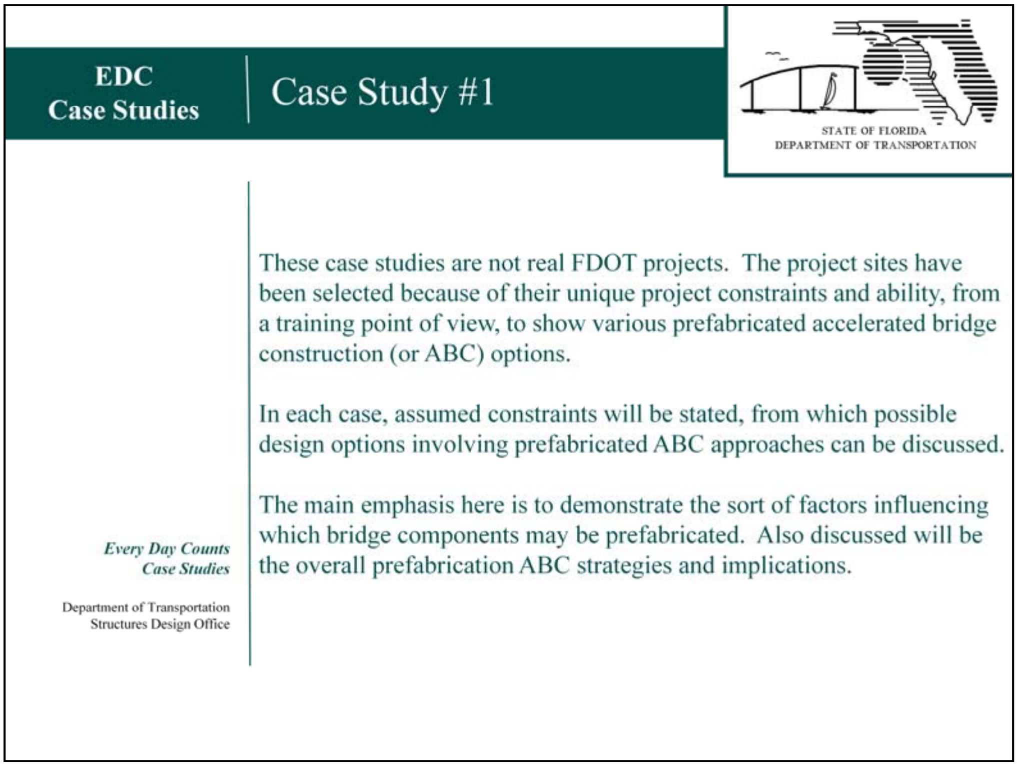
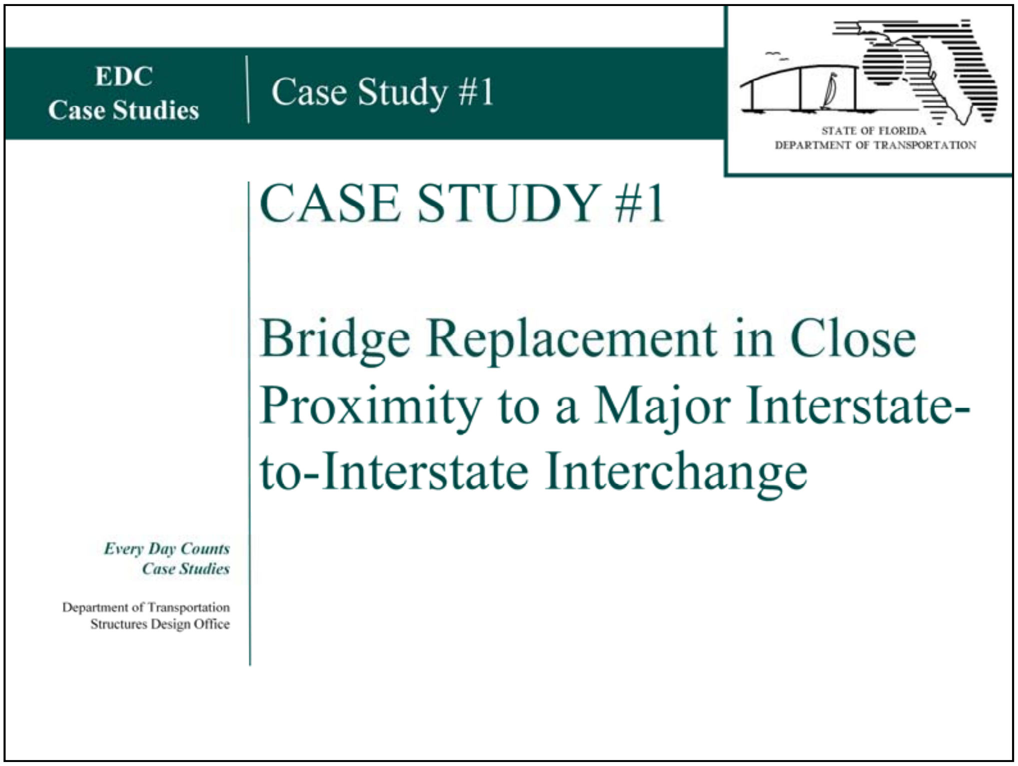
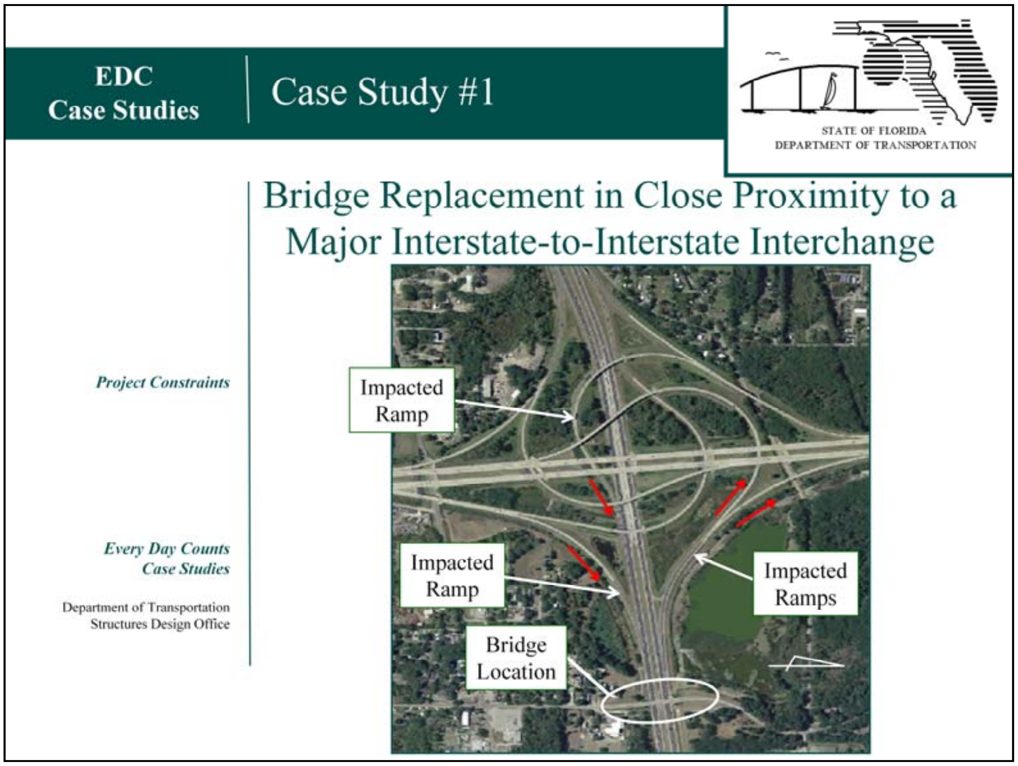


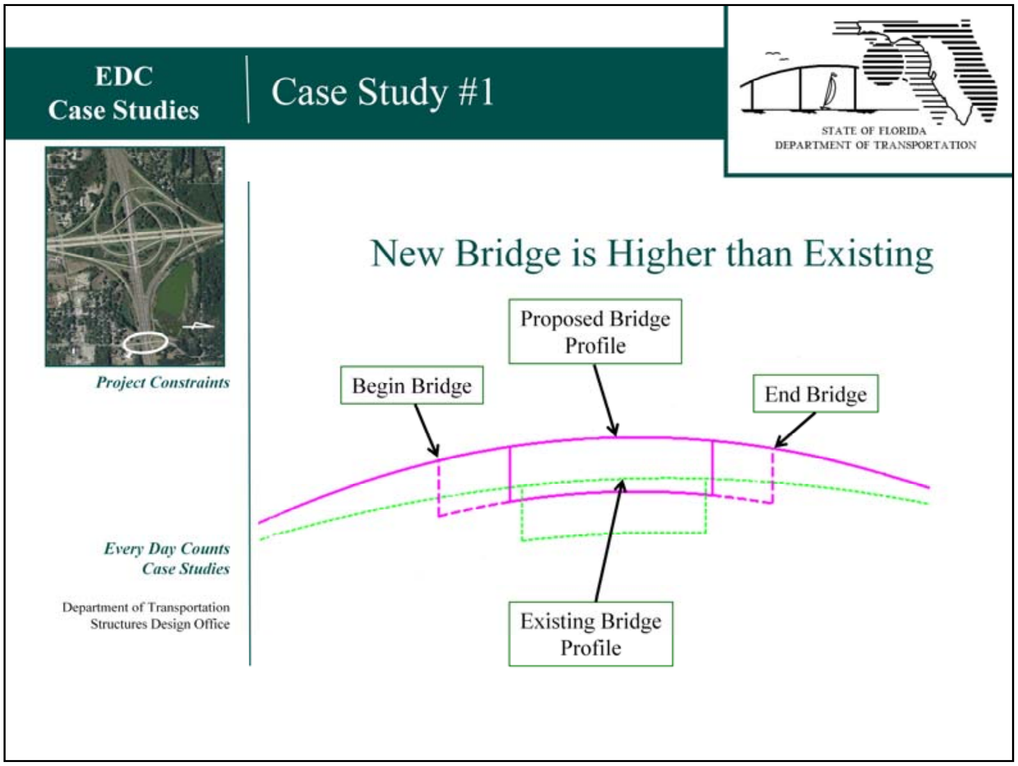
- These case studies are not real FDOT projects. The project sites have been selected because of their unique project constraints and ability, from a training point of view, to show various prefabricated accelerated bridge construction (or ABC) options.
- In each case, assumed constraints will be stated, from which possible design options involving prefabricated ABC approaches can be discussed.
- The main emphasis is to demonstrate the factors influencing the bridge components that may be prefabricated. Also discussed will be the overall prefabricated ABC strategies and implications.



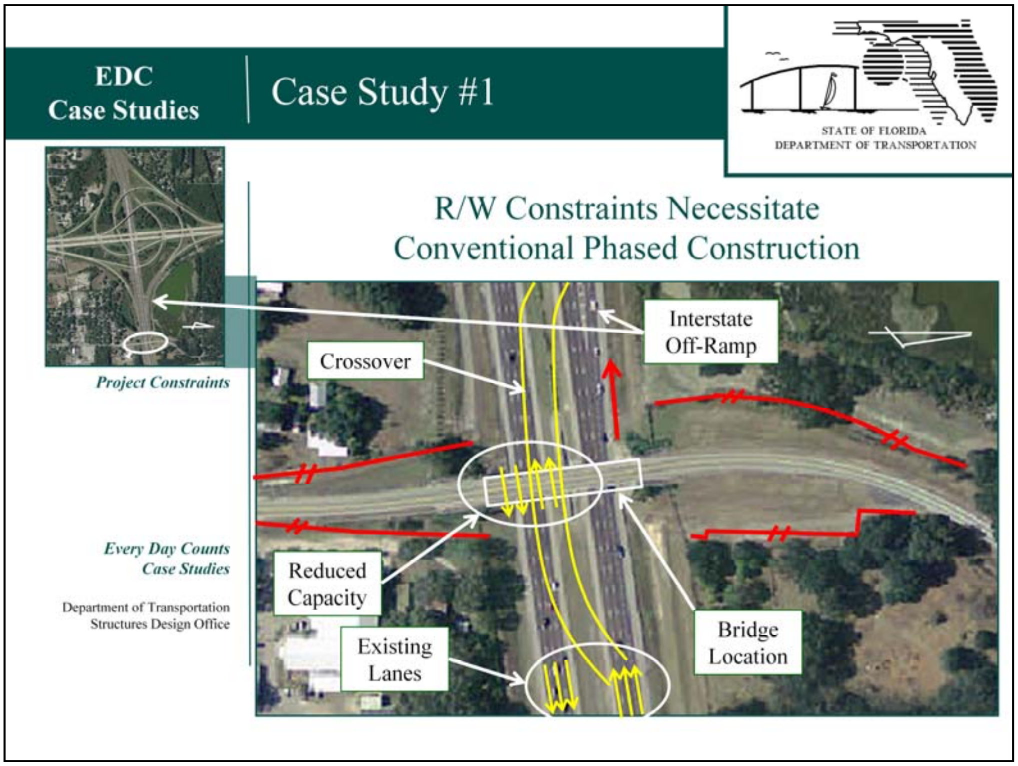
- Case Study #1 is a bridge replacement close to a major interstate-to-interstate interchange.
- This project poses unique challenges specifically related to the nearby interchange ramp access and maintenance of traffic.



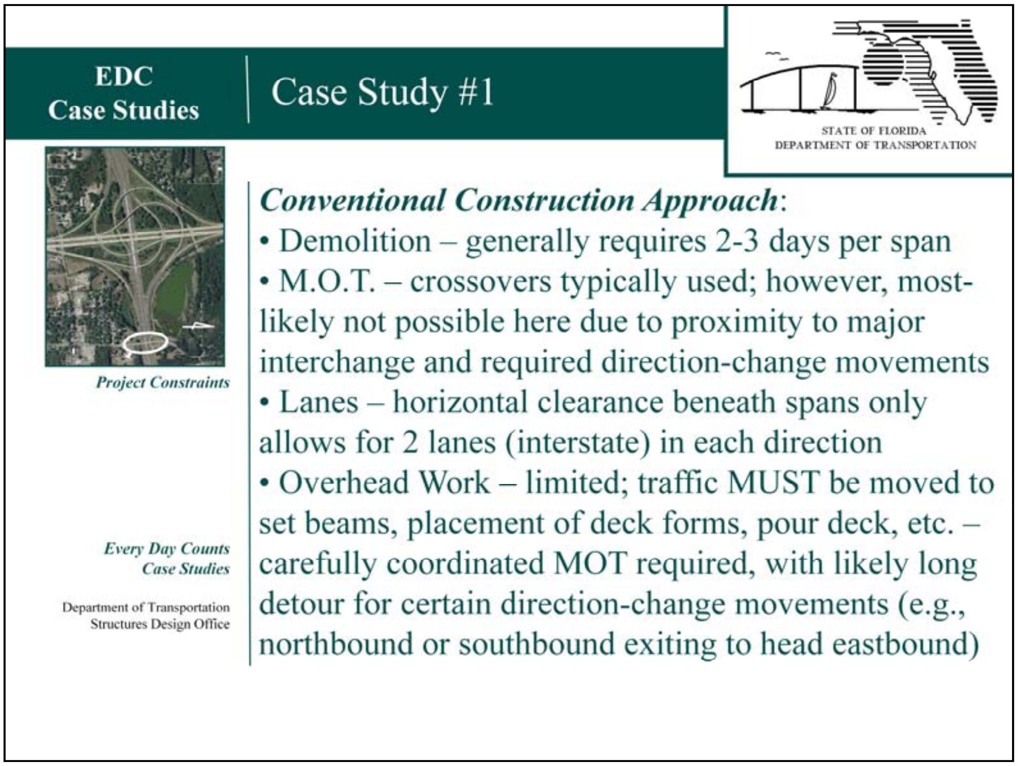
- This view shows the bridge's proximity immediately to the east of a major interstate-to-interstate interchange.
- The primary challenge for this project is the demolition of the existing structure and construction of the new structure while minimizing user impacts to traffic on the ramps, the interstate, and local roads.
- Typical bridge demolition generally takes 2 to 3 days per span.
- Maintenance of traffic for this type of work is normally accomplished with crossovers. Crossover are used in order to keep traffic from underneath spans on which work is being performed
- However, the proximity of construction and access to the ramps on the east side of the interchange make crossovers very difficult, if not impossible.



- The new bridge is on the same alignment as the existing but is at a higher elevation and has a deeper superstructure.
- This geometry, in fact, allows for consideration of an innovative design approach which allows for accelerated construction to be covered on later slides.



- The limitations of the project include:
- A crossover reduces capacity on the east-west interstate from 3 lanes in each direction to 2 lanes in each direction. Each span that has to be replaced is only long enough for 4 total lanes underneath, 2 lanes in each direction, as shown in the crossover diagram.
- As mentioned previously, the ability of the crossover to accommodate the ramps on the east side of the interchange will be difficult if not impossible (see key map in upper left corner for interchange layout and ramp proximity to bridge replacement).
- Some of the traffic may have to be directed to the next interchange to the west and then use a U-turn to accommodate the north-south movements; however, this may not be practical due to traffic volume, especially during peak hours.
- Available right-of-way would likely allow for phased bridge construction but is somewhat limited on the south end.
- Finally, phased construction lengthens construction time which extends the length of time users are impacted.



For the conventional construction approach there are several considerations…

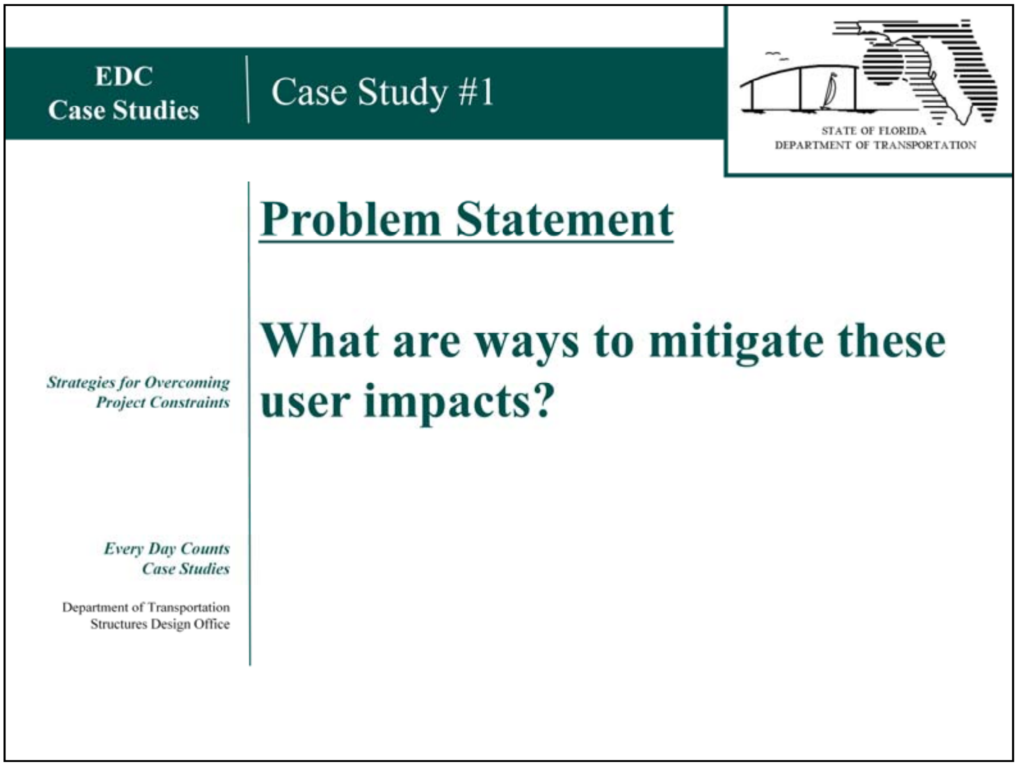
➢ Demolition - Demolition usually requires 2 to 3 days per span.

➢ Crossovers - As mentioned previously, crossovers would typically be required but would impede ramp access.

➢ Horizontal Clearance - Available clear roadway width beneath each span reduces capacity on the east-west interstate under the bridge from 3 lanes to 2 lanes in each direction.

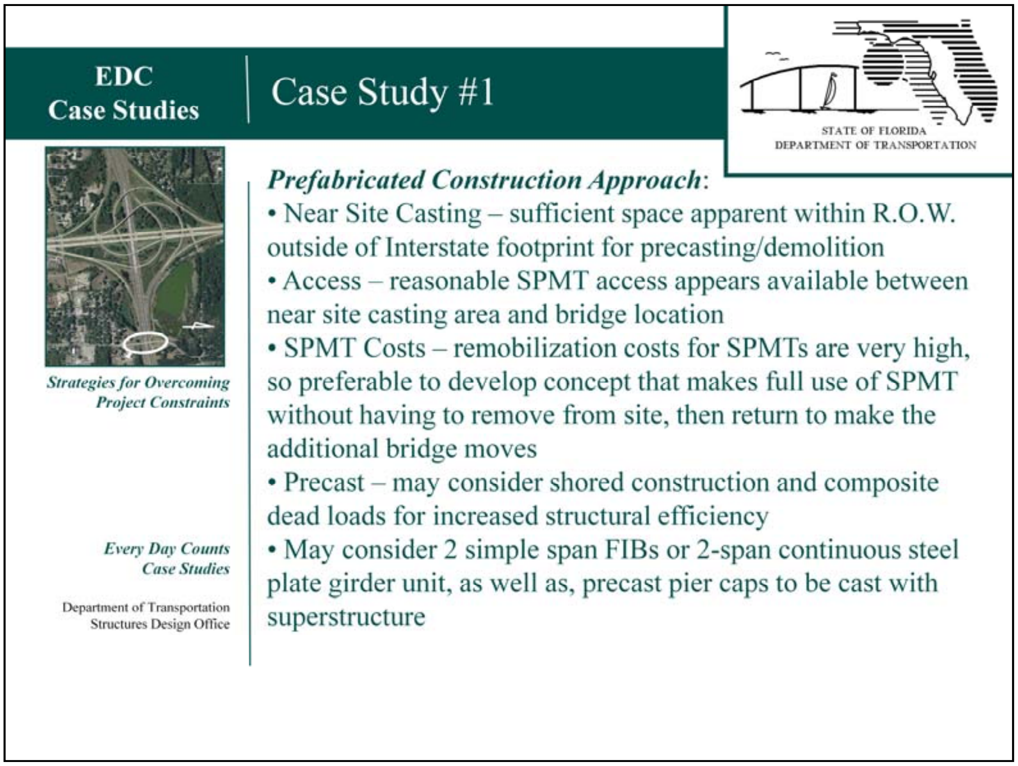
➢ Overhead Work – Beam placement at night could be done using “pacing” or “rolling road blocks”, but would affect use of interchange ramps, as well.

➢ During pacing, major connection ramps would need to be closed, traffic re-routed to the west, then U-turned back to this interchange from the other direction to use the unaffected ramps.



What are ways to mitigate these user impacts?

- One approach is to consider ways to accelerate bridge demolition, as well as, beam placement in order to accommodate traffic and reduce user impacts.



To accomplish the goals of reduced user impacts:

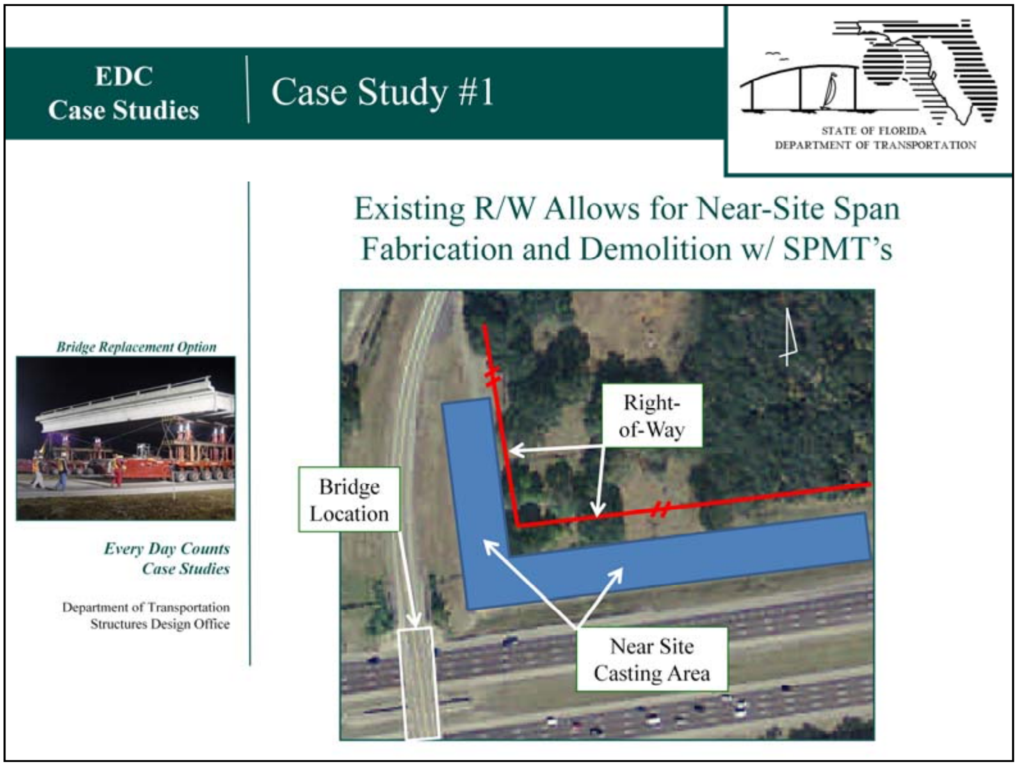
➢ Use full-span prefabricated construction with the use of Self-Propelled Modular Transporters (or SPMTs).

➢ Use Near-Site Casting. In order to use SPMTs, designers must determine if there is sufficient area within the right-of-way for near-site casting and relatively-level access from the casting site to the bridge location.

➢ Consider SPMT Costs. The mobilization costs of the SPMT are high. Therefore, the time the SPMT is on site must be limited and the use of SPMT's must be maximized by using it for both the removal of the existing bridge and the placement of the new bridge.

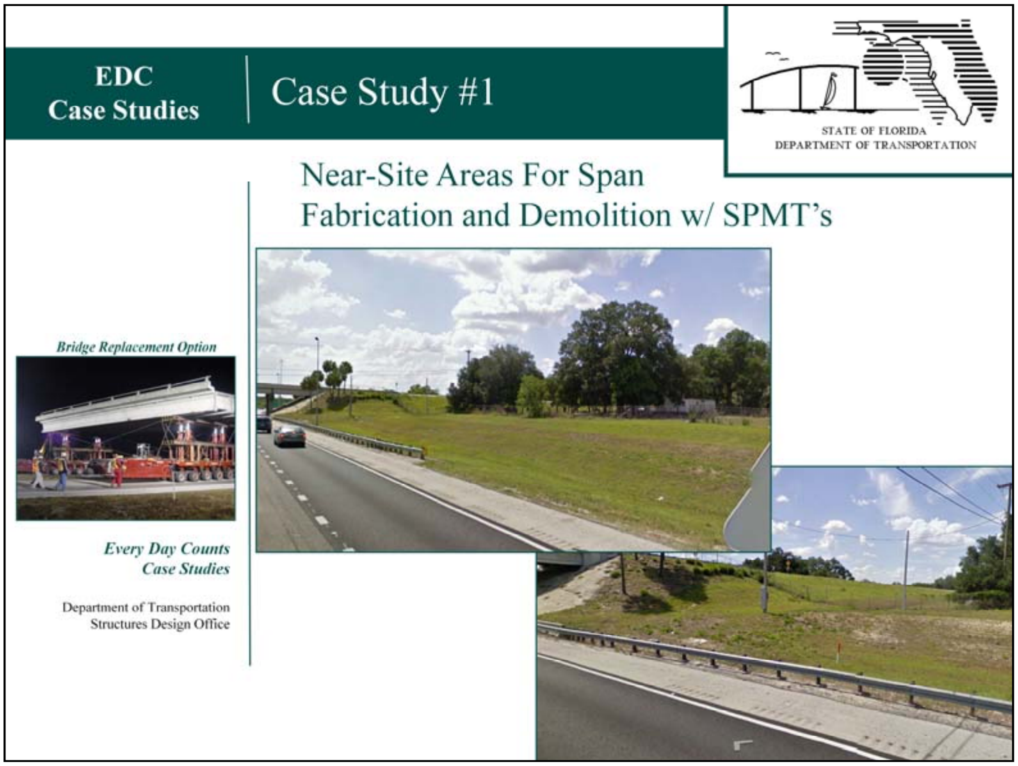
➢Consider near site precasting of the superstructure. Full-span near-site casting offers the advantage of utilizing the composite section to increase structural efficiency of the superstructure using shoring of the span during deck placement.

➢ For this example, consider using 2 simple-span bridges with Florida I-Beams (FIBs) or a 2-span continuous steel plate girder unit.

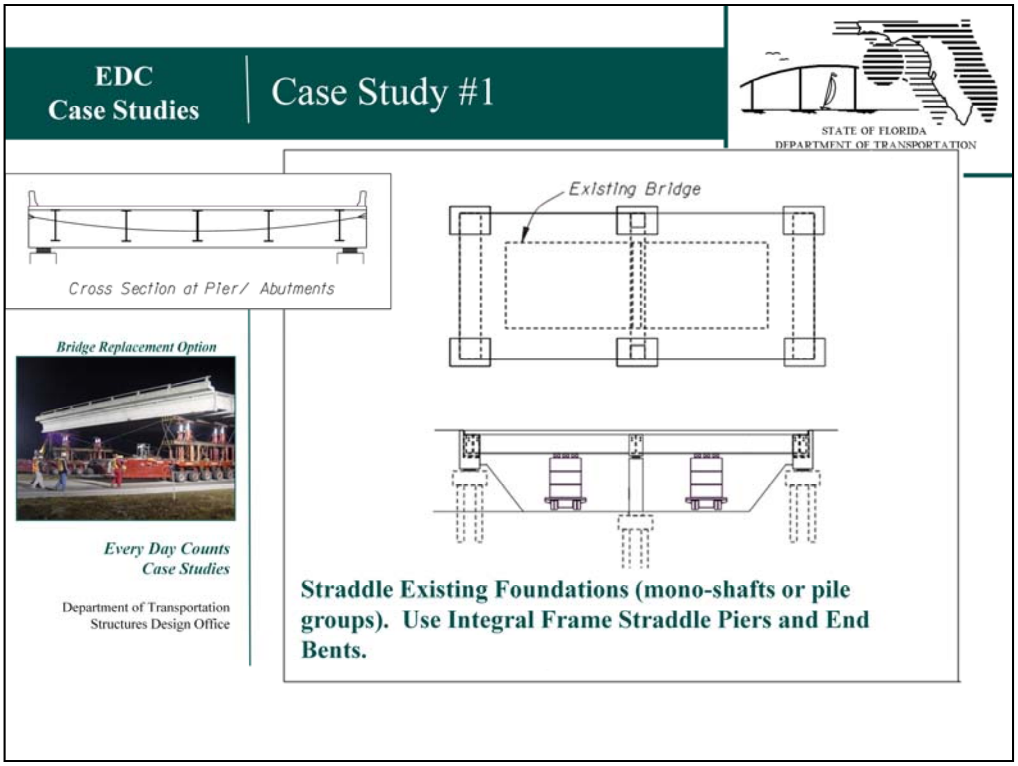


➢As seen on this slide, there appears to be sufficient level space with the right-of-way for near-site casting.

➢ This space should also be adequate for temporary storage and demolition of existing spans.



- Relatively-level terrain is evident in these two pictures. This is required for the delivery of the spans using SPMT's
- The overhead utilities seen the lower right photo may require temporarily relocation or otherwise avoided.



- As previously discussed, one strategy involves a concept for using SPMT's to remove the existing bridge and place new spans in one weekend to avoid the high cost of remobilizing the SPMT's

- This slide shows a straddle pier bridge replacement SPMT concept. The foundations for the new longer, higher bridge straddle the existing structure. This eliminates the need for phased construction and allows for simultaneous construction.

- In this case, the existing and proposed bridge width allows for the piers and abutments to straddle the existing bridge footprint. A wider bridge would likely require phased construction as well as SPMT re-mobilization

- The construction process would proceed as follows:

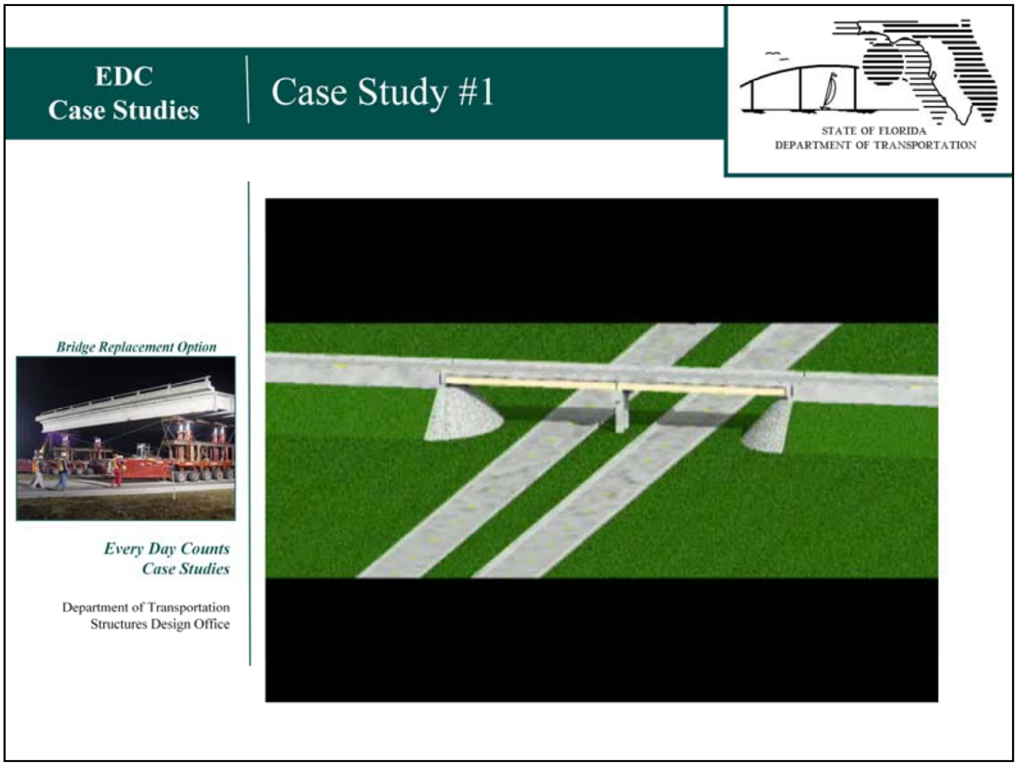
    - First, construct new foundations either side of existing pier and at end bents.

    - Simultaneously, precast new superstructure/substructure integral pier/end bent cap at the near-site location.

    - Next, remove the existing spans using SPMTs.

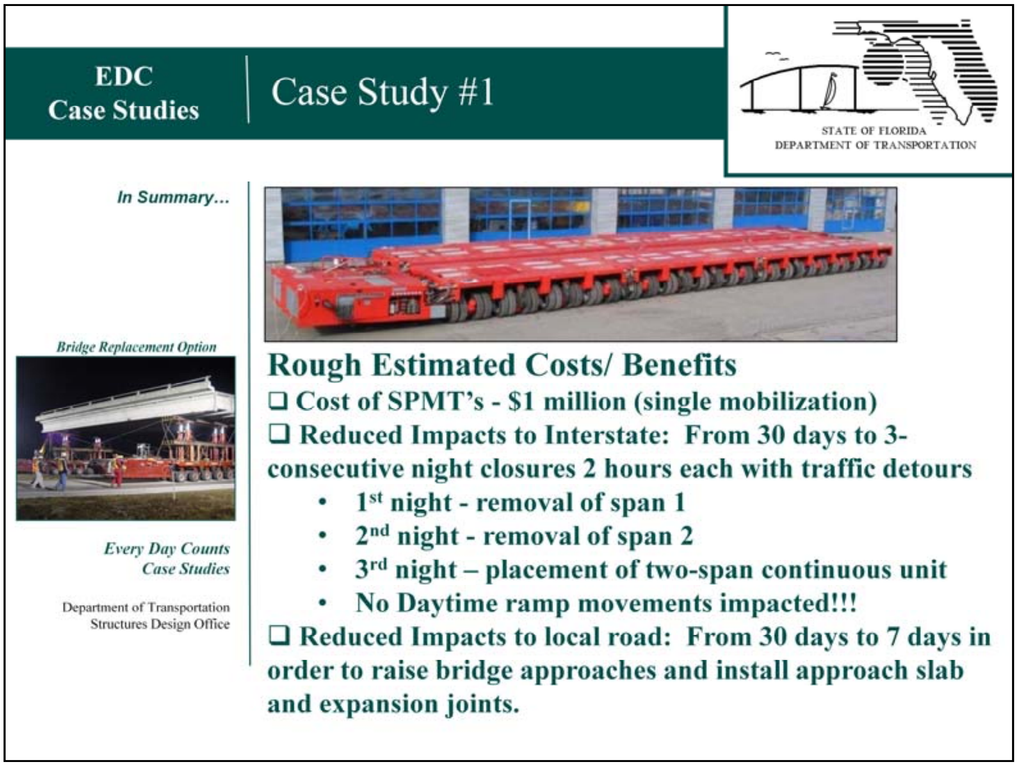
    - Finally, demolish the existing end bents and pier and deliver the new substructure/superstructure spans using SPMTs.

- The main implementation concern is fit-up of the bearings at the six (6) support locations. Preformed anchor bolt holes, specific shimming options, specific survey requirements, etc. need to be clearly stated in the plans to ensure successful fit-up in the field.



This animation shows the construction sequence

- First, the substructure and ramp approaches are constructed at their new location outside the footprint of the existing bridge and without any disruption to the interstate.
- Then the existing spans are removed using SPMTs, one span at a time, using a short interstate closure.
- Then the new 2-span unit is placed using SPMTs and a short closure time is once again required.
- Lastly, the new bridge approach slabs, expansion joints, end bents, and approach roadway are constructed while traffic on the interstate is flowing as normal.



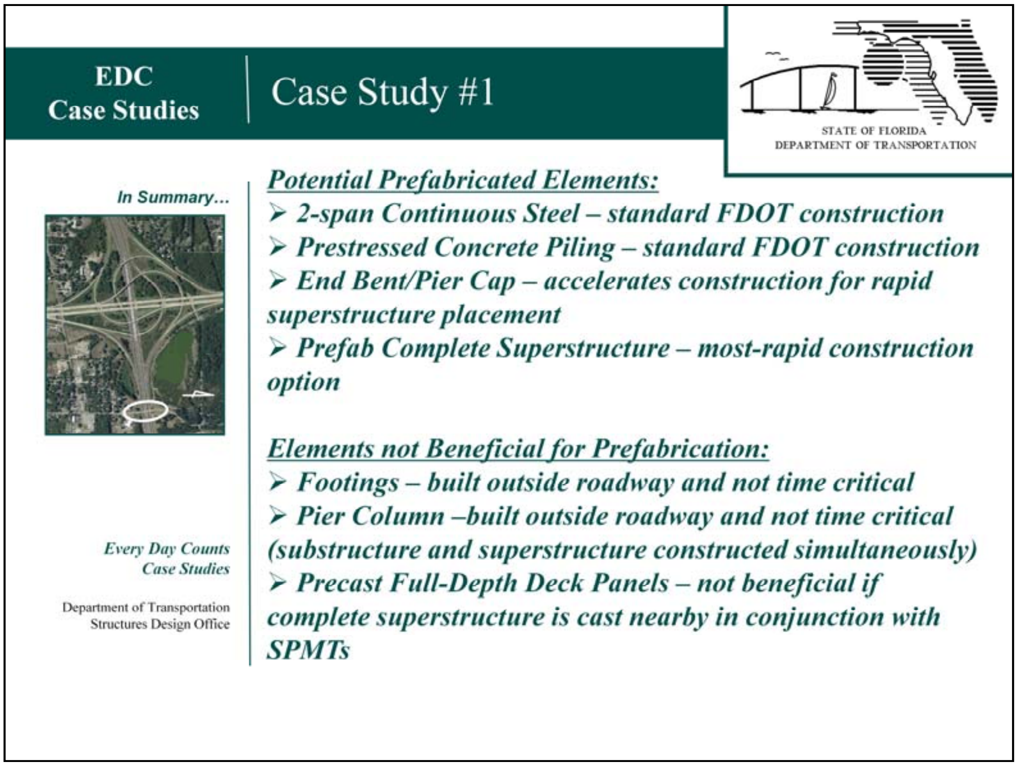
➢ The costs and benefits for this concept are estimated as follows:

➢ Generally, the cost of SPMT mobilization is approximately $1 million dollars.

➢ The user impacts on the interstate are reduced from 30 days to 3 days with none of the impacts occurring during the day.

➢ It may be possible to combine both span removals into a single night further reducing user impacts.

➢ And finally, local road user impacts are reduced from 30 days to 7 days.



In Summary, the …

Potential elements for prefabrication include:

➢ Usisng 2-span Continuous Steel which is already standard practice in Florida

➢ Also Prestressed Concrete Piling which is also standard practice in Florida

➢ End Bent/Pier Cap. The construction of these components accelerates the superstructure placement.

➢ and Prefab Complete Superstructure. This is the most-rapid construction option

The elements not considered beneficial for prefabrication include:

➢ Footings which are constructed outside roadway and not on critical path

➢ Pier Columns which are constructed outside roadway and not on critical path (substructure and superstructure can be constructed simultaneously)

➢ and Precast Full-Depth Deck Panels which are not beneficial if the complete superstructure is cast nearby in conjunction with SPMTs