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Neal Bridge - Pittsfield, Maine : Composite Arch Bridge, Constructed Fall 2008, February 2009

Maine Department of Transportation

Neal Bridge – Pittsfield, Maine
Composite Arch Bridge
Constructed Fall 2008

In the fall of 2008, MaineDOT built a buried arch bridge constructed with composite materials. The arches were manufactured from 12-inch diameter rigidized inflatable hollow carbon fiber composite tubular arches spaced at approximately 2-feet on center, erected into place and filled with concrete. A 4-inch deep corrugated fiber reinforced plastic (FRP) decking was installed on top. The head walls were constructed with a FRP sheet pile system and the wing walls were constructed from a prefabricated concrete T-Wall retaining wall system. Approximately 4 feet of fill was placed over the structure with typical MaineDOT subbase and hot mix asphalt pavement roadway section. The span of the arches is 27-feet, the guardrail to guardrail width is 30-feet, and the headwall to headwall width is 45-feet.

Figure 1 - Installing Composite Arches

Figure 2 - Installing composite decking

The University of Maine Advanced Engineered Wood Composite Center developed the bridge design as a novel use of composite materials to simplify construction and reduce the maintenance and life cycle costs associated with buried structures. The lightweight carbon fiber arches are manufactured by inflating a tubular carbon composite shell and bending it to the proper bridge vertical profile. The arches cure on site within hours. The inflatable composite arches provide three simultaneous functions: They act as a stay-in-place form for the concrete, function as an external reinforcement for the concrete, and protect the concrete from corrosion and freeze-thaw damage. The arches can be erected by hand, reducing or possibly eliminating the need for heavy equipment during bridge construction. The arches and corrugated decking can both be compactly stacked which reduces the staging area

Figure 3 - Installation of composite retaining wall

required during construction. These attributes make this technology ideal for tight or inaccessible construction sites, and have the potential to reduce the total time of construction.

Figure 4 - MSE Retaining wall

Since the concrete in the arches is protected from the elements by the composites shell and because of the non-corrosive performance of the composites materials themselves, this design should reduce the maintenance costs and increase the design lifespan of these types of structures. The net result should be a decrease in the total lifecycle costs.

An advantage of this system is that it is similar in configuration to standard construction, as it shares many details at the foundation, head walls, wing walls, and backfill buildup. Therefore it should integrate easily with existing construction techniques. Once proven, this technology should be scalable to longer span bridges, including spans longer than the competing metal plate arch and precast concrete buried bridges.

Figure 5 - Concrete placement

Figure 6 – Completed Bridge