ABC Innovative Projects

South Punaluu Stream Bridge					
Location	Route 83 (Kamehameha Highway) near the Punaluu Beach Park in eastern Oahu				
State	Hawaii				
Owner	State				
Year ABC Built	2011				
State ID #	159				
NBI #	003000830302442				
Coordinates	***Latitude:*** 21.581667		***Longitude:*** -157.886667		
Contact Person	Paul T. Santo, P.E. Bridge Design Engineer Hawaii Department of Transportation Phone: 808-692-7611 Email: paul.santo@hawaii.gov				
Mobility Impact Time	***ABC:*** 24 months		***Conventional:*** estimated 27 months		
Impact Category	*Tier 1*	*Tier 2*	*Tier 3*	*Tier 4*	***Tier 5***
					X
Primary Driver(s)	• minimized environmental impacts – deck topping did not require shoring or falsework in the streambed • reduced traffic impacts • reduced onsite construction time – precast planks were fabricated during pier construction				
Description	• 170-ft-long and 50-ft-wide three-span precast prestressed “trideck” adjacent tee beam bridge (51 ft – 66 ft – 53 ft) • Rural location • Average Daily Traffic count: 10,060 (2010) • Traffic management alternative, if constructed conventionally: extended use of detour across adjacent temporary bridge ***Existing Bridge:*** The existing two-lane seven-span continuous concrete slab bridge was 126 ft long and 26 ft wide. The substructure consisted of concrete pier caps on concrete socket piles connected to timber piles. Built in 1926, the bridge was structurally deficient and functionally obsolete and required replacement. ***Replacement Bridge:*** The replacement bridge was designed for current loads and seismic standards. It has two 12-ft-wide traffic lanes, two 8-ft-wide shoulders, and a shielded walk/bikeway. The cross-section consists of ten 5-ft-wide 25-inch-deep 9,000 psi precast prestressed concrete triple-tee beams called “tridecks,” with a minimum 6.5-inch-thick cast-in-place concrete topping that increases in thickness to conform to the roadway cross slope. A precast decked tub member spanning between the abutments and piers supported a waterline. Each substructure consists of cast-in-place post-tensioned concrete caps that are supported by two 5-ft-diameter drilled shafts. This structural system replaced the original bid documents that showed precast prestressed concrete AASHTO girders through a value engineering proposal by the construction contractor. This proposal also reconfigured the placement of drilled shafts to facilitate their installation to avoid				

	relocation of overhead power lines. See the “High Performance Materials” section below for high performance materials used in the bridge. ***Construction Methods:*** The precast tridecks and tub member were fabricated at a precast plant and shipped to the job site. The concrete for the tridecks was required to pass a total charge not exceeding 1000 coulombs at 90 days from casting as determined by AASHTO T277. The contractor assembled a temporary prefabricated steel truss bridge adjacent to the site. Traffic was shifted to the temporary bridge and the existing bridge was closed and demolished. Drilled shafts were constructed. Pier caps were cast over the drilled shafts, with top surface of the caps conforming to the roadway cross-slope. The lower strands in the caps were post-tensioned and the ducts grouted after the concrete reached adequate strength. Cranes were used to place the tridecks directly on the concrete seats cushioned by a layer of felt. The precast tub members supporting a waterline were designed to span between the abutments and piers. Keys between beams were filled with non-shrink grout. Tridecks were connected to each other with weld ties spaced at 5 ft spacing. The deck was cast over the tridecks and into the reinforced closure joints over the piers and abutments. The upper strands in the pier caps were then post-tensioned and the ducts grouted. The deck was textured longitudinally by mechanical grooving, and the aesthetic concrete traffic railing was constructed. No deck overlay or sealant was applied. Traffic was switched to the replacement bridge, and the temporary bridge was removed. The contract time for completion of all contract items was 500 working days from Notice to Proceed. It did not include incentives / disincentives. The bridge was opened to traffic in about 24 calendar months and contract items were completed in about 32 calendar months after Notice to Proceed. Actual approved extension of time was not available.
High Performance Materials	• Glass fiber-reinforced polymer reinforcement in edge of trideck flange on each side of the bridge and at corner of abutment seats where concrete cover is less than desirable • Stainless steel reinforcement in diaphragms of trideck system, precast tub member supporting a waterline, and the aesthetic bridge railings • Lightweight concrete (115-pcf; 56-day compressive strength of 4,500 psi) in precast concrete cover for the precast tub supporting a waterline
Photos Additional photos	  

Project Planning	*Decision-Making Tools*	*Site Procurement*	***Project Delivery***	***Contracting***
	•	•	• Design-bid-build	• Full lane closure • VE

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

Structural Solutions	***Prefabricated Bridge Elements & Systems***			*Construction*
	Elements	*Systems*	***Miscellaneous***	•

	• Adjacent tee beams • Other – Precast decked tub beam	•	• Grouted keys	
Costs	The engineer's estimate for the project was $ 19.0 million. The low bid was $14.6 million ($4.4M = 23% lower than engineer's estimate). There were three bidders. The cost per square foot of bridge was $760 based on FHWA guidelines for calculation of bridge construction unit cost.			
Funding	*Federal only*	*State only*	*Federal and State*	***Other***
				ARRA – 100%
Incentive Program ($)	*Highways for LIFE*	*IBRD*	*SHRP2*	*Other*

Contract Plans	**Complete Set:**	Structural Plans (link to pdf)	**ABC *:**	
Specifications	**Complete Set:**	Concrete Structures Specifications (link to pdf) Structural Concrete Specifications (link to pdf) Standard Specifications [http://hawaii.gov/dot/highways/specifications2005/specifications/spectble.htm]	**ABC *:**	Concrete Structures Special Provisions (link to pdf) Structural Concrete Special Provisions (link to pdf)
Bid Tabs	Bid Tabs (link to pdf)			
Schedule	**Engineer's:**	Not available.	**Actual:**	
Other Related Information				
Photo Credits	Hawaii Department of Transportation			

* Specific to the ABC used in the project.