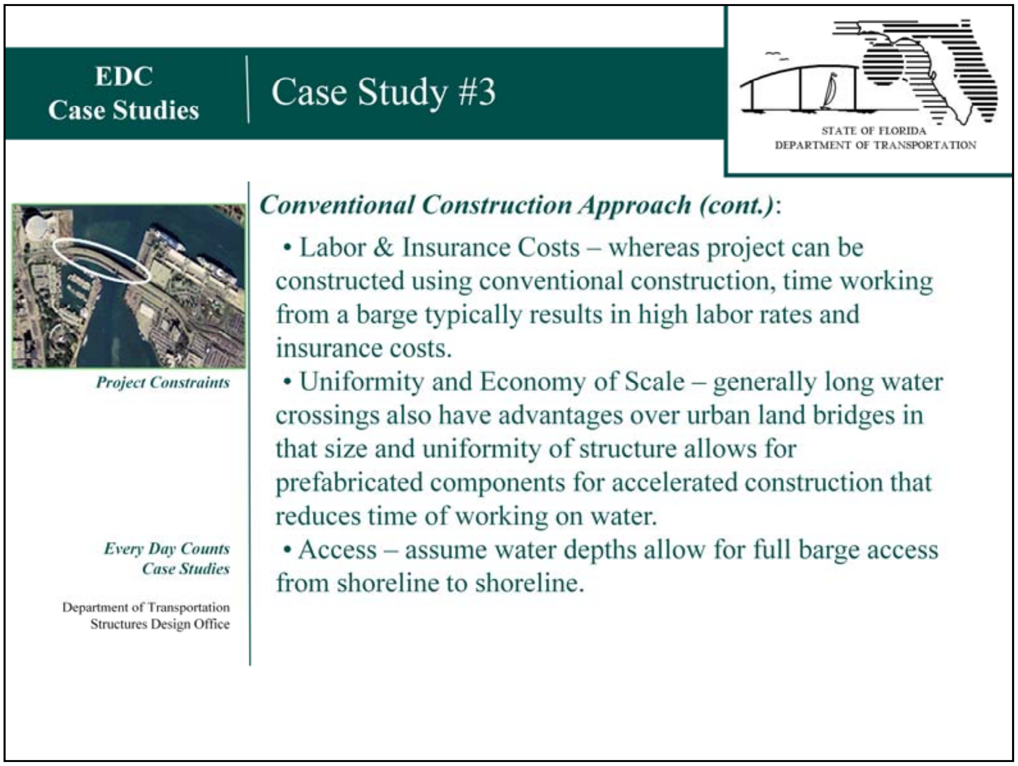
➢ Maintenance of Traffic – affects cruise line traffic and commercial trucking traffic to/from the port

➢ Demolition – a segmental bridge erected in balanced-cantilever takes longer to demolish (typically 8 to 10 days) than standard beam bridges because it generally occurs in the reverse order of construction

➢ Stability Towers – are required for demolition just as they were for original construction

➢ Right-of-Way – property constraints require phased construction since the new bridge must be built on the original alignment

➢ Lane Reduction – if phase constructed on existing alignment, the capacity would be reduced to 2 lanes in each direction



Some additional considerations for conventional construction:

➢ Labor & Insurance Rates – even though the project can be constructed using conventional methods, time working from a barge typically results in high labor rates and insurance costs for having workers over water.

➢ Economy of Scale – uniformity and project size allows for prefabrication and accelerated construction and lends to a learning curve resulting in streamlining the assembly line processes and prefabrication.

➢ Water Depths – assume water depths allow for full barge access from shoreline to shoreline.

EDC
Case Studies

Case Study #3

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

Problem Statement

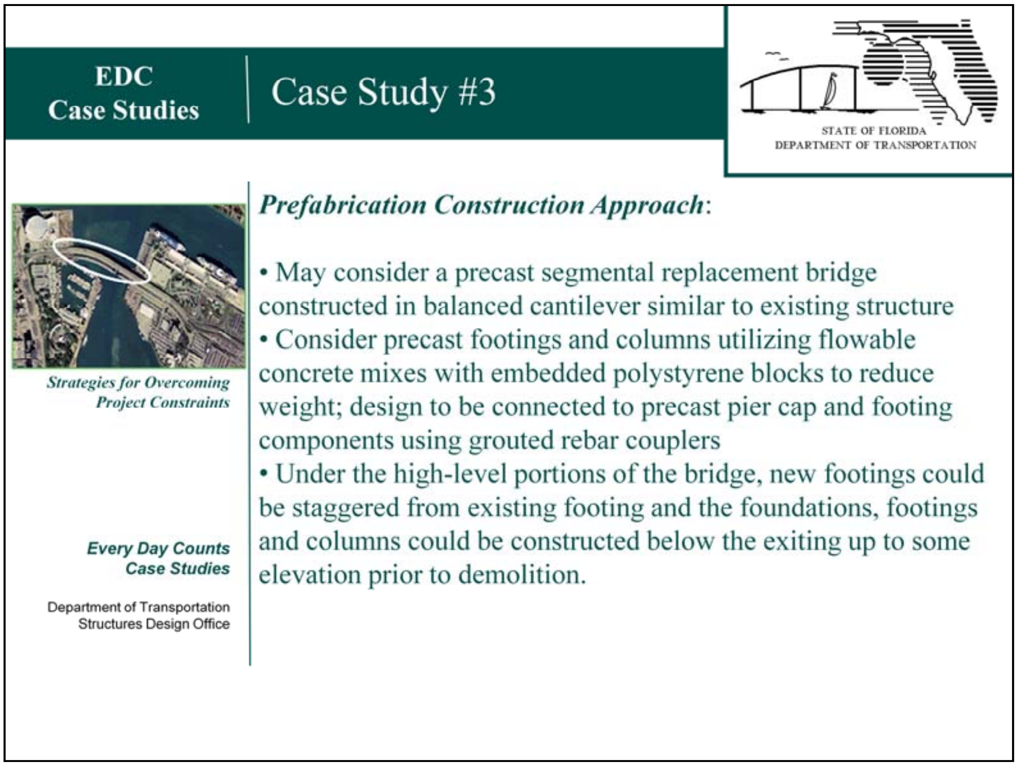
What are ways to mitigate these user impacts and labor/insurance costs?

Strategies for Overcoming Project Constraints

Every Day Counts Case Studies

Department of Transportation
Structures Design Office

How can constraints such as indirect user costs and direct costs such as labor rates and insurance be mitigated?



Some considerations for the prefabricated construction approach include:

➢ May consider replacing existing structure in kind, segmental for segmental.

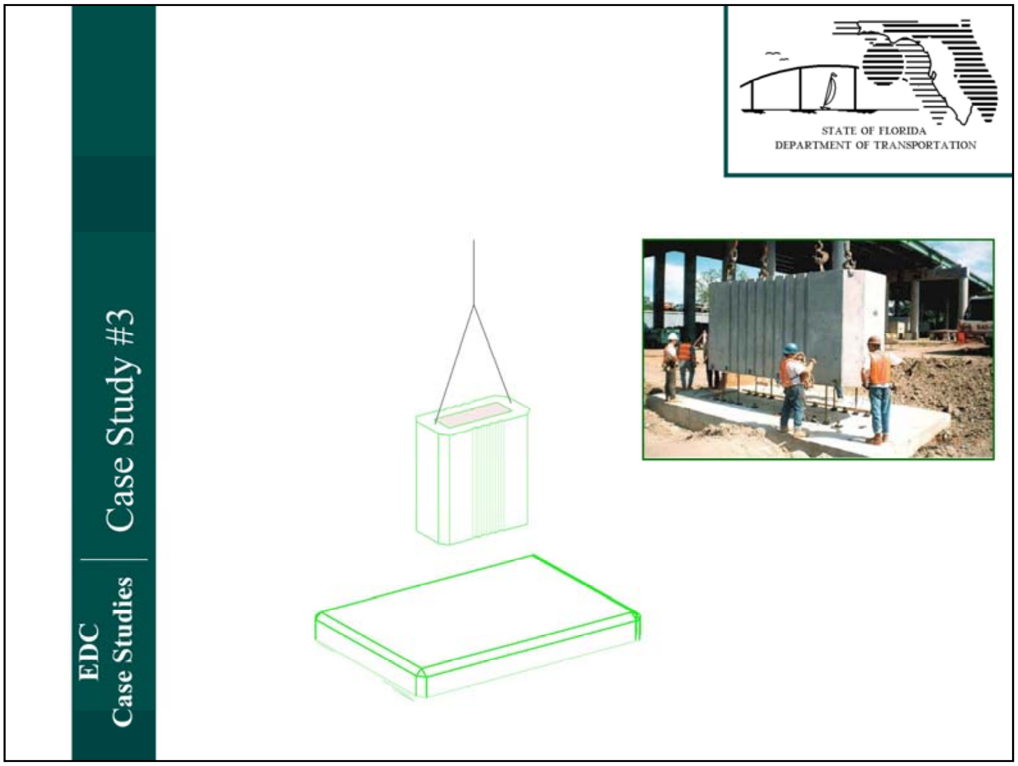
➢ Footings and columns may be considered for precasting utilizing flowable concrete mixes with embedded polystyrene blocks to reduce weights.

➢ These components would be connected using mild reinforcing steel with grouted sleeve couplers without the need for post-tensioning

➢ Due to likely footing sizes and lifting weights, the footings may need to be cast-in-place.

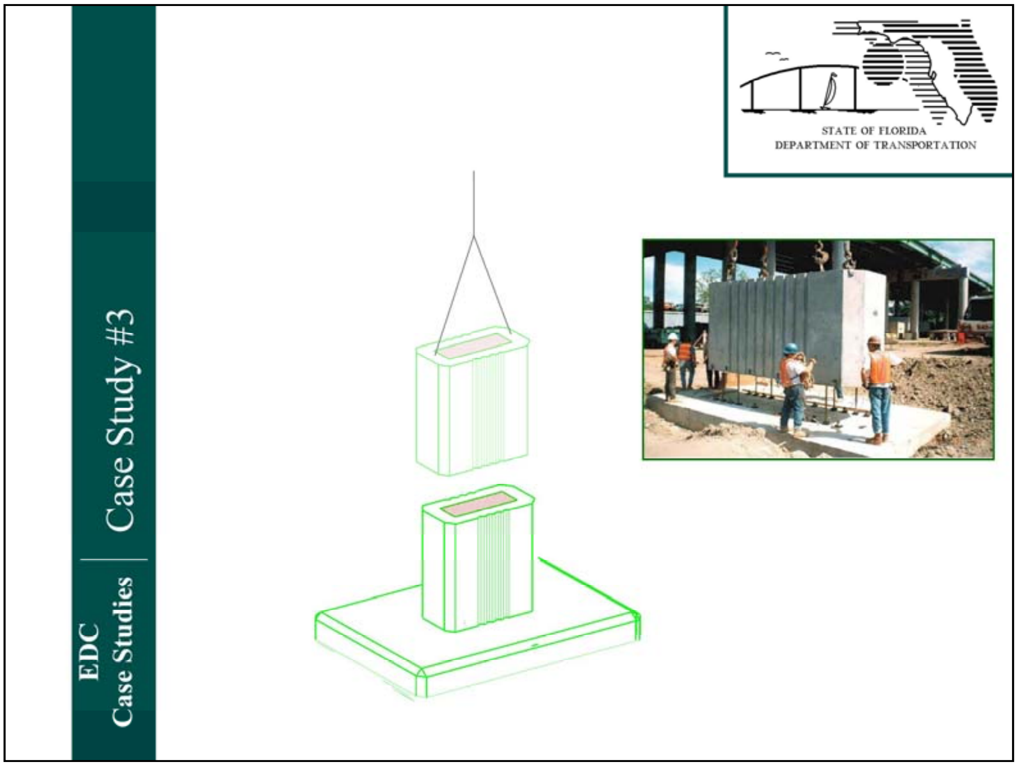
➢ Consideration could be given to a precast concrete bathtub S.I.P form concept where shell is isolated from structural concrete in-fill (no steel through interface).

➢ The new footings could be staggered from existing to allow for substructure construction of the new bridge up to some elevation prior to bridge demolition.



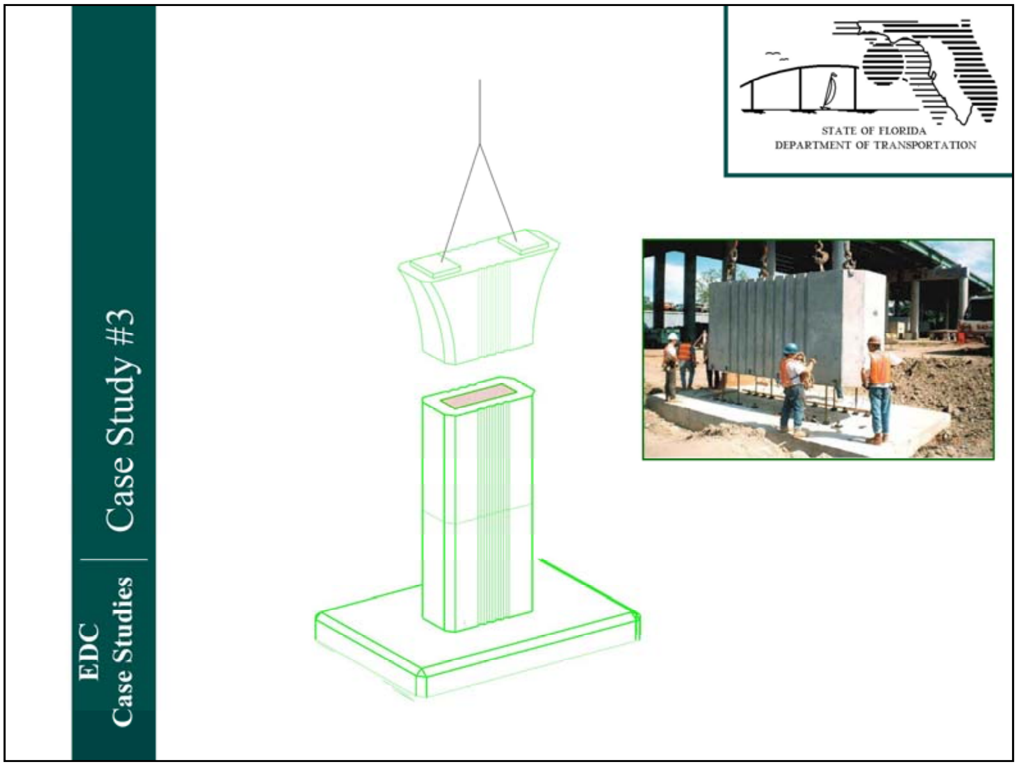
➢Here you can see the progression of the precast segmental pier column construction:

➢ With precast and/or CIP footings in place, precast column segments can "flown-in" by barge-mounted crane and placed onto a ½" bed of grout and plastic shims relatively quickly with the rebar connections then grouted.

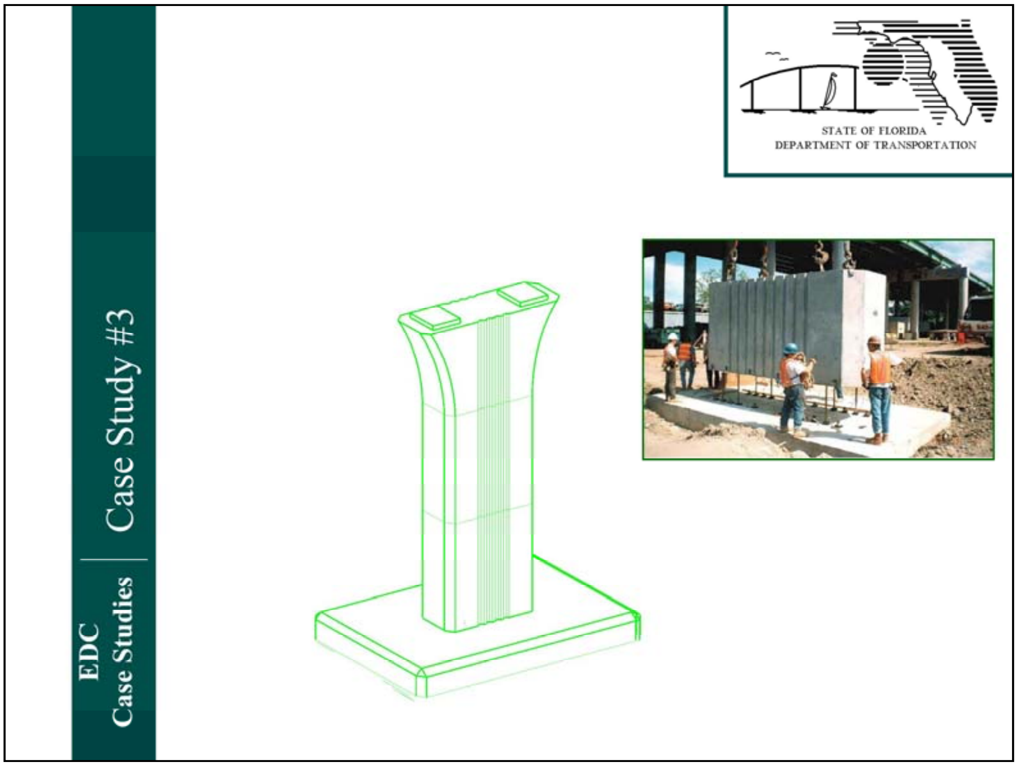


➢ Next, the second precast column segment can be epoxied along with the first and then the reinforcing bars at the column-to-column interface can be grouted.

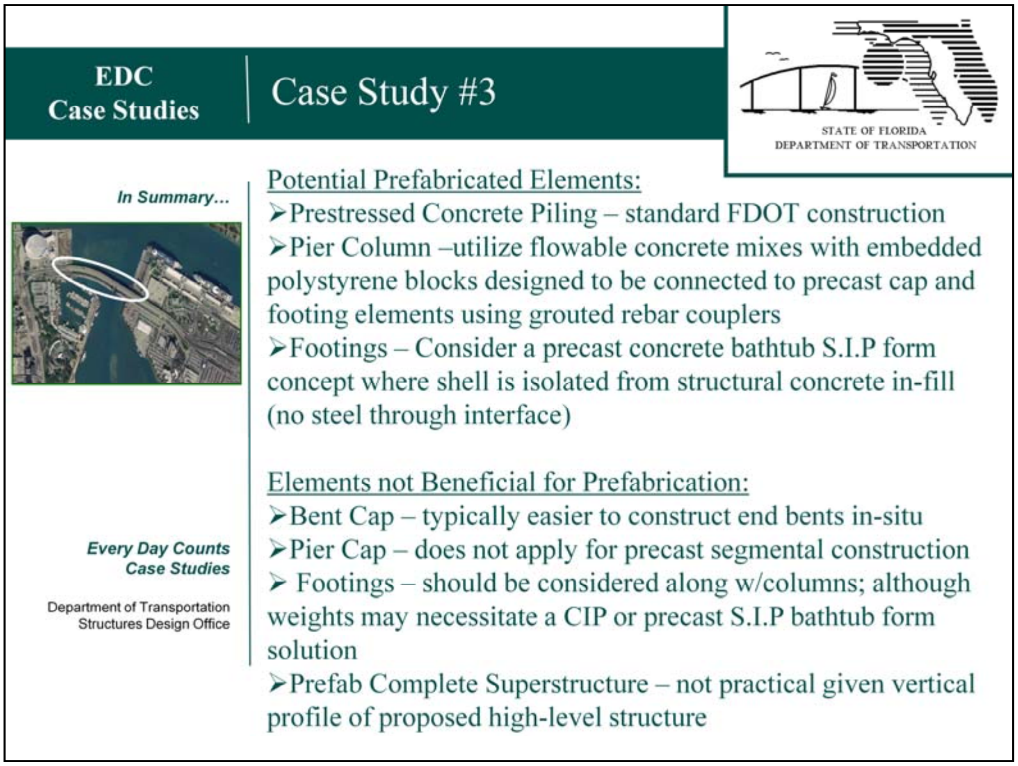
➢ This assumes mated casting of the joint.



> Lastly, the precast cap with polystyrene in-fill block to reduce weight can be placed on a ½” bed of grout and plastic shims then rebar coupler grouted into place.



> Please refer to Case Study #2 for related discussion on connection details, lifting weights, vessel collision, solid pier requirements, and other relevant topics.



In Summary…

<u>Potential elements for Prefabrication include:</u>

➢ Prestressed Concrete Piling – already standard practice in Florida

➢ Footings – consider along w/ precast columns to speed construction

➢ Pier Columns – utilize flowable concrete mixes with embedded polystyrene blocks to reduce lifting weight and design elements to be connected using grouted rebar couplers

<u>Elements not considered beneficial for Prefabrication include:</u>

➢ Florida I-Beams – proposed spans are too long to consider FIBs

➢ Bent Cap – typically easy to construct end bents in-situ

➢ Pier Cap – does not apply for precast segmental construction

➢ Prefab Complete Superstructure – not practical given vertical profile of proposed high-level structure