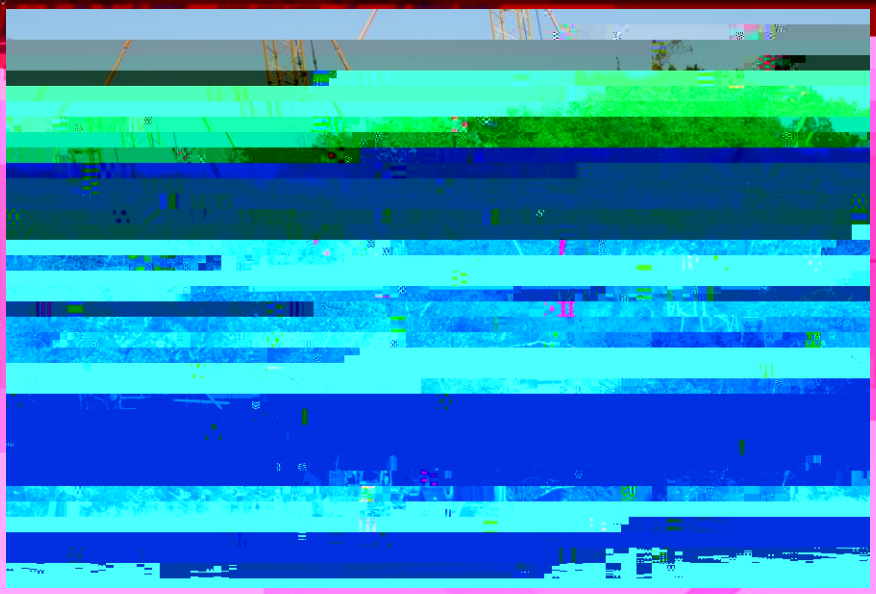
Missouri Demonstration Project: Replacement of Three Bridges Using Hybrid-Composite Beam Technology

Final Report
March 2013



U.S. Department of Transportation
Federal Highway Administration

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INTRODUCTION

HIGHWAYS FOR LIFE DEMONSTRATION PROJECTS

The Highways for LIFE (HfL) pilot program, the Federa

¶ **Quality**

- User satisfaction ð An assessment of how satisfied users are with the new facility

problems with constructing the piers, but none of the delay was associated with the HCB technology. Even in this case the overall time did not exceed the average construction time for conventional bridge replacement projects.

Because the roadways were closed during construction, it was not possible to measure construction-related congestion in the typical way. Traditionally, the principle component of user cost associated with construction is the increased travel time for the detour and the associated vehicle operating costs (VOC). However, because of TJETBT1 0 0 1 277.90 45 612.58 Tm[(low volumes of traffic used on) TJETBT1 0 0 1 30 detour routes for these projectBT1 0 0 1 134.9 598.78220.61 598.78 Tm[(, a)4(t no t)-3(im)-3(e)4(did t)-3(ra)7(f

jobsite, which reduced delay.

Two of the three structures were replaced with no change in location or geometrics. However, the new structures are significantly wider than the existing structures and have updated safety barrier. The third structure, in Dade County, was replaced with a widened deck and updated safety features, and it was constructed slightly downstream of the existing structure to correct geometric issues. As a result of the geometric revisions, safety improvements, and widened structures,

PROJECT DETAILS—MO 76 IN DOUGLAS COUNTY

BACKGROUND

The first of three structures replaced under this demonstration project was a bridge over Beaver Creek on F igure 2

Figure

Figure 3. Old structure on MO 76 in Douglas County.

HCB Mockup Pour

The use of HCB technology was new to both MoDOT and the contractors iio20l4l/chein thend

Figure 4. Half-scale mockup of HCB.

Figure 6. Modified slump test.

Figure 7. Slump test results from self-consolidating concrete.

Figure 13. Section view of HCB from constrqction plans.

SUBSTRUCTURE CONSTRUCTION

The exist

than the previous 3-year average, meeting the goals of the HfL program. Future safety is expected to improve as welg,because the structur

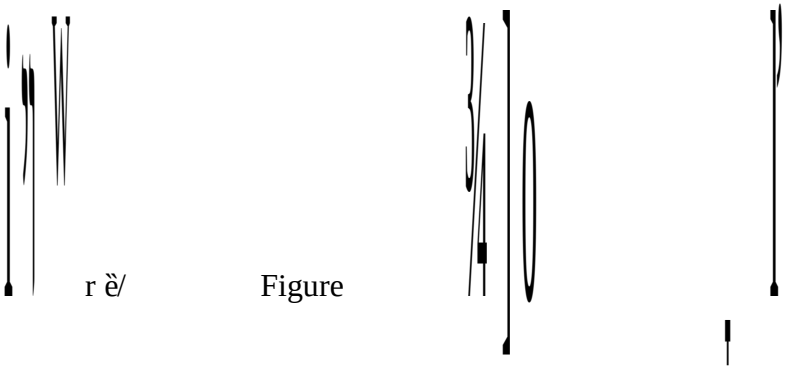
5 presents the results of this analysis. Overall, the mobility impact of the full road closure was minimal. Travel time increased by about 9.0 minutes per vehicle.

PROJECT DETAILS—MO 49 IN REYNOLDS COUNTY

BACKGROUND

The second of the three strEctEres replaced under this demonst

Tests were performed on self-consolidating concrete to ensure the mix would flow adequately through forms without forming voids. The slump test was modified in that the cone was inverted and the diameter of the resulting circle of mix was measured (see figure 27)e Ŷ a $ ę M ᵐ ae diar ted



r è/ Figure

Figure 33. Original 4-in access holes for concrete introduction.

Figure 33 shows how concrete was introduced at quarter" e 4 q"

Figure 35 shows that, after the concrete set, there was a gap between the beams of about

Table 6. Crash rates for original and detour routes before construction, Reyno

Flagger operations would be adequate for MOT on prevailing low-volume traffic conditions with no significant delays anticipated during future bridge deck repairs, so future road user costs were not considered in the

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Figure 37. Existing structure on MO 97

Figure 38. Cross section of HCB for the Dade County structure.

Figure 39 shows the end view cross section of the voided box beam section with the location of shear connectors, compression reinfo ssi.

Beaa] τ ȳ = guiq 42. Beams lined up for installation.

[illegible] 46.

CONSTRUCTION COSTS

The original design for this structure usi prestressed coocrete beams resulted in an estimated cost of $170 per square foot. This amountsstimated total cost of $988,693 for HCB and $542,187 for prestressed coocrete beams. Modiatioo to us

Table 13. Life cycle cost analysis of bridge deck for the Dade County project.

Year

As-Built Case

$\text{Delay}_{\text{Auto}}$ = (AADT) * 0.852 (percent autos) * 97.4 (veh-

= 684

appropriate additives to ensure a mix that flows easily and does not set up in transit to the jobsite.

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