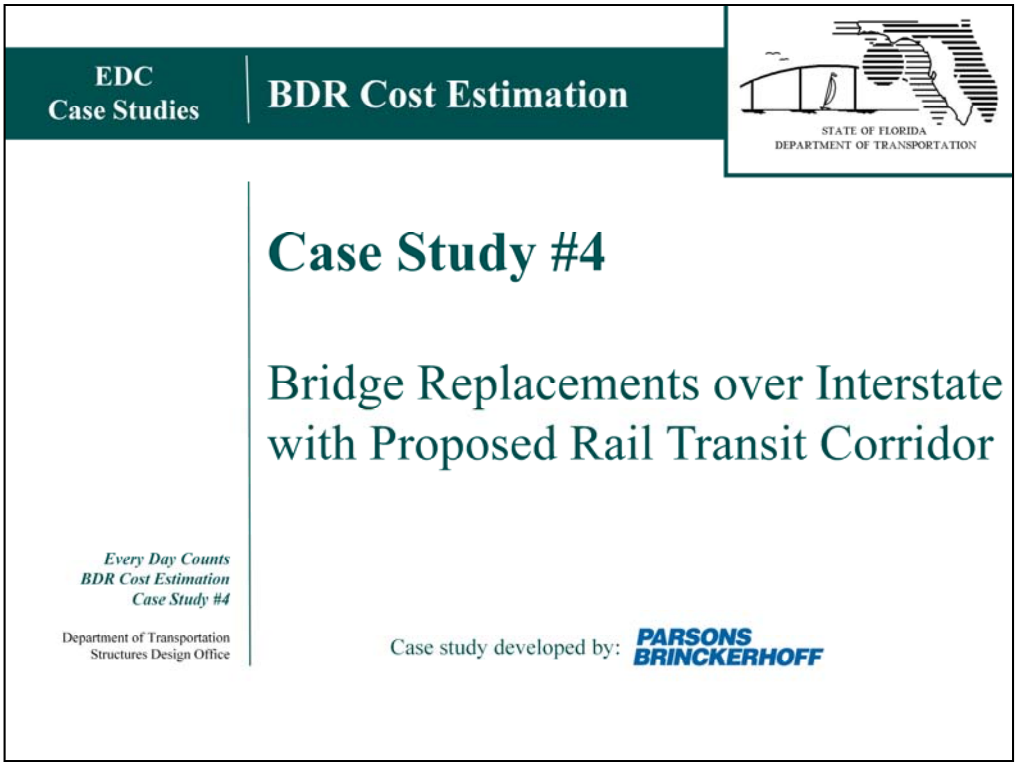

- Case Study #4 will investigate two local road bridge replacements over an interstate that is being upgraded to increase traffic capacity and add a proposed rail transit corridor in the median.
- The audience is cautioned to view Case Studies #1 and #2 prior to this case study, since this presentation will not repeat the material discussed previously.

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Project Constraints

Bridge Replacements over Interstate with Proposed Rail Transit Corridor

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Case Study #4

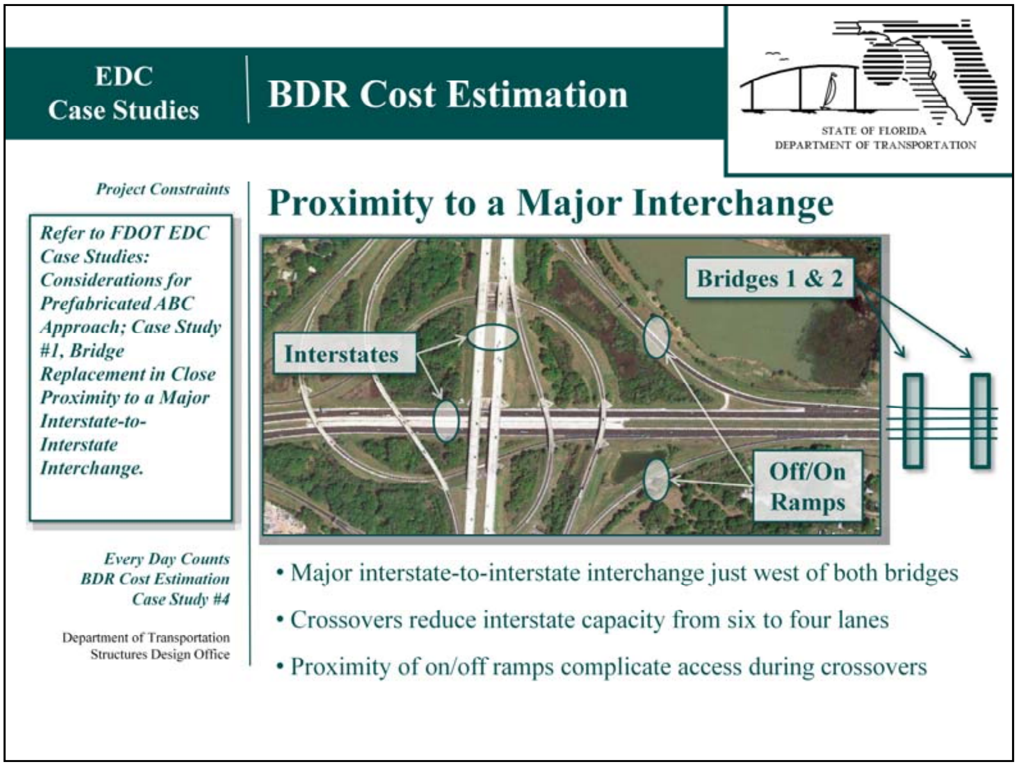
Department of Transportation
Structures Design Office

- Two bridges being replaced over the interstate
- Bridges have deficient vertical clearance for proposed transit corridor in median of interstate
- More horizontal clearance desired due to widening interstate
- Bridges are over 60 years old and are deteriorating

➢ This aerial view shows the existing bridges which pass over the interstate. The bridges are located approximately one-half mile apart, and have similar cross-sections and structural configurations.

➢ Replacement is required due to the following factors:

> ➢ First, a transit corridor is being established in the median of the interstate, and the existing bridges do not have sufficient vertical clearance
>
> ➢ Second, the interstate is adding an outside lane in each direction, thus it is desired to have longer bridges to accommodate the required horizontal clearance, and
>
> ➢ Lastly, the existing bridges were built over 60 years ago and show signs of deterioration.

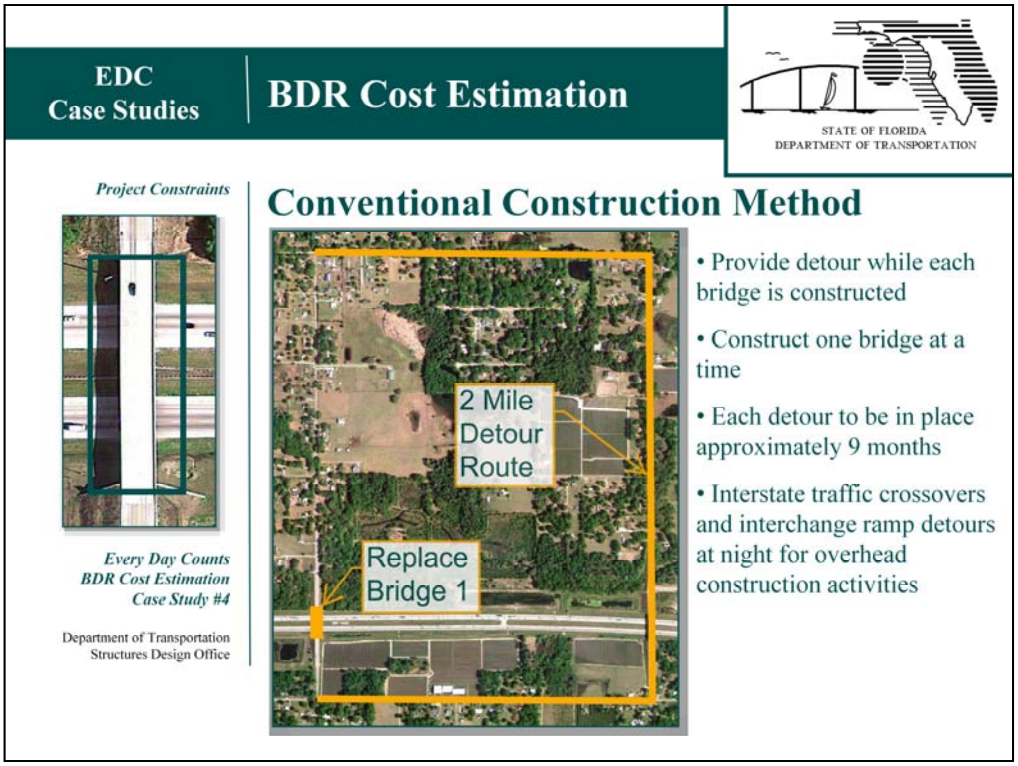


➢ This view indicates proximity of a major interstate-to-interstate interchange just west of the two bridges that will be replaced.

➢ The scenario is similar to Case Study #1 of the Florida Department of Transportation's EDC Case Studies entitled: Considerations for Prefabricated ABC Approach. Due to the similarities with this case study, not all traffic impacts of conventional construction will be listed in detail. However a few of the larger concerns are as follows:

➢ Maintenance of traffic during bridge construction will be accomplished with crossovers to keep traffic from underneath spans in which work is being performed. This will reduce capacity from 3 lanes in each direction to 2 lanes.

➢ The close proximity of bridge construction to on-ramps and off-ramps of the intersecting facility will complicate access to these ramps during crossovers. Some ramp traffic will have to be directed to the next interchange to the west and then use a U-turn to accommodate the north-south movements.

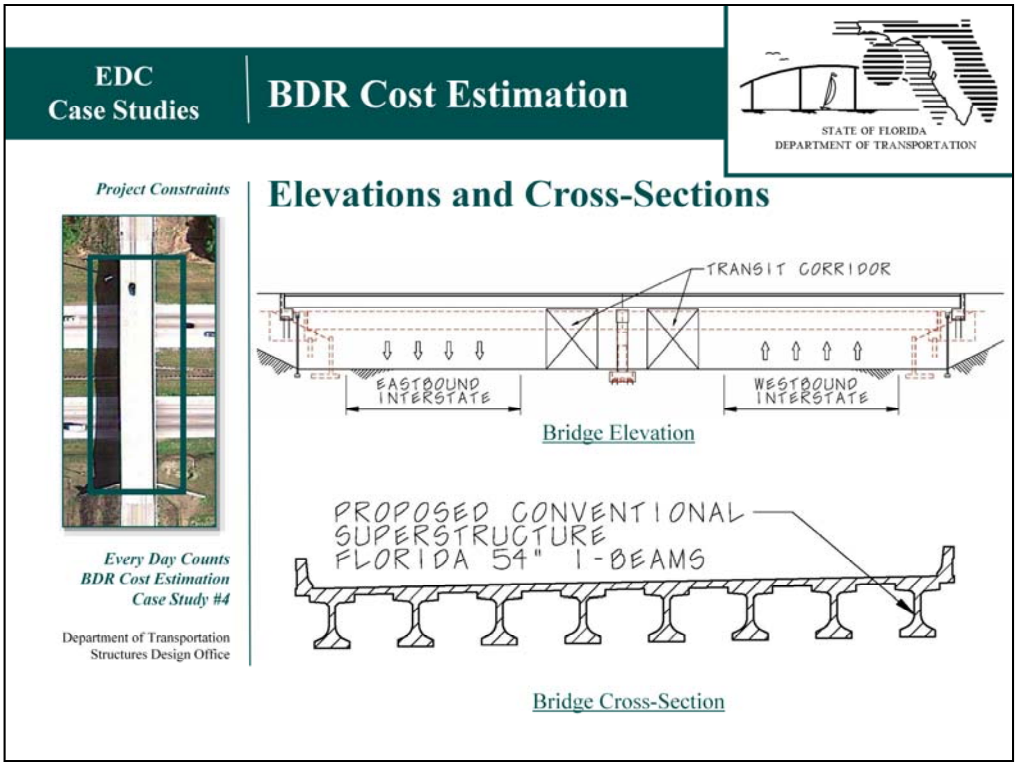


➢ Due to the close proximity of the two bridge locations, a two mile detour route can be used while each bridge is being constructed. Therefore, a detour bridge will not be needed.

➢ After the first bridge is finished, the detour will be switched, and the second bridge then constructed.

➢ This scenario will require each detour to be in place for approximately 9 months.

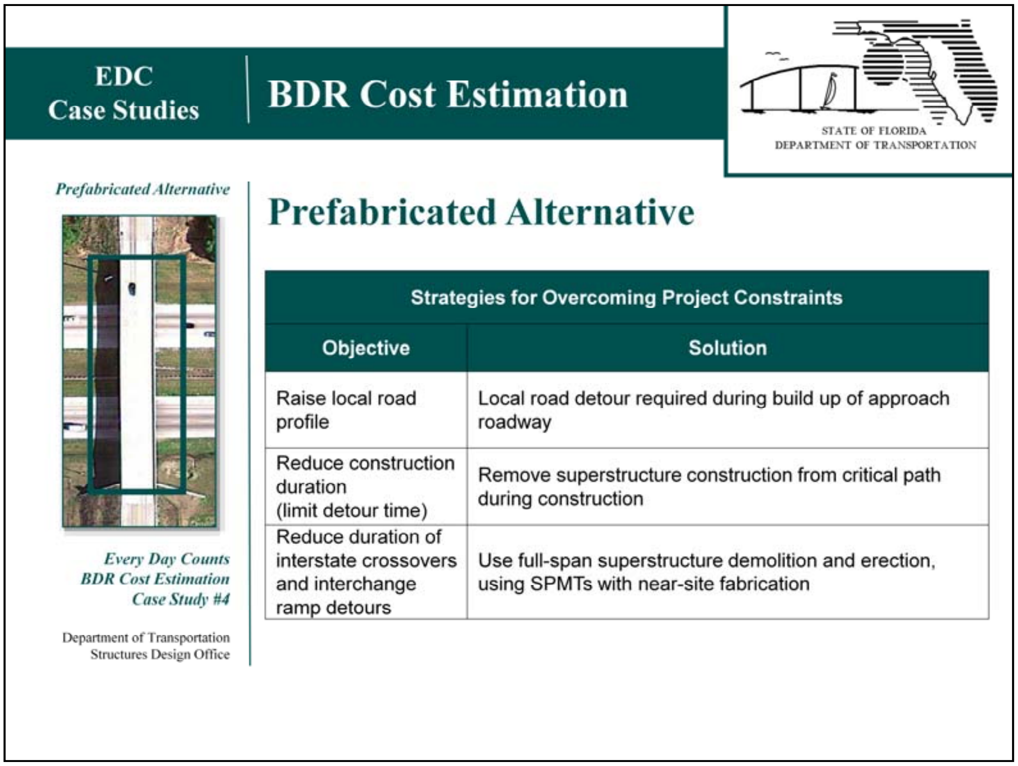
➢ As mentioned in the prior slide, it is anticipated that night time interstate crossovers and interchange ramp detours will be used during overhead bridge construction activities. These include items such as bridge demolition, girder erection, and bridge deck construction.



➢ The improved cross-section of the interstate is shown here, along with an elevation of the existing and proposed new bridges.

➢ The proposed bridges are two-span structures with wrap-around MSE wall end bents. Longer spans add more horizontal clearance, and increase the bridge profile to allow adequate space for the transit corridor.

➢ The proposed bridge cross-section is assumed identical to those used for Case Studies 1 through 3.

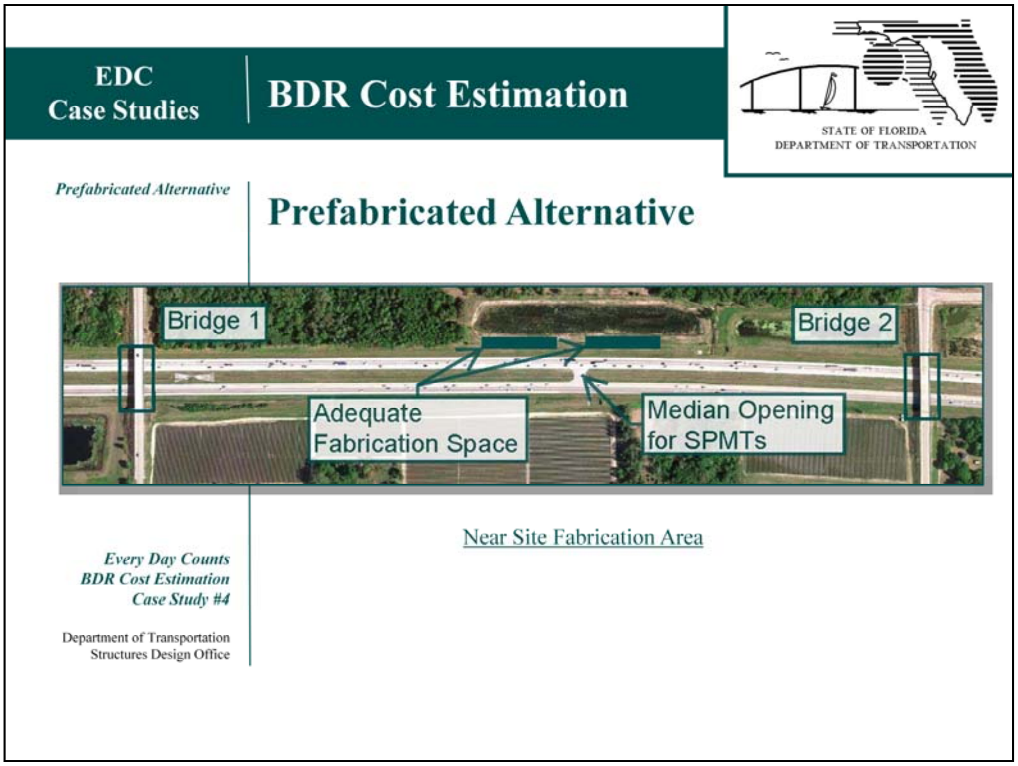


➢ The prefabricated alternative will attempt to minimize user impacts to the local road and interstate traffic.

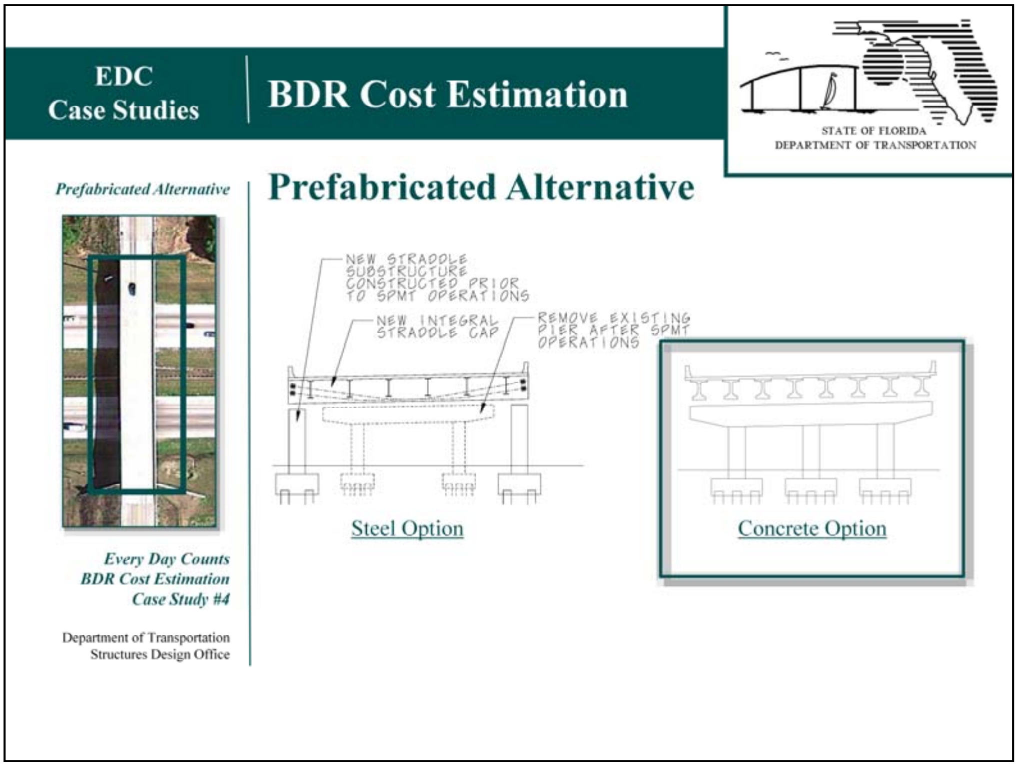
➢ Due to raising the bridge profile, the approach roadways will require significant grade work, therefore the detours are inevitable. However, if the construction duration can be shortened by using a prefabricated approach, it could provide significant relief to the users of the local roads.

➢ Another objective is to reduce the duration of interstate crossovers and interchange ramp detours. This can be done by constructing the superstructures adjacent to the site, and moving them into place using SPMTs during a single night time closure. The SPMTs can also be utilized to remove the existing superstructure prior to demolition.

➢ SPMTs also have the inherent benefit of reducing construction time of the bridges. This allows the contractor to construct the substructures and superstructures simultaneously, hence limiting the detour time required, and considerably reducing the construction duration of each bridge.



- The aerial photograph shown here indicates there is adequate space to fabricate the superstructures adjacent to the site. Since the bridges are located only one half a mile apart, the superstructures can be assembled at the half way point, and easily moved during the night time closure.
- The aerial view also points to an existing paved median opening, located near the halfway point between bridges. This is advantageous since it will allow the SPMTs to easily access both sides of the interstate.



➢ Two scenarios for the prefabricated superstructure were considered; steel plate girders with an integral pier cap, as well as a prestressed Florida I-Beams.

➢ Advantages for the steel option were presented in Case Study #1, where it was assumed that existing end bents were reused and widened. However for this case study, the end bents will need to be replaced due to their age and the raising of the vertical profile. This makes the steel solution less attractive, as the time savings is negated by the necessity to construct the end bents and retaining walls after removal of the existing superstructure.

➢ Other disadvantages are that the steel option will have a higher direct cost and will require a full interstate facility closure due to continuity of the superstructure.

➢ Therefore, the steel option is less beneficial to this scenario, and hence, the concrete option will be used for the prefabricated alternative.

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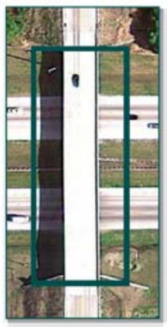
Prefabricated Alternative



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Case Study #4

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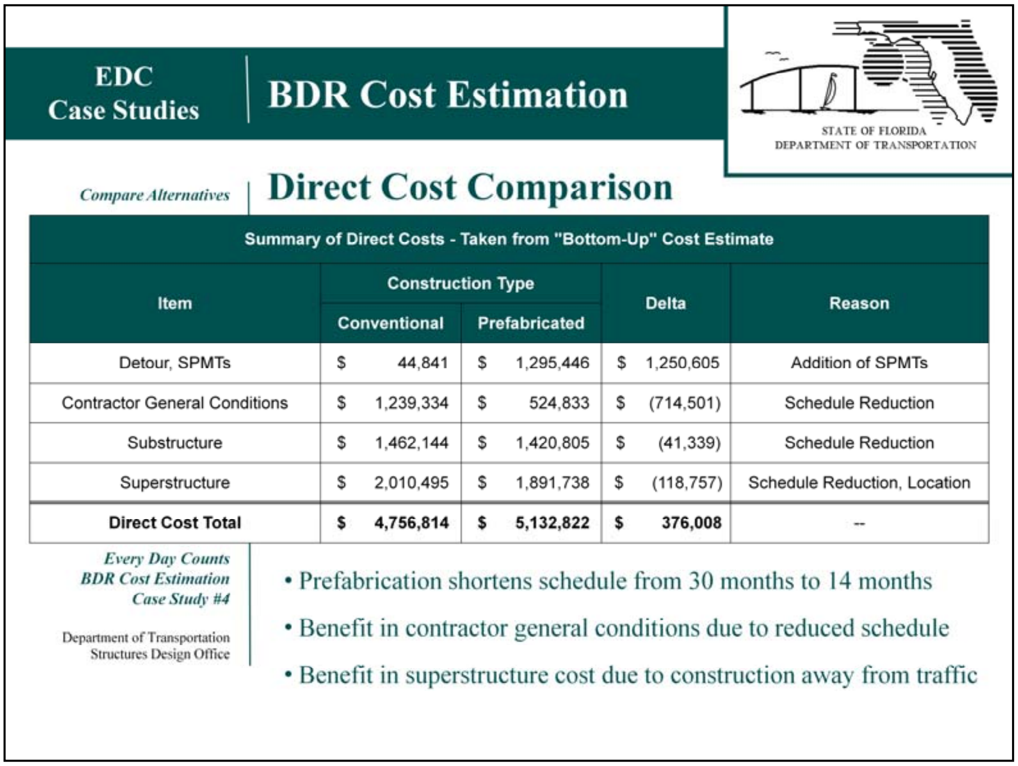
Prefabricated Alternative

User Benefits per Bridge			
User Impact	**Conventional**	**Prefabricated**	**Savings**
Local Road Detours	36 weeks	21 weeks	15 weeks
Interstate Crossovers	18 nights	4 nights	14 nights
Interstate-to-Interstate Ramp Detours	18 nights	4 nights	14 nights

➢ Bridge composition for the prefabricated alternate will be identical to that used for Case Study #2.

➢ The chart shown here compares user impacts for each alternative.

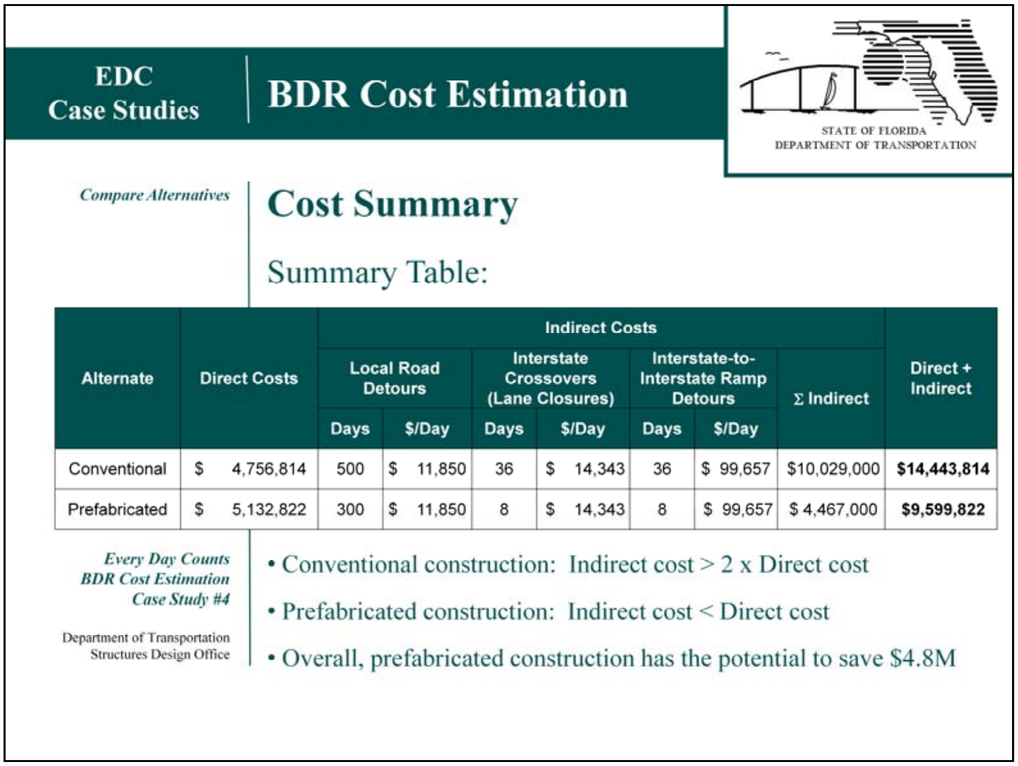
➢ The prefabricated alternative achieves significant time savings for the duration of local road detours, the number of interstate crossovers and associated interstate to interstate ramp detours. These time savings are attributed to using SPMTs for both demolition and erection, but do come at a cost since both local roads cannot be demolished and replaced at the same time. The time lag between SPMT operations will factor into the direct costs.



➢ Direct cost for each alternative has been calculated by a construction estimator, and is presented here.

➢ Similar to the prior case studies, costs for conventional versus the prefabricated solutions are compared. The rightmost columns indicate cost deltas between the alternatives, and list the prevailing reason for the differences.

➢ Overall the prefabricated alternative has a direct cost of 376 thousand dollars or about 8% more than conventional construction.



Alternate	Direct Costs	Indirect Costs							Direct + Indirect
		Local Road Detours		Interstate Crossovers (Lane Closures)		Interstate-to-Interstate Ramp Detours		Σ Indirect	
		Days	$/Day	Days	$/Day	Days	$/Day		
Conventional	$ 4,756,814	500	$ 11,850	36	$ 14,343	36	$ 99,657	$10,029,000	**$14,443,814**
Prefabricated	$ 5,132,822	300	$ 11,850	8	$ 14,343	8	$ 99,657	$ 4,467,000	**$9,599,822**

- The combination of direct and indirect costs associated with each construction scenario is shown here.
- It is obvious that the indirect costs associated with this case study is substantial.
- For conventional construction, the indirect cost is more than double the direct costs.
- For prefabricated construction, the indirect cost is slightly less than the direct costs.
- When looking at the summations, the prefabricated alternative is $4.8M dollars less than conventional construction, and supports the indication that prefabricated elements should be considered for the project.

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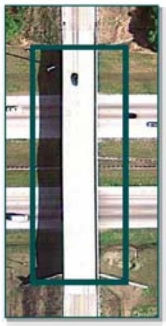
Compare Alternatives



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Assessment Matrix

Selection Factor	Factor Weight (%)	PREFABRICATED		CONVENTIONAL	
		Score (0 to 5)	Weighted Score*	Score (0 to 5)	Weighted Score*
Total Direct Costs	50	4	200	5	250
Total Indirect Costs	25	4	100	1	25
Factor 3 - *Constructability*	5	3	15	5	25
Factor 4 - *Traffic Impacts*	0		0		0
Factor 5 - *Construction Duration*	10	5	50	3	30
Factor 6 - *Durability*	0		0		0
Factor 7 - *Environmental Impacts*	0		0		0
Factor 8 - *Aesthetics*	0		0		0
Factor 9 - *Project Risk*	10	3	30	5	50
Factor 10 - *Other*	0		0		0
TOTAL (Σ Factor Weights = 100%)	100	--	***395***	--	380
TOTAL (Excluding Indirect Cost Factor)**	75	--	295	--	***355***

- Indirect costs make prefabricated construction more favorable

➢ This slide presents the assessment matrix prepared for this case study.

➢ Looking at the last two rows of the table, when excluding indirect cost, conventional construction is more favorable. However when accounting for both direct and indirect costs, the prefabricated construction alternative is more favorable.