

PROBLEM DEFINITION STUDY

Rex Whitton Expressway, Jefferson City
Cole County, Route 50/63, MoDOT Job No. J5P0820



FINAL REPORT

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STUDY DESCRIPTION

The Rex Whitton Expressway (US 50/63) Problem Definition Study is being conducted by the Missouri Department of Transportation (MoDOT), Cole County Department of Public Works, the City of Jefferson, and consultant, George Butler Associates, Inc. (GBA). The primary purpose of the project is to identify transportation deficiencies (needs) of the existing Rex Whitton Expressway facility from just east of the Route 179 interchange, through the US54/US63 Tri-level interchange, across the downtown section and the Central East Side section of Jefferson City, ending just east of the Eastland Drive interchange.

In addition to identifying existing deficiencies, the study details future traffic operational concerns based upon expected traffic growth projections throughout the region and along the corridor. Based upon these identified issues, the report developed a range of potential improvement scenarios that would be expected to address these concerns. Please note that the developed corrective concepts are not meant to determine or limit the improvement strategies that could be implemented as part of any future projects, but were developed to help define the scope and magnitude of the future improvement projects that may be undertaken to solve identified deficiencies.

The Rex Whitton Expressway is made up of various roadway elements and cross-sectional types through the limits of the study area. The western portion of the Expressway is comprised of the median divided, high speed freeway type section of U.S. 50. Access is controlled with grade separated interchanges and speeds are posted at 55 and 65 miles-per-hour (mph) in different sections. As the route approaches the downtown portion of the study area from the west, US 50 intersects US 54/63 at the Tri-level interchange. Beginning immediately west of and through the Tri-level, the roadway transitions from the rural high speed design section to an urban arterial cross-section with a 45 mph speed limit, curbs, raised medians, and signalized control of the at-grade intersections with the local city streets. As the route exits the eastern edge of the downtown area, it again becomes a controlled access facility with the 55 mph speeds and arterial type roadway characteristics on the outside and a raised median. This intermediate type section continues eastward from the downtown through the interchange with Clark Avenue. East of Clark Avenue, the expressway again becomes a 65 mph freeway type facility with a wide, depressed median and full shoulders.

The primary boundaries of this study extend 250 feet north of and south of the existing roadway right-of-way. Within this boundary, existing traffic, geometric, and safety concerns were identified and reviewed. At each interchange/intersection location, the corridor enlarges to encompass a standard interchange/intersection with MoDOT's access

management guidelines applied. Each of the substantive deficiencies along and within the corridor are tabulated and discussed in this report.

Additionally, a larger footprint was defined for the identification of cultural and environmental concerns and projected land use modifications and redevelopment plans. This increased area was evaluated to serve as a framework for future evaluations of corridor access improvements and other roadway opportunities. This expanded area extended north from the expressway to about the Missouri river and southward from the expressway to a line approximately ½ mile south.

EXISTING CONDITIONS AND INVENTORIES

The following sections of the report detail the completed field investigations, the inventory and evaluation of physical conditions, review of safety considerations and crash experience, and the detailed analyses of current traffic operations that exist along the Rex Whitton Expressway through the project limits.

SAFETY ISSUES AND CRASH EXPERIENCE ... A detailed review of crash experience along the corridor was completed to determine if there were any safety concerns or identified crash patterns that could be attributed to deficiencies to the current roadway design or configuration.

Under a separate initiative, the freeway type sections of the Expressway were identified as areas with many accidents, especially during wet or snow conditions. As such, a pavement grooving project was completed during 2000 and 2001 construction periods. A post study of the construction project determined that the grooving reduced the overall accident number by approximately 15% along the freeway sections of the expressway, a significant improvement. The overall reduction in crashes and therefore the effect that this improvement had on the reported accident rates is contained within the reported analyses following. A copy of the “Before and After Study: Cole County – US 50 & 54 Grooving Project” is contained with **Appendix A**.

Even with the completed grooving project, the corridor as a whole has crash experience slightly higher than would be anticipated for this type of facility under normal traffic conditions. The freeway type section of the Expressway west of the Tri-level, including the Dix Road interchange, and the section east of Jackson Street, including the Clark Avenue Interchange, both experience slightly higher than the state-wide average for similar freeway type facilities. This is detailed on **Table 1**, following. In addition, a copy of the state-wide crash rates utilized for this study is contained in **Appendix A**.

**Table 1
Segment Crash Rate Information**

Location	Total Crashes		Injury Crashes		Fatal Crashes	
	Project Rate	Statewide Rate	Project Rate	Statewide Rate	Project Rate	Statewide Rate
Rex Whitton						
Rt. 179 to Dix	158.02 **	121.08 (1)	37.18 **	31.04	1.86 **	0.86
Dix to Bolivar	162.41 **	121.08 (1)	55.65 **	31.04	1.14 **	0.86
Bolivar to Jackson	899.65 **	176.36 (2)	200.29 **	49.23	1.67 **	1.28
Jackson to Clark	221.45 **	121.08 (1)	58.28 **	31.04	5.83 **	0.86
Clark to Eastland	179.69 **	121.08 (1)	48.81 **	31.04	2.22 **	0.86
* Rates are calculated per hundred million vehicles miles ** Indicated rates higher than the comparable Statewide Rate (1) Based on 1999-2003 5-year average for Freeway Segments (2) Based on 1999-2003 5-year average for Expressways						

Review of the crash history did not identify any specific locations, patterns, or deficiencies that appeared to be substantial contributors or causes of the crashes along the corridor. The crashes within the freeway type segments were well spread along the corridor and did not appear to have any definitive patterns.

As can also be seen in **Table 1**, the most significant deviation above the statewide rate occurs in the segment of the corridor between Bolivar Street and Jackson Street. Along this section of the corridor, the current accident rate is over 5 times higher than the rate for similar Expressway type facilities across the state. This is the section of the expressway that currently has the most urban characteristics and has signalized controls of at-grade intersections with city streets.

To further investigate the factors related to the high crash rates of the downtown segment, a detailed review of the intersection crash history was completed. **Table 2** details the crash rates for the five at-grade signalized intersections within the downtown area.

**Table 2
Intersection Crash Rate Information**

Location	Number of Crashes	Overall Crash Rate	Injury Crash Rate
Rex Whitton w/			
Missouri Blvd.	113	1.21	0.27
Broadway Street	70	0.93	0.16
Jefferson Street	65	0.87	0.24
Madison Street	97	1.32	0.33
Monroe Street	95	1.39	0.29

* Rates are calculated per million entering vehicles
 Note: Intersection accident rates not tabulated by MoDOT

Of these five signalized intersections, the intersection of Missouri Boulevard with the Expressway experienced the highest number of crashes with 113 crashes while the intersection of Monroe Street with the Expressway experienced the highest crash rate of 1.39 crashes per million entering vehicles during the five-year study period.

The majority of the crashes at each of these location are of the rear-end variety which can be attributed to the congested conditions that exist throughout this portion of the corridor. This is very common along a congested, signalized corridor. A detailed discussion of the existing signal operations and congestion is detailed in following portions of this report.

A similar detailed review of the crash history within the interchanges though the corridor was also completed. The overall crash rates for these interchanges was calculated and is detailed in **Table 3**. It is interesting to note that in general, the diamond interchanges of Dix and Clark with the Expressway have much lower numbers of incidents than any of the at-grade intersections. The Tri-level interchange of US 50 with the US 54/63 ramps experienced a crash rates similar to those experienced at the signalized locations. This is due to the fact that, while the number of crash incidents is low, the volume of entering traffic that conflicts at the Tri-level is also very low, and as such a higher rate of crashes is experienced.

Table 3
Interchange Crash Rate Information

Location	Number of Crashes	Overall Crash Rate	Injury Crash Rate
Rex Whitton w/			
Dix Road Interchange	11	0.24	-
Tri-Level Interchange	13	1.25	0.21
Clark Interchange	30	0.62	-

* Rates are calculated per million entering vehicles
Note: Interchange accident rates not tabulated by MoDOT

Detailed information on the completed safety review, along with crash diagrams at the downtown intersections and interchange influence areas are contained in **Appendix A – Crash Experience**.

GEOMETRIC DEFICIENCIES ... One important task of this study was to determine whether there are any roadway geometrics and/or physical infrastructure deficiencies within the primary study corridor that may be contributing to any safety concerns. Each segment of the study corridor was reviewed and field checked to determine the compliance with the established Missouri Department of Transportation Standard Design Criteria.

As expected, in each of the distinct roadway segments, different design criteria and operational constraints exist. The freeway type sections have been constructed as a high speed facility with wide medians and extensive clear zones. Through the downtown portion of the corridor, the roadway has been built with a lower design speed and signalized at-grade intersections for local access. The transitional segments between the freeway portions of the

Expressway and the downtown segment have a mixture of both types of roadway elements that have been uniquely combined to match the terrain and surrounding land use constraints. As such, there is no single set of criteria that can be used to evaluate this corridor.

Following is a discussion of the geometric elements that were identified along the freeway and higher speed segments of the study corridor through plan research and field investigations. Photographs with descriptions of the identified deficiencies are contained in **Appendix B – Roadway Deficiencies**. The geometric elements of the roadway through the downtown segment of the project corridor were in line with those expected for an arterial street section with traffic signal controls. While the clear zones, medians, and curbs are not typical design elements for an Expressway, they are acceptable for a signalized, arterial section of street.

West Project limits through the Dix Road Interchange to the Tri-level Interchange...

Within this high speed, freeway type segment of the study corridor, two locations were identified that had minor clear zone limitations.

- ½ mile west of Dix Road (**Exhibit B-1a**)
 - Rock face 29.5 ft from edge of pavement EB
 - Rock face 31.5 ft from edge of pavement WB
- ¼ mile east of Dix Road (**Exhibit B-1b**)
 - Rock face 25 ft from edge of pavement EB
 - Rock face 22 ft from edge of pavement WB

For the posted speed limit of 65 mph through this segment of the corridor, 30 to 34 feet of clear zone is required based upon the “2002 Roadside Design Guide”.

In addition, the existing guardrail protecting the Dix Road interchange bridge was field identified as being short with regard to the vertical concrete bridge abutment it is intended to protect.

- At Dix Road (**Exhibit B-1c**)
 - Inadequate guardrail at bridge EB and WB

In each of the above cases, the deficiencies were found to be technical in nature. Review of the crashes experienced through these areas did not identify any of the noted deficiencies as contributing factors to or the cause any of the crashes. As such, the above deficiencies do not require attention or correction unless other projects present an opportunity to address them.

Within the Tri-Level Interchange... Within the Tri-level interchange, only one deficiency was identified through field investigations. The existing sight distance for the northbound US 54 off-ramp is limited due to bridge support pillars being in the sight lines. As the exiting drivers approach the stop bar, visibility to the west is hindered by the highway embankment and support structures.

- Bridge pillars obstruct view of NB US 54 off ramp looking west at stop bar (**Exhibit B-2**)

There are limited opportunities to correct this condition without extensive and expensive modifications to the Tri-level interchange. Only limited crash history at the interchange can be attributed to this sight distance limitation and therefore, no corrective action should be taken at this time. If modification of the Tri-level is considered at a future date, correction of this deficiency should be undertaken.

Jackson Street Bridge and Rock Cut Section ... The Jackson Street bridge and associated roadway cut limit the available width of the Expressway and encroach within the required clear zone for the facility. The vertical rock face and bridge abutments are separated from the roadway by protective barriers and fencing.

- Jackson Street Bridge Cut (No Picture)
 - Rock face EB and WB (protected by guardrail)

In the above case, the deficiency was found to be technical in nature. Review of the crash experience through these areas did not identify any of the noted deficiencies as contributing factors to or the cause any of the crashes. As such, the deficiency does not require attention or correction unless other projects present an opportunity to address them.

Jackson Street through Clark Avenue Interchange Embankments ... The existing fill slopes for the Expressway east of Jackson Street through the Clark Avenue interchange were all originally constructed with between 55% and 70% slopes. Typical earthen fill embankments are constructed at a maximum of 33% slopes (3:1), while engineered slopes for rock fills can sometimes be constructed with 50% slopes (2:1). Additionally, the steep fill slopes begin downward within a few feet of the back of curb. With no significant shoulders, the steepness of these embankment slopes provide no opportunity for recovery for vehicles that leave the pavement until the toe of the slopes are reached.

- East of Lafayette Street (**Exhibit B-3**)
 - Viaduct Embankments with 55% sideslope - all quadrants
- At Clark Avenue
 - EB off-ramp with 55% sideslope (**Exhibit B-4a.1**)
 - EB on-ramp with 70% sideslope (**Exhibit B-4a.1**)
 - WB off-ramp with 60% sideslope (No Picture)
 - WB on-ramp with 63% sideslope (**Exhibit B-4a.2**)

Review of the crash history as related to the embankment slopes did not identify any incidents that can be attributed to the steepness of the slopes. As such, no actions should be taken to correct the steepness of the slopes unless some other improvement project provides an opportunity.

Expressway Typical Section – Jackson Street to east of Clark Interchange ... The existing roadway section of the Expressway through the transitional segment immediately east of the downtown arterial section has a mix of both high speed and low speed elements. The vertical and horizontal design is adequate for the 55 mile-per-hour posted speed limit, but there are no provisions for shoulders that typically would be present on roadways posted at this speed. Similarly, the raised portion of the median is only 2 feet in width and provides

only for a total separation of 8 feet between opposing traffic flows, a low speed design element.

- West of Clark Avenue
 - 55 mph speed limit with no shoulder (curb and gutter) and 2 ft paved median (**Exhibit B-4b.1**)
- At Clark Avenue
 - Short guardrails at bridge EB and WB (**Exhibit B-4b.2**)
 - Bridge over Rex Whitton Expressway has no guardrails (blunt ends) (**Exhibit B-4b.3**)
- East of Clark Avenue
 - 2 ft paved median with no shoulder (**Exhibit B-4b.4**)

The crash record did show some serious head-on injury accidents had occurred within this segment of the study corridor. Due to this, MoDOT has recently completed a project to construct a raised median barrier from Monroe Street eastward to where the freeway type section begins west of the Eastland Interchange to provide positive separation between the traffic flows and thereby reduce the potential for head-on accidents.

Clark Avenue to Eastland Road ... Within this high speed, freeway type segment of the study corridor, two locations were identified that had minor clear zone limitations.

- ½ mile west of Eastland Road
 - 65 mph speed limit with no shoulder (curb and gutter) (No Picture)
 - Rock face 26 ft from edge of pavement WB (**Exhibit B-5**)

For the posted speed limit of 65 mph through this segment of the corridor, 30 to 34 feet of clear zone is required based upon the “2002 Roadside Design Guide”.

Please note that many of the geometric deficiencies listed are technical deficiencies only when compared to the standard MoDOT design criteria as currently established. With the implementation of the new practical design initiative, many of these concerns shall not be required to be addressed as part of any improvement projects as they have not been found to have negative impacts on the overall operations or safety of the corridor.

TRAFFIC OPERATIONAL DEFICIENCIES The primary existing deficiency of the Expressway is the unsatisfactory handling of the high traffic volumes and the associated traffic congestion, especially during the peak periods. Today, there are multiple factors which affect the capacity and traffic operations of Rex Whitton Expressway within the study corridor.

Three major U.S. routes converge at the Tri-level interchange, with two of the routes going through downtown Jefferson City along Rex Whitton Expressway. The lack of alternative routes for the highway traffic forces all of the through highway traffic onto Rex Whitton Expressway.

The freeway section of Rex Whitton Expressway from Dix Road to the Tri-level Interchange operates with good freeway levels of service. Likewise, the freeway section from Jackson

Street eastward through the Clark Avenue Interchange to the end of the project limits is also operating with good levels of service.

The downtown section of Rex Whitton Expressway from Missouri Boulevard to Monroe Street is currently an arterial section with traffic signals at every intersection. The downtown signalized section is operating near capacity today and some movements experience poor levels of service during the peak periods. The signalized intersections are the most critical capacity constraints for the downtown section, due to their close proximity to one another and the high traffic volumes that the signals are serving. **Figures C1-1 through C1-4 in Appendix C** shows the existing traffic volumes throughout the study corridor. **Figures C2-1 through C2-4** depict the existing levels of service throughout the study corridor.

BRIDGE AND STRUCTURAL INVENTORY AND ASSESMENT There are twenty one existing bridges that will influence the cost, phasing and constructability of strategies to relieve congestion along Rex Whitton Expressway from Route 179 to Vetter Lane. This is primarily due to 3 characteristics, the structure geometries, conditions, and locations.

Three of the structures are owned by the City of Jefferson.

Geometries ...None of the structures were constructed to allow widening of Rex Whitton, and very few can accommodate a widening without replacement. The exceptions are some of the box culverts that can be extended, and the Lafayette/Wears Creek Viaduct.

While feasible, extensions of culverts will be complicated because the alignments of the channels they serve are not in line with the existing culverts.

Bridges in the Tri-level interchange have varying spans due the three levels. This results in their columns conflicting with any potential lane configuration of a wider expressway.

The four overpasses at Dix Road, Jackson Street, Chestnut Street, and Clark Avenue are concrete rigid frames that have only 80' of horizontal clearance underneath, making it very difficult to widen to three lanes each way.

Vertical clearance is limited at 15'-8" by the Tri-level interchange and the Jackson Street overpass.

Conditions ... Most of the bridges are in good condition though all but three are 42 to 46 years old. Repairs are already planned or being accomplished where condition ratings are low, such as the deck on the Lafayette Street viaduct. This generally good condition is noteworthy because replacement of any of these bridges to accommodate an expressway strategy will represent loss of an asset that could have 15-25 years of remaining life.

There is one bridge where the current condition is poor and will therefore affect all strategies. The existing box culvert that runs under Miller St. is 1300' long and is in need of repair or replacement prior to any widening of the expressway.

Locations ... Construction or modification of bridges will require the addition of walls and considerable amounts of temporary shoring to protect adjacent streets, parking, buildings, and other bridges.

The three channels of the Wears Creek FEMA floodplain will likely be affected by any improvement strategy. Flood elevations will need to be maintained and limitations on placement of obstructions in the channels will affect structure types and costs.