ABC Innovative Projects

I-5 / US 12 Bridge at Grand Mound				
Location	US 12 over I-5 at Grand Mound in Thurston County, south of Olympia			
State	Washington			
Owner	State			
Year ABC Built	2011			
State ID #	12/118			
NBI #	0017998B0000000			
Coordinates	***Latitude:***	46.80277778	***Longitude:***	-123.00750000
Contact Person	Jugesh Kapur, P.E. State Bridge and Structures Engineer Washington State Department of Transportation Phone: 360-705-7207 Email: kapurju@wsdot.wa.gov			
Mobility Impact Time	***ABC:***	3 months of bridge construction; no lane reduction since built on adjacent parallel alignment	***Conventional:***	5 months

Impact Category	*Tier 1*	*Tier 2*	*Tier 3*	*Tier 4*	*Tier 5*

Primary Driver(s)	• reduced traffic impacts • reduced onsite construction time • improved site constructability • improved work-zone safety • improved material quality and product durability • reduced life-cycle cost
Description	• 176-ft long and 84-ft wide two-span (88 ft – 88 ft) prestressed deck bulb tee girder bridge; 29.4º skew • Urban location • Average Daily Traffic count: 59,000 for I-5 (2011); 15,000 for US 12 (2011) • Traffic management alternative, if constructed conventionally: traffic not impacted since built on an adjacent parallel alignment ***Existing Bridge:*** The existing three-lane four-span prestressed concrete girder bridge was 255 ft long and 49 ft wide, supported on spread footings. It had three 12-ft-wide traffic lanes and two 4.5-ft-wide shoulders. Built in 1963, the bridge was deteriorated and required replacement. ***Replacement Bridge:*** The replacement bridge has four 12-ft-wide traffic lanes (two lanes in each direction), a 13-ft-wide turn lane in the middle, a 5-ft-wide bike lane, and two 6.5-ft-wide sidewalks. The cross-section consists of fifteen 35-inch-deep prestressed deck bulb tee girders (W35DG), with a 5-inch-thick cast-in-place topping over the deck bulb tees. The outside girders have a 5.5-ft-wide top flange, and the 13 interior girders have a 5.75-ft-wide top flange. As part of this Highways for LIFE project, the University of Washington performed a

	number of tests to prove the precast column-to-footing connections details. The objective of the US 12 Bridge project was to demonstrate the constructability of the bent system details on an actual bridge project. It is a replacement bridge that was built just north of the existing bridge on a parallel alignment. The prefabricated elements are precast segmental columns, precast segmental pier caps, precast deck bulb tee girder superstructure, and precast end and intermediate diaphragms. Based on research results, the exterior of the precast column segment that extends into the footing is roughened to improve shear stress transfer and is octagonal-shaped to provide more uniform interface surface. ***Construction Methods:*** To place the precast column segments into the cast-in-place footings, the contractor first excavated for the footing and installed the footing forms. The leveling pad was placed and the first column segment erected. Footing reinforcement was placed, and the footing was cast. The footing forms were removed, and backfill was placed. To place the precast column segments and bent cap, the contractor placed and shimmed the middle and top column segments, installed column bracing, and placed and shimmed the precast bent cap segments. The contractor used the typical WSDOT practice of integrating the prestressed girders with the integral full-depth diaphragm over a first-stage cap beam to provide longitudinal moment transfer from the bent columns to the superstructure. The precast first-stage cap beam was built in two pieces to have manageable lifting and hauling weights; the pieces were connected with a closure joint near the cap mid-span. To grout the joints between column segments and the column to cap, the grout forms were installed and sealed, grout was pumped and grout tubes closed, grout forms were removed and grout in the joints and grout tubes was inspected, and unfilled grout tubes were repaired and back grout tubes were patched. The deck bulb tee girders were erected, girder bracing installed, ties between girders welded, deck reinforcement placed, and topping cast. The pier diaphragm concrete was cast 10 days after the topping was cast. The traffic barriers and sidewalks were cast, and other finish and approach work done prior to opening the bridge to traffic on its new alignment. No overlay was applied. No incentives or disincentives were included in the contract. ***Stakeholder Feedback*:** This is the first bridge for WSDOT with precast columns, precast beams, and all precast superstructure with seismically-resistant connections. As this was the first experience for the contractor, no substantial time savings were achieved but safety in the field was improved. As more experience is gained, WSDOT believes more time savings will be seen. The contractor indicated that they would have preferred the columns to be cast in place; however, they could see the benefit to using a single (full-height) precast column with the grout connection at the precast bent cap only. This would eliminate the cure time for the concrete and require bracing for only one day. With the installation of all the segments and precast bent cap prior to grouting, bracing was required for an extended period of time. *Lessons Learned* Duct grout tubes should be identified to their respective grout duct. This will help in post grouting inspection and in grouting construction troubleshooting.

	Details for the shear and torsion reinforcing at the crossbeam closure should have been detailed to show interlocking ties instead of "U"-shaped stirrups with hooks for ease of longitudinal rebar placement.
High Performance Materials	•
Photos Additional photos	  

Project Planning	*Decision-Making Tools*	*Site Procurement*	***Project Delivery***	*Contracting*
	•	•	• Design-bid-build	•

Geotechnical Solutions	*Foundations & Walls*	*Rapid Embankment*
	•	•

Structural Solutions	***Prefabricated Bridge Elements & Systems***			*Construction*
	Elements	*Systems*	***Miscellaneous***	•
	• Adjacent deck bulb tee beams • Precast caps and columns	•	• CIP reinforced concrete closure joints • Grouted keys • Grouted ducts in precast substructure • Precast diaphragms	

Costs	The engineer's estimate for the project was $22.37 million. The low bid was $15.52 million ($6.85 million = 30% lower than engineer's estimate). The engineer's estimate for the bridge portion of the project was $3.05 million, and the low bid for the bridge portion was $2.46 million. There were 15 bidders. The cost per square foot of bridge deck was $160 (including mobilization and approach slabs), compared to $211 per square foot of bridge deck for conventional construction in this region in 2011. The bid price for precast beams was $1,500 per linear foot. The bid price for precast columns was $1,200 per linear foot.			
Funding	*Federal only*	***State only***	*Federal and State*	*Other*
		X		
Incentive Program ($)	***Highways for LIFE***	*IBRD*	*SHRP2*	*Other*
	$400,397			
Contract Plans	**Complete Set:**	Bridge Plans (link to pdf)	**ABC *:**	
Specifications	**Complete Set:**	Specifications (link to pdf)	**ABC *:**	
Bid Tabs	Not available.			
Schedule	**Engineer's:**	Not available.	**Actual:**	
Other Related Information	"Highways for LIFE Projects and Accelerated Bridge Construction in Washington State," 2011 PCI National Bridge Conference Proceedings (link to pdf) WSDOT ABC Website [http://www.wsdot.wa.gov/eesc/bridge/ABC/]			

	WSDOT Bridge and Structures Office Website [http://www.wsdot.wa.gov/eesc/bridge/]
Photo Credits	Washington State Department of Transportation (WSDOT)

* Specific to the ABC used in the project.