When compared with conventional concrete, ultra-high-performance concrete (UHPC) offers enhanced mechanical and durability properties that make it an ideal material for use in the construction, repair, and preservation of highway bridges. Early widespread adoption of UHPC began with connections between prefabricated concrete bridge elements. UHPC has a high bond strength with conventional concrete substrates and high tensile strength, resulting in shortened development and splice lengths, which makes it an ideal material for connections. The next phase of more widespread adoption of UHPC has involved preservation and repair activities, and has been supported through the Federal Highway Administration (FHWA) Every Day Counts program. UHPC link slabs were identified as one of the most promising applications of UHPC for preservation and repair.

A link slab creates a continuous slab in the longitudinal direction by using a partial- or full-depth slab running between adjacent simple spans that is designed to accommodate the end rotation of the girders without introducing moment continuity between spans. Link slabs can be used to eliminate deck joints between simple spans to help extend the service life of existing bridges. The high tensile strength and post-cracking strain capacity, high bond strength, and decreased splice lengths for embedded reinforcement make UHPC an ideal material for link slabs. UHPC link slabs are typically designed to be only partial depth, often 4 in. deep, and only a few feet long.

Link-slab design is different than the design of conventional reinforced concrete elements, where an element is designed to resist applied loads. The demand on a link slab is generated from the total girder end rotations from the ad-

Figure 1. Typical ultra-high-performance concrete link-slab configuration for retrofitting a precast concrete beam bridge with a composite cast-in-place deck superstructure to eliminate deck joints. All Figures: Federal Highway Administration.

![Diagram of UHPC Link Slabs](image-url)
A recent FHWA report, *Ultra-High Performance Concrete (UHPC) Link Slab Design Example*, presents a design example for a UHPC link slab. The example illustrates the step-by-step process of designing link slabs to replace the expansion joints on a four-span superstructure. The example is for a steel simple-span composite bridge containing traditional expansion joints, but the same design principles and process would be applicable to a prestressed concrete simple-span composite bridge. Construction details are provided for the existing structure and link-slab design. Calculations are provided to determine the longitudinal horizontal loads for the structure to evaluate the effect of the link slabs on the existing substructure and foundation elements.

The redesign of the bearings is also included, and the procedure for accounting for thermal effects and shrinkage in the link-slab design is provided. Additional details on previously constructed link slabs and the approaches used by several states for the design and implementation of link slabs are summarized by Thorkildsen and Ailaney.

The FHWA link-slab design example is a valuable resource to bridge owners and bridge designers looking for a simple and innovative solution to retrofit deteriorated or leaking bridge deck joints and preserve the superstructure and substructure elements below them.

### References


