Sustainability of Rural Steel and Concrete Bridges

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Overview

Increasingly, short span bridge owners and designers are emphasizing the importance of sustainability in repair and replacement projects. The potential impact of bridges on the environment has become an important consideration when selecting materials for a crossing. However, minimal information is available to evaluate and compare the sustainability of materials used for the superstructure of a bridge.

To address this inadequacy, the University of Wyoming conducted a study and developed a methodology to evaluate the life cycle sustainability (cradle to grave) of two functionally equivalent steel and concrete rural bridges.

Bridges Evaluated

The two functionally equivalent bridges used within the study are two-lane, approximately 35-ft.-long simple spans, located in Whitman County, Washington, and built with local crews. Only the superstructure of the bridges was considered in the analysis.

Seltice-Warner Bridge

The steel bridge consists of seven rolled beam girders and a corrugated metal deck for a gravel riding surface. The bridge is 35 ft.-8 in. long and 28 ft. wide, and was built in 2020.

Thornton Depot Bridge

The concrete bridge consists of eight precast prestressed rectangular girders. The girders themselves are the concrete riding surface. The bridge is 34 ft. long and 32 ft. wide, and was built in 2019.

Sustainability Criteria

Four criteria were developed to evaluate and compare the sustainability of the two bridges:

- Embodied carbon emissions of materials, and emissions from equipment
- Embodied energy of materials, and energy consumption from equipment
- Waste management and recyclability
- Life cycle cost

Research Results

The results show that, over the life cycles of the two bridges, the concrete bridge:

Results in 26.3% more embodied CO2e emissions

Results in consumption of 8.7% more energy

Results in recycling of 17.8% less material (at the end of its service life when compared with the steel bridge)

The concrete bridge also has a life cycle cost that is 23% higher than the steel bridge.

It should be noted that these results only apply to the specific aforementioned bridges and the results may vary when making other bridge comparisons. Additional research on this topic is recommended.

Download the complete report, including information on an equivalent cost procedure that considers monetized sustainability benefits, at ShortSpanSteelBridges.org.

For questions or additional information:
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