

I-65 Bridges from I-264 to Kennedy Interchange

Planning Study

Jefferson County, KY

August 2019



KENTUCKY
TRANSPORTATION
CABINET



In Partnership With





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Introduction

The Kentucky Transportation Cabinet (KYTC) initiated a study of the I-65 Bridges in Jefferson County in June 2018. This study's objective is to assess conditions and prioritize and develop conceptual strategies for repair or replacement of all bridges along Interstate 65 between the Watterson Expressway (I-264) and the rebuilt Kennedy Interchange in Louisville, KY, 28 bridges in all (**Figures ES1 and ES2**).



Figure ES1: Study Bridges – South



Figure ES2: Study Bridges – North

Three bridges were identified as priorities for KYTC: 179N over CSX RR, Burnett Avenue, and Hill Street; 183N over Brook Street and Kentucky Street; and 191N over Jacob Street, Broadway Street and Gray Street. Replacement scenarios have also been developed for bridges 183N and 179N due to their poor condition. In addition to the structural focus, this study includes an environmental overview

with attention to socioeconomic impacts, review of adjacent projects for synergistic construction possibilities, preliminary traffic impact analyses, and a framework communication plan for construction activities.

Purpose and Need

The purpose of this study is to evaluate, identify and develop strategies to address deficiencies in 28 bridges on Interstate 65 between the Watterson Expressway (I-264) and the rebuilt Kennedy Interchange in Louisville.

As part of KYTC's asset management program, these strategies are needed to maintain safe and efficient travel through the I-65 corridor.

Structure Condition

Bridge inspections show declining conditions over time for most of the bridges in the study area. See (**Table ES1**) below for existing conditions.

Table ES1: Bridge Ratings

Bridge ID	Route Under	Sufficiency Rating	NBI Ratings			Bridge Condition
			Deck	Super-structure	Sub-structure	
209N	PHILLIPS LN	75.9	5	5	5	Fair
210N	MANNING RD	73	5	5	5	Fair
211N	E ENT TO FAIRGROUNDS	81.4	5	5	5	Fair
212N	BRADLEY AVE, N ENT FRGRND	82	5	5	5	Fair
213N	CRITTENDEN DR (KY 1631)	94	6	6	6	Fair
205N	NORFOLK SOUTHERN RR	72	5	5	5	Fair
180N	EASTERN PKWY	84	5	6	5	Fair
181N	WARNOCK ST	82	5	6	5	Fair
182N	BRANDEIS AVE	74.7	5	5	5	Fair
179N	CSX RR, BURNETT, HILL ST	49	5	4	3	Poor
208N	PRESTON RAMP TO 65 SB	66	5	5	6	Fair
207N	S PRESTON ST ON RAMP	80	5	6	6	Fair
206N	WOODBINE ST	70	6	6	5	Fair
187N	E ORMSBY AVE	80.2	5	6	6	Fair
186N	OAK ST	69	5	6	5	Fair
185N	FLOYD ST	81.6	5	6	6	Fair
184N	ST CATHERINE ST	82	5	7	5	Fair
183N	S BROOK, E KENTUCKY ST	46.7	5	4	4	Poor
190N	CALDWELL ST	86.8	6	6	6	Fair
189N	E BRECKINRIDGE ST	67.2	6	5	6	Fair

Table ES1: Bridge Ratings (continued)

Bridge ID	Route Under	Sufficiency Rating	NBI Ratings			Bridge Condition
			Deck	Super-structure	Sub-structure	
188N	COLLEGE ST	80.1	6	6	6	Fair
191N	JACOB, BROADWAY, GRAY ST	73.9	6	5	5	Fair
192N	CHESTNUT ST	77.1	6	5	5	Fair
193N	BROOK ST, MUHAMMAD ALI	76	5	5	5	Fair
194N	MUHAMMAD ALI	96	7	7	6	Fair
196N	FLOYD ST	75.7	5	6	5	Fair
195R	FLOYD ST	96.9	7	7	6	Fair
197R	LIBERTY ST	96	5	6	6	Fair

Notes to Table 1:

Sufficiency rating is a numerical value (0 for the worst and 100 for the best) that gives an indication of a bridge's eligibility for rehabilitation or replacement and is based on structural adequacy, safety, serviceability, function obsolescence, and essentiality for public use.

National Bridge Inventory (NBI) condition rating (0 for worst and 9 for best) reports the condition of a bridge component as an evaluation of its current physical state compared to what it was on the day it was built.

Good = Bridge has all three NBI condition ratings for deck, super and sub of 7 or higher.

Poor = Bridge has at least one NBI condition rating for deck, super or sub of 4 or lower.

Fair = all other bridges.

Adjacent Projects

Louisville Metro Two-Way Streets

Louisville Metro has initiated a plan for the conversion of select one-way streets to two-way circulation. The only street under I-65 planned for conversion at this time is Jefferson Street, outside of our project limits. Louisville's Public Works Department should be contacted for possible coordination during construction if city streets have planned utility or paving work in the study area.

Brook Street Off-Ramp

Bridge 196N over Floyd Street is an off-ramp being studied for realignment. This project is in the design phase and could be ready for construction as early as 2021. Because alternates being considered would replace bridge 196N, it is recommended that any proposed repairs in this area be delayed until the disposition of a new bridge is known.

I-65 Ramp Modifications Scoping Study

This 2008 study included alternatives to improve traffic flow, safety, and access associated with the I-65 ramps from Crittenden Drive to St. Catherine Street. No recommendations have been implemented, and no particular advantage would be gained from concurrent I-65 bridge repairs if portions of the ramp improvements are implemented.

Environmental Overview

Any proposed bridge repair projects in the study area will have minimal environmental impacts because all construction will occur within existing right of way. No impacts to historic properties, archaeological sites, ecological resources, etc. are anticipated. Socioeconomic impacts may occur due to temporary disruptions during construction to commuters, local residences, businesses, and the homeless population who seek shelter beneath several of the area bridges.

With the availability of detour routes, the impacts to commuters and businesses are expected to be minimal. However, the homeless populations that reside under several of the bridges will be temporarily displaced by construction activities. After coordination with Louisville Metro and homeless advocacy groups, policies and procedures successfully implemented during similar projects will be utilized for this work.

User Impacts

Traffic Impacts Analyses

Traffic operational analyses were completed for both single-lane closures during the weekday and total closure by direction for weekend-only construction activities. These analyses indicated a reduction in Level of Service from LOS C/D to LOS E/F during weekday closures and weekend closures. Also, queueing analysis showed that during afternoon peak hours (4:00-6:00 pm), additional traffic backup of 7,000-8,600 feet could be anticipated for the single-lane weekday closure scenario. The queue analysis shows that the existing four-lane and three-lane sections have no queueing; however, the three-lane segments with a single-lane closure begin to generate a 7,000-8,600 feet queue during the peak hours (4:00-6:00 pm).

Under-Bridge Parking

Under-bridge parking exists at several locations within the study area via permits. Permit holders have been identified and when those areas are scheduled for repair, coordination should begin early so that alternate accommodations can be secured prior to construction.

Communication Plan

Successful Public Information Plans / Communication Plans for similar Louisville interstate projects were reviewed, and a conceptual plan for both weekday and weekend road or lane closures, as well as parking displacement, is included in **Appendix D**.

Recommendations

Abutment Joint Elimination

The vast majority of bridges in this study have active corrosion within the concrete at their abutments and concrete girder ends, if comprised of concrete girders. This is the location of expansion joints, and it is evident that many joints have failed and are leaking (**Figure ES3**). Abutment joint elimination via deck slab extension is recommended wherever possible (**Figure ES4**).



Figure ES3: Typical Abutment Joint Leakage and Concrete Damage

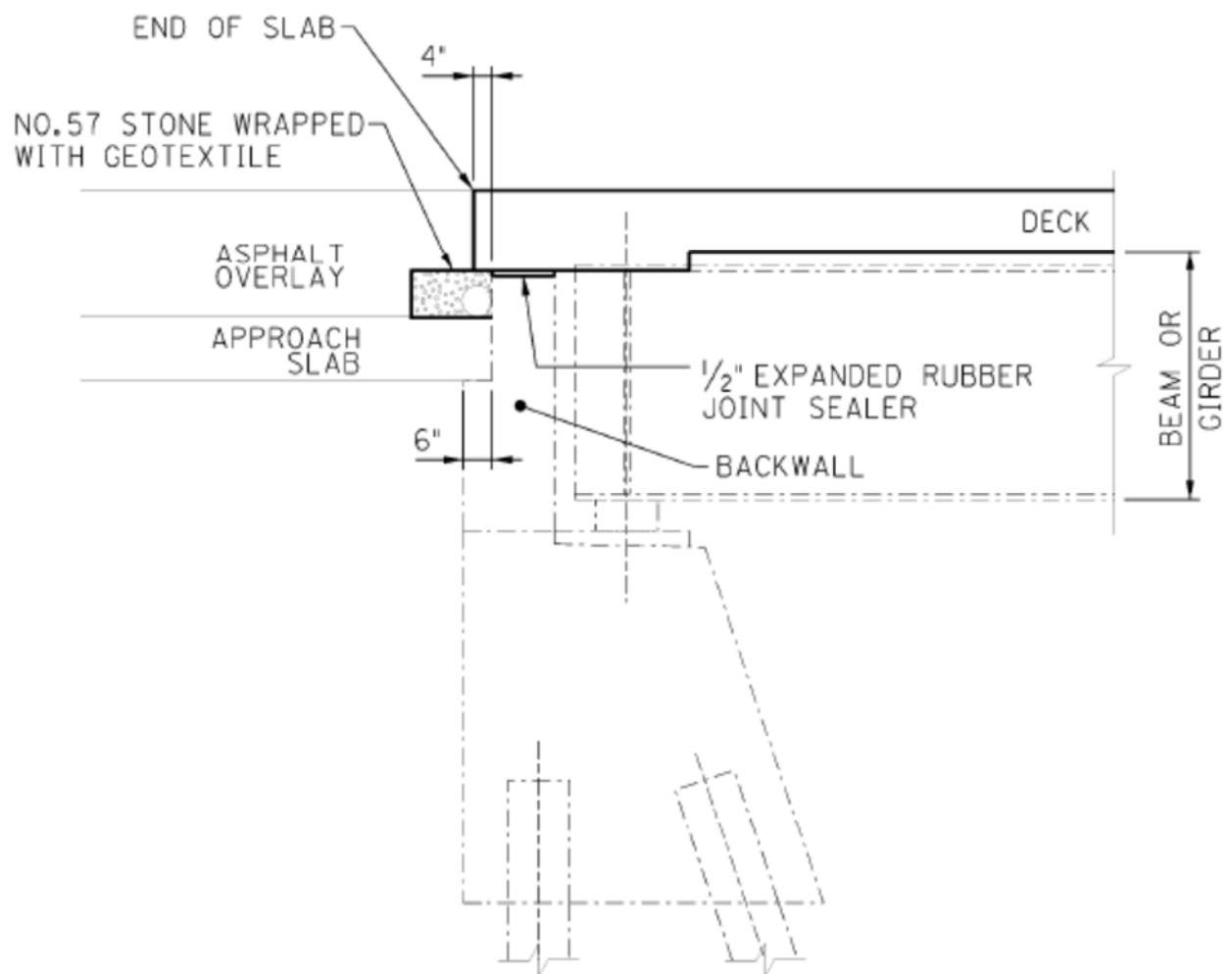


Figure ES 4: Abutment Joint Elimination by Slab Extension

Traffic operational analyses show that the effect/impact of the single-lane closure with traffic shift is comparable to complete direction closures with weekend-only work. The continuous single-lane closure to traffic is the recommended maintenance of traffic scheme to allow time for abutment joint elimination of half a bridge width, by direction, at a time.

Pier Joint Elimination

Similarly, expansion joints at piers have identical leakage and corrosion problems and can be eliminated in some instances (**Figure ES5**). Pier joint elimination by implementing link-slabs and reconfiguring bearings for longitudinal movement and load resistance is recommended wherever possible (**Figure ES6a and ES6b**).



Figure ES5: Typical Pier Joint Leakage and Concrete Damage

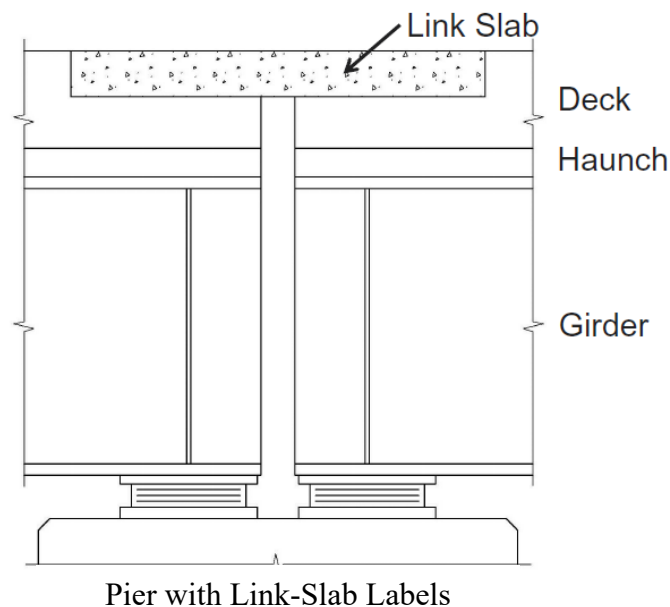
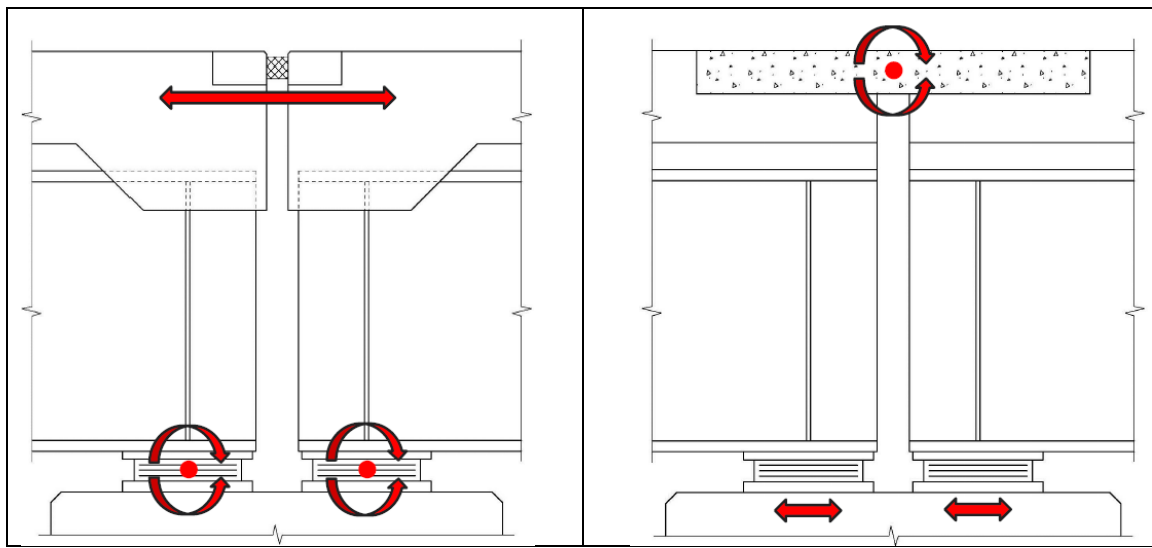


Figure ES6a: Changes to Bridge Using a Link Slab



Pier Configuration with Joint

Pier Configuration with Link-Slab

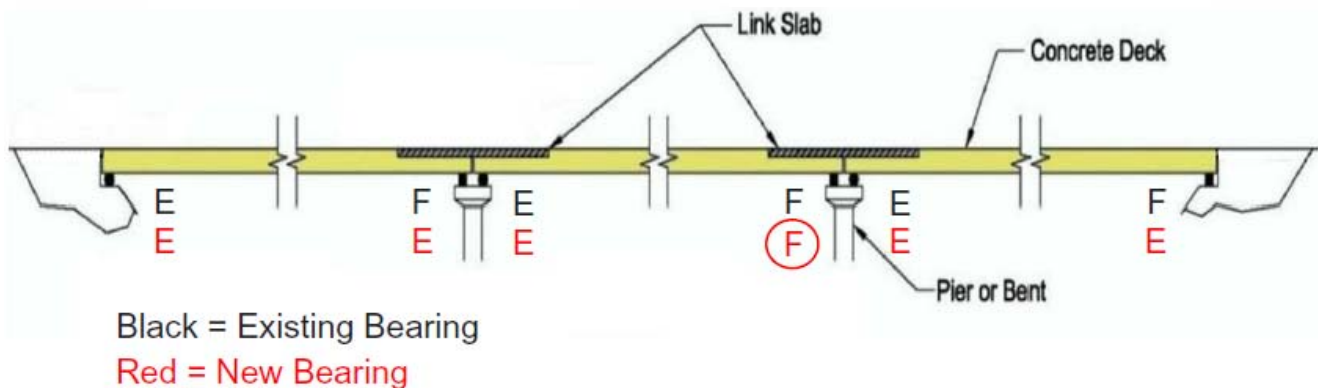


Figure ES6b: Changes to Bridge Using a Link Slab (New York Department of Transportation Presentation)

Additional Improvements

Several instances of slab debonding at bridge ends were observed. (**Figure ES7**) It is recommended to add shear studs to the top flange of the steel beams when abutment joints are eliminated. Likewise, corrosion was observed at several joints between bridge barriers at the median (**Figure ES8**). Elimination of this median joint is also recommended by replacing the two barriers with a single barrier, similar to the north end of the study area.



Figure ES7: Typical Slab Delamination at Bridge Ends



Figure ES8: Typical Median Joint Leakage and Corrosion

Baseline repair cost estimates include conventional repair techniques to known deficiencies, improvements listed above, and special repairs for isolated structural steel cracks and damage caused by vehicles. Special post-tensioned, integral straddle bents are repair options for Bridge 183N (Brook and Kentucky Streets); Bridge 191N (the Broadway Bridge) has options to use Fiber Reinforced Polymer (FRP) fabric for girder repairs or replacement with a new prestressed concrete girder line.

Extended Durability - Galvanic Cathodic Protection

It is recommended that traditional repairs be augmented with cathodic protection where leaky joints have infused concrete areas with chlorides. Basic cathodic systems distribute zinc rods or pucks uniformly throughout the repair zones, and at minimum, a 30-year corrosion-free repair can be achieved for only an additional 6% to the construction cost.

Priority Bridges

183N over Brook Street and Kentucky Street: Multiple options are provided to repair this bridge including repair of structural steel cracking by coverplating and by encasement into a post-tensioned (PT), integral straddle pier. Replacement options are also postulated with PT straddle bents where needed. Existing abutments are large counterfort vertical abutments; so replacement options identified recommend to leave most, or all of the existing abutments in place, and to span over them to establish new integral end bents.

179N over Burnett Avenue, Hill Street, and CSX RR: This bridge recently had emergency shoring due to disintegration of some of the south abutment's concrete-bearing areas. A concrete repair option is provided in the estimate as well as a superstructure-only replacement and a complete replacement.

191N over Jacob Street, Broadway Street, and Gray Street: This long bridge consists of seven different structural units, with a reinforced concrete unit over Broadway Street having a severely deteriorated girder. It can be repaired in place with a fiber reinforced polymer (FRP) fabric bonded to the repaired surface or by removing the damaged girder line and replacing the girder line with a new prestressed concrete girder and slab area.

Replacements

Bridge 183N over Brook and Kentucky Streets cost is \$17.2 - \$18.5 million to replace. Although approximately three times the cost of repairs, replacement would be a prudent investment for this 60 plus year-old bridge with fracture critical members and many undesirable fatigue prone details.

Bridge 179N over Burnett Avenue, Hill Street, and CSX railroad, cost is \$5.7 million for superstructure replacement and \$8.1 million for full bridge replacement. With the repair options approaching \$3.8 million, replacement should be seriously considered.

Prioritization

All 28 bridges were ranked as High, Moderate, or Low priority based on condition. The three priority bridges, identified above, are the only ones ranked High, eight ranked as Moderate and 17 ranked Low priority. Bridge 196N was ranked moderate but it may be replaced as a part of an existing project; the project team recommends delaying action on it. The remaining seven moderately deteriorated bridges are clustered in two areas, namely at the north and south ends of the study area.

Schedule of Construction

Repair/replacement of 179N, 183N, and 191N should be first to be constructed, followed by all eight bridges rated moderate priority, then the 17 low-priority group would be completed. So construction crews are not hop-scotching around the corridor for years on end, it is recommended to geographically group the eight moderate-priority bridges with additional lower-priority bridges (**Figures ES9 and ES10**). Specific group size depends on available funding, exact scope of work, and tolerance for construction duration. Suggested contract packages with estimated construction costs are:

Executive Summary

High Priority:

Repair Package No. 1: 179N, 183N and 191N

Estimated Cost = \$14,460,000

Moderate Priority: College Street to Liberty Street

Repair Package No. 2: 188N, 192N, 193N, 194N, 195R, 197R

Estimated Cost = \$7,650,000

Moderate Priority: Phillips Lane to Brandeis Avenue

Repair Package No. 3: 209N, 210N, 211N, 212N, 213N, 205N, 180N, 181N, 182N

Estimated Cost = \$11,200,000

Low Priority: Preston Street Ramps to Breckinridge Street

Repair Package No. 4: 208N, 207N, 206N, 187N, 186N, 185N, 184N, 190N, 189N

Estimated Cost = \$8,850,000



Figure ES9: Repair Package Grouping – South

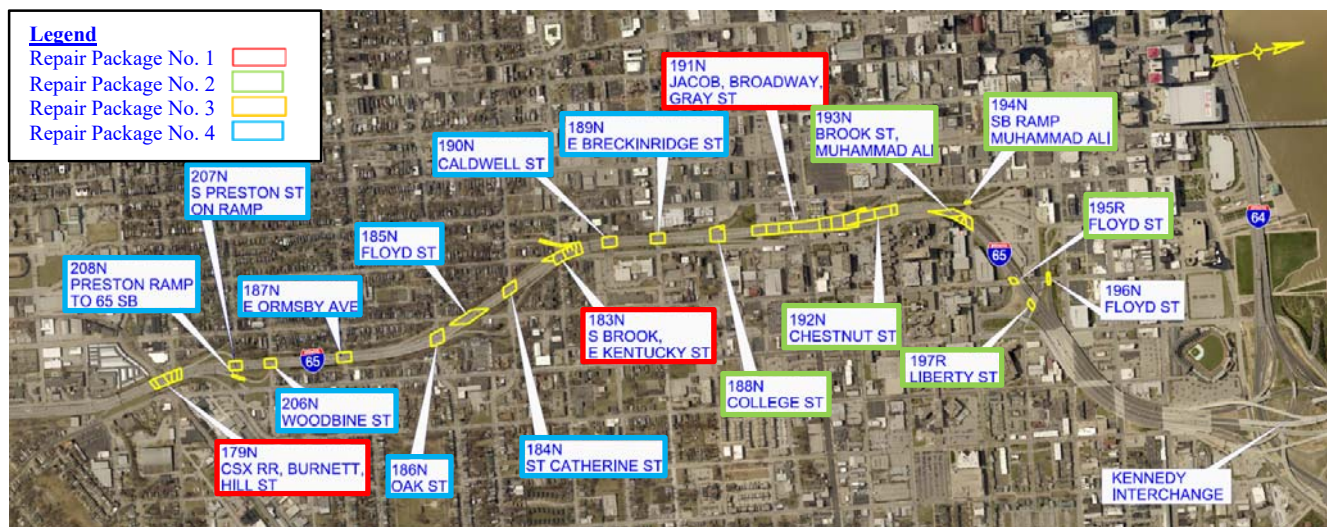


Figure ES10: Repair Package Grouping – North