Florida Department of Transportation

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OFFICE OF THE
SECRETARY

STRUCTURES DESIGN BULLETIN C11-04
ROADWAY DESIGN BULLETIN 11-06

DATE: April 5, 2011

TO: District Directors of Operations, District Directors of Production, District Design Engineers, District Construction Engineers, District Geotechnical Engineers, District Structures Design Engineers

FROM: Robert V. Robertson, P. E., State Structures Design Engineer
David O'Hagan, P.E., State Roadway Design Engineer

COPIES: Brian Blanchard, David O'Hagan, David Sadler, Charles Boyd, Jeffrey Ger (FHWA), Derek Soden (FHWA)

SUBJECT: FHWA Every Day Counts Initiative–Precast Bridge Components

REQUIREMENTS

Plans Preparation Manual, Volume 1

1. Replace Section 26.9.2.9 with the following:

Precast Bridge Options: Investigate the use of either partial or full precast bridge alternate(s) with the specific purpose of accelerating bridge construction and reducing user impacts. As part of this investigation:

A. Conduct a feasibility assessment responding to questions similar to those listed in Exhibit 26-F.
B. Based on responses to the feasibility questions, explain whether a precast alternate should be considered an advantage on the project or what site constraints, economic impacts, or other factors (e.g., haul distance from precast yard, project variability, etc.) precluded or limited its application. If precasting is determined not to be applicable for the project, provide a statement in the BDR indicating so and the reasons why. This statement fulfills the requirements of this section.
C. Only if precasting is found to be viable, evaluate preliminary precast alternates and associated MOT schemes against conventional methods using the assessment matrix and referenced links given in Exhibit 26-F. Provide enough detail in the preliminary evaluation in order to estimate total direct and indirect costs. Indirect costs, typically referred to as road user costs, include fuel use and man-hour losses resulting from detours, anticipated traffic

flow reduction, and reduced speed limits. Determine indirect costs using the Department's software at the following link:

http://infonet.dot.state.fl.us/tlconstruction/SchedulingEng/AddSoftwareScheduling.htm.

At this stage, a meeting with the District Structures Design Engineer is recommended to discuss the preliminary evaluation and cost estimates before finalizing the alternates for inclusion in the BDR.

D. Report the estimated total direct costs and estimated total indirect costs, as well as the sum of both, for <u>*each*</u> alternate as three separate dollar amounts in a summary table in the same section as the completed assessment matrix (see "Alternate Cost Summary table in Exhibit 26-F).

<u>Commentary</u>: *Providing both the direct and indirect costs of the project in the BDR enables Department management to make informed decisions to maximize construction dollars while at the same time minimizing construction time and economic impacts to Florida's traveling public.*

Also, demonstrate in the BDR text that consideration was given to identify and employ other innovative techniques aimed at reducing costs, shortening project delivery time, enhancing safety during construction, and protecting the environment.

2. Insert Exhibit 26-F:

As attached to this Structures Design Bulletin.

<u>COMMENTARY</u>

The primary purpose for investigating the use of precast elements versus conventional construction is to determine the best balance between direct and indirect costs while delivering the bridge project in a timely manner and minimizing impact to the traveling public.

Additional direction regarding determining the direct cost implications of the precast approach will be forthcoming in a future release of the ***Structures Manual***. Some of the topics will include savings associated with: (1) labor rates and insurance costs for reduced time working from a barge on a large water project; (2) structural efficiencies resulting from precasting (e.g., composite dead loads in the case of shored deck casting); and, (3) increased productivity rates of precasting.

<u>BACKGROUND</u>

The FHWA and FDOT support use of accelerated project delivery techniques, such as precast/ prefabricated elements and systems, as an economical way to increase quality, reduce costs and time to construct, and support safety.

The FHWA has deployed a new initiative, entitled "Every Day Counts," which is intended to highlight some advantages of accelerated project delivery. Prefabricated bridge elements and systems may offer time savings, cost savings, safety advantages, and convenience for travelers. The use of these innovative concepts can aid in solving many constructability challenges while potentially revolutionizing bridge construction in the United States and should be investigated.

More information on the Federal Highway Administration's "Every Day Counts" accelerated project delivery initiative can be found at the following website: http://www.fhwa.dot.gov/everydaycounts/.

IMPLEMENTATION

This revision to ***PPM*** Vol. 1, Section 26.9.2.9 is effective immediately for all projects still in the BDR stage and all future projects.

This Structures Design Bulletin is intended to clarify current policy. Prior to negotiating man-hours or finalizing the BDR scope of services, the District should perform an informal feasibility assessment in order to determine if precast alternates should even be considered. See Exhibit 26-F for the Feasibility Assessment Questions.

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Attachment

PPM Chapter 26 Exhibit 26-F: Precast Alternate Development

Precast Feasibility Assessment Questions:

Several negative responses to the following questions more than likely indicate precasting is not feasible for the project. In this case, provide a statement in the BDR stating that precasting is not feasible and indicate the reasons why in order to satisfy the requirements of ***PPM*** Vol. 1, 26.9.2.9.

- Will precasting reduce traffic impacts? Factors may include: average traffic volumes being affected, detour lengths and durations, lane reductions and duration.
- Is this structure likely to be on the critical path for construction of the project or is this structure on a hurricane evacuation route which requires accelerated delivery?
- Is the size of the project large enough to benefit from economy of scale, assembly line construction processes, and is it large enough to capitalize on a construction learning curve?
- Is precasting practical given the project aesthetics when component lifting weights are considered?
- Is precasting practical given project variability? Factors may include: formwork reuse, multiple construction methods and steps, and variable equipment requirements.
- Does the project site have space within FDOT R/W to use as a near-site casting yard and can precast elements be hauled from likely near-site casting yard locations to the site?
- Can precast elements be hauled from likely off-site prestressed yard locations to the site?
- Are the lifting weights practical given the assumed equipment, construction access, and construction methods?
- Can connection details be developed with the following characteristics –
  - > durable?
  - > easily inspected during construction?
  - > accommodates shaft/pile placement tolerances?
  - > accommodates fit up?
  - > accommodates differential camber (full-depth deck panels)?

<u>Assessment Matrix</u>:

The following is a tool useful in documenting the decision making process for evaluation of precast construction versus conventional cast-in-place construction for a particular project. Also shown is a sample Alternate Cost Summary Table indicating how to summarize the component cost estimates and their sum.

SAMPLE ASSESSMENT MATRIX
- example values in italics -

		PRECAST		CONVENTIONAL	
Selection Factor	**Factor Weight (%)**	**Score** *(0 to 5)*	**Weighted Score***	**Score** *(0 to 5)*	**Weighted Score***
Total Direct Costs	*40*	*4*	*160*	*5*	*200*
Total Indirect Costs	*10*	*5*	*50*	*4*	*40*
Factor 3 - *Constructability*	*25*	*3*	*75*	*4*	*100*
Factor 4 – *Traffic Impacts*	*0*				
Factor 5 - *Construction Duration*	*0*				
Factor 6 - *Durability*	*0*				
Factor 7 – *Environmental Impacts*	*10*	*5*	*50*	*2*	*20*
Factor 8– *Aesthetics*	*15*	*5*	*75*	*3*	*45*
Factor 9 – *Other*	*0*				
Factor 10 – *Other*	*0*				
TOTAL (∑ Factor Weights = 100%)	***100***		***410***		***405***
TOTAL (Excluding Indirect Cost Factor)**	*90*		*360*		*365*

*Weighted Score = Factor Weight x Score **See following explanation, Instructions "6."

<u>Assessment Matrix Instructions</u>:

1. **List Selection Factors** to be used to evaluate the applicability of alternates to meet the goals of the project. Factors are project specific and always include Total Direct Costs and Total Indirect Costs (road user costs) and may include some of the following: Constructability, Traffic Impacts (e.g., Maintenance of Traffic, Detours, Traffic Delays, etc.), Construction Duration, Durability, Environmental Impacts, and Aesthetics. Include other Factors as required to capture any unique project characteristics that are not otherwise addressed. Note that as many or as few criteria may be used in the assessment matrix as deemed appropriate by the designer; though, a sufficient number of Selection Factors (i.e., criteria) are required to provide a thorough evaluation of the alternates being considered to meet the objectives of the project. When choosing selection factors and applying factor weights avoid double counting benefits. For instance, indirect costs and traffic impacts may be related selection factors.

Costs of precast versus conventional may be affected by:

- Savings associated with labor rates and insurance costs for reduced time working from a barge on a large water project.
- Savings associated with structural efficiencies resulting from precasting (e.g., composite dead loads in the case of shored deck casting).
- Savings associated with simultaneous substructure and superstructure component construction.
- Savings associated with increased productivity rates of precasting.

2. **Construct** a two-dimensional table allowing one row for each Selection Factor and two columns for each alternate, one for Score and one for Weighted Score.
3. **Factor Weights** to distinguish the level of importance of each criterion relative to the other criteria in achieving the project objectives. Weighting the various factors will usually require Department/District input. Distribute the Factor Weights such that their sum is equal to 100%.
4. **Score** the relative difference between alternates. Range of scores can vary for a given project (e.g., 0 to 5 or 0 to 10). Scoring may be accomplished by a committee and then the average score for each Selection Factor entered into the matrix.
5. **Calculate** the Weighted Score by multiplying the Factor Weight by Score for each alternate.
6. **Total** the Weighted Score columns: (1) Provide the absolute total of each column, which includes the Indirect Costs Score and, (2) Provide the column total _excluding_ the contribution from the "Total Indirect Costs." It is useful for management to compare the impacts, both relative and in hard dollar amounts, of indirect costs on bridge construction projects when making their decisions. *The column with the largest total weighted score theoretically indicates the alternate which most closely meets the project objectives as implicated by the matrix construct.*

SAMPLE ALTERNATE COST SUMMARY

Alternate	Direct Costs* ($)	Indirect Costs**							Sum: Direct + ∑Indirect ($)
		Lane Closures		Detour Time		Facility Closure		∑Indirect ($)	
		Days (#)	$$/Day	Days (#)	$$/Day	Days (#)	$$/Day		
Precast 1									
Precast 2									
Conventional 1									
Conventional 2									

***** In calculation of Direct Costs, give specific consideration to factors that will:

> increase the cost of the bridge, as necessary to accommodate –

- self-propelled modular transporters (SPMTs)
- large capacity cranes
- special erection equipment
- casting yard setup

> decrease the cost of the bridge, as necessary to accommodate –

- reduced labor rates (e.g., work from barges)
- reduced maintenance of traffic (MOT) work restrictions
- reduced worker compensation insurance rates (e.g., work from barges)
- increased production rates due to assembly line processes.
- increased production rates due to multiple crews working simultaneously

****** Use engineering judgment and knowledge of construction processes to estimate the number of days required for each lane closure, detour, or facility closure for each alternate. Coordinate this estimate with the preliminary construction schedule and MOT scheme.

Referenced Links:

• Connection Details for Prefabricated Bridge Elements and Systems
http://www.fhwa.dot.gov/bridge/prefab/if09010/

• Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges
http://www.fhwa.dot.gov/bridge/pubs/07022/

• Framework for Decision-Making
http://www.fhwa.dot.gov/bridge/prefab/framework.cfm

• Prefabricated Bridge Elements and Systems Cost Study: Accelerated Bridge Construction Success Stories
http://www.fhwa.dot.gov/bridge/prefab/successstories/091104/index.cfm

• FDOT RUC (Road User Cost) software
http://infonet.dot.state.fl.us/tlconstruction/SchedulingEng/AddSoftwareScheduling.htm