



Preliminary Risk Assessment of Proposed MoPac Underpasses at Slaughter Lane and La Crosse Avenue

MoPac (State Loop 1) Intersections, Austin District

From North of Slaughter Lane to South of La Crosse Avenue

CSJ: 3136-01-015

Travis County, Texas

October 2014

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 16, 2014, and executed by FHWA and TxDOT.

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To: Central Texas Regional Mobility Authority
Texas Department of Transportation—Austin District

From: Jacobs Engineering Inc.

Subject: Preliminary Risk Assessment of Proposed MoPac Underpasses at Slaughter Lane and La Crosse Avenue

Date: October 29, 2014

1. Introduction

This memorandum summarizes the risk to sensitive environmental features and resources posed by the proposed under-passing of Slaughter Lane and La Crosse Avenue. The proposed project, which is under development and evaluation through the MoPac Intersections Environmental Study, is subject to the National Environmental Policy Act (NEPA). The study involves preparation of an environmental assessment (EA) document, public engagement activities including a public hearing, and an environmental finding. The study team has evaluated the potential for a significant hydrogeological connection between the intersections project area and known area caves that could affect water quality, quantity, and protected species. This memorandum is preliminary and subject to change pending completion and approval for public circulation of the EA. More detailed information about potential project impacts and mitigation measures is contained in a series of technical memoranda being developed in support of the EA.

The memorandum begins with a summary of the proposed project and the reasons why an underpass solution is proposed. It then references additional geologic studies conducted by the study team regarding environmental risk, followed by conclusions regarding risk of cave and karst feature encounters, water quality, water quantity and protected species.

2. Project Summary and Design Rationale

The purpose of the proposed project is to improve intersection operations and enhance safety. The proposed improvements involve grade-separating the cross streets of Slaughter Lane and La Crosse Avenue, allowing MoPac through lanes to underpass the existing cross streets. The proposed improvements to MoPac consist of two 12-foot lanes, 10-foot outside shoulders and 4-foot inside shoulders in each direction. The drainage system would continue to utilize curb and gutter, existing hazardous material trap (HMT) structures disturbed by the improvements would be replaced, and temporary and permanent water quality Best Management Practices (BMPs) will be incorporated.

The grade separation at La Crosse Avenue and MoPac would be configured as a standard diamond interchange. The grade separation at Slaughter Lane and MoPac would feature a diverging diamond interchange (DDI). Advantages of the proposed DDI at Slaughter Lane include 1) improved 2035 operations compared to other intersection solutions evaluated (e.g., SPUI, diamond), and 2) no additional right-of-way (ROW) and no changes in access for Slaughter Lane businesses compared to other innovative, at-grade solutions (e.g., roundabout, Town Center concept).

Safe east-west access for pedestrians and bicycles would be provided at both intersections. A shared-used path is proposed from Slaughter Lane to La Crosse Avenue within the existing ROW along the west side of MoPac.

Development of the proposed improvements included an evaluation of both overpass and underpass options. Consideration was given to engineering and cost, public input, and environmental factors.

A. Engineering and Cost

Existing conditions in the project area favor the geometry for an underpass, owing in part to the original construction plans, which were designed with a planned future underpass at both Slaughter Lane and La Crosse Avenue. When MoPac South was built in the early 1990s, the intent was to convert the connections at Slaughter Lane and La Crosse Avenue to entrance and exit ramps when the future through lanes are constructed. For this reason, the underpass option requires less reconstruction of the entrance and exit ramps. The overpass option would involve extensive reconstruction of the ramp profiles to tie into Slaughter Lane and La Crosse Avenue. Underpassing the two cross-streets is estimated to cost \$12.5 million less than overpassing them, the main reason for which is the longer bridge lengths required for overpassing.

B. Public Input

The public involvement efforts on the MoPac Intersections Environmental Study have included discussions with stakeholder organizations, participation in community events, a webpage on www.MoPacSouth.com, e-newsletters, postcards, and an open house held in October 2013. The public input received during this effort reveals considerable concern for potential noise and visual impacts. Of the 127 comments in the open house record, 26 indicated concern about traffic noise and 10 expressed concerns about visual impacts. Noise and visual effects would be minimized by the underpass option, and the majority of public comments regarding these issues have stated a preference for the underpass option. Of the 127 open house comments, 17 favor the overpass option and 43 favor the underpass option.

C. Environmental

Environmental factors considered as part of the evaluation of underpass vs. overpass included (1) consideration of drilled shafts, (2) extent of the excavation, (3) existing underground pipelines, and (4) the application of water quality controls.

- 1) Regardless of whether MoPac goes under or over the two cross-streets, the bridges will need drilled shafts that would extend approximately 20 feet below grade. The advantage of the underpass option is that it substantially reduces the number of drilled shaft locations. This is because for the underpass option, each cross-street bridge would consist of only two abutments and only one multi-column bent, which adds up to a total of 13 columns and four abutments. The overpass option at Slaughter Lane would require two 1,500-foot long bridges, with each bridge consisting of two abutments and 14 single column bents. At La Crosse Avenue, the overpass option would require two 600-foot long bridges consisting of two abutments and four single column bents each. To summarize, the underpass option requires an estimated 13 columns and four abutments while the overpass option requires an estimated 36 columns and eight abutments.

Both options would penetrate the Grainstone member, which is known to contain voids. The Slaughter Lane overpass option also has potential to reach the Grainstone/Kirschberg contact, an area known for laterally extensive caves. Because the Slaughter Lane and La Crosse Avenue overpass options require so many more drilled shafts over a wider area, the risk for encountering voids is considered to be greater.

- 2) For the underpass option, the maximum cut under Slaughter Lane would be approximately 23 feet, and under La Crosse Avenue approximately 25 feet. Average depth of the maximum cuts below native ground for the entire length of the Slaughter Lane underpass, not including the construction fill that was added when Slaughter Lane was built, is 15.6 feet. For the entire length of the La Crosse Avenue underpass, the average depth of the maximum cuts below native ground, not including the construction fill in that area, is 15.8 feet. Final design strategies for minimizing the depth of excavation include: (1) where reasonable, flatten the median ditch slopes; (2) depending on geotechnical assessment of slope stability, steepen the back slopes between the mainlanes and ramps once the 30-foot clear zone is met; and (3) alter the ditches from a "V" ditch to a trapezoidal channel section once the ditch capacities have been determined.
- 3) At this stage of the project design, it is assumed that the extent of excavation for the roadway and ditches would be approximately 23 feet, which would not require the relocation or adjustment of the Magellan, Phillips 66 or Kinder Morgan pipelines. The need for adjustments to the Magellan pipeline will be further evaluated and determined during final design and coordinated with the pipeline owner.

- 4) The underpass design will meet or exceed all current Texas Commission on Environmental Quality (TCEQ) Edwards Aquifer Protection Program (EAPP) requirements, and will comply with the 1990 Consent Decree and Partial Final Judgment regarding the continued use of HMTs.
- 5) Voids are encountered on many projects located on the recharge zone and well defined mitigation procedures have been developed by both the TCEQ and the City of Austin. The goals of these procedures are to protect groundwater quality both during and after construction and to maintain hydrologic connectivity where active flow paths are encountered. Any voids encountered will be mitigated in accordance with TCEQ rules outlined in Title 30 Texas Administrative Code Chapter 213.5 (f)(2). If large voids are encountered, innovative engineered solutions (i.e., project-specific design solutions) will be utilized to maintain the flow of groundwater and surface-derived nutrients (if any) and prevent untreated surface water from the project area from entering the void.

3. Additional Geologic Studies

Caves and karst features are known to occur in the geologic units present in the project area; therefore, it is possible that karst voids will be intersected during construction, particularly during down-cutting into bedrock for the proposed underpasses at Slaughter Lane and La Crosse Avenue. Zara Environmental LLC and Dr. Michael Barrett, subconsultants to Jacobs Engineering Inc., were asked to gather additional data and perform additional analysis of potential impacts to nearby caves and karst features resulting from the proposed MoPac Intersections Project beyond the scope of what is included in the project's draft Geologic Assessment. Zara's technical memorandum, *MoPac Intersections Project – Additional Geologic Studies*, is the source for many of the conclusions provided herein.¹

A variety of data gathering techniques were evaluated to help define the risk associated with encountering voids during construction, including both geophysical and field methods. These include:

- Electrical resistivity
- Ground penetrating radar
- Dye tracing to determine flow paths
- Geologic mapping to determine which members of the Edwards Group would be encountered during excavation and their propensity for cave formation
- Determining relative elevations of caves vs. the proposed excavation to assess potential for hydrologic connectivity
- Defining surface drainage basins for the known caves to see if surface runoff from the project could enter a cave

Electrical resistivity and ground penetrating radar would provide information about subsurface anomalies in the project area, but these data would need to be calibrated to geotechnical borehole data

in order to yield reliable interpretations. Even then the surveys would only confirm that voids were present, but not provide the critical information about whether the voids provided active flow paths or whether protected species were present.

Dye tracing would be costly and time consuming and would probably only confirm that we are in the subsurface drainage basin of Blowing Sink Cave, since a trace from Wildflower Cave has already shown that at least part of the project area is in the subsurface drainage basin of Blowing Sink Cave. However, for reasons noted in the conclusions section below, it is unlikely that the proposed project would impact the quantity or quality of water reaching Blowing Sink Cave.

Consequently, the detailed evaluation conducted by the study team focused on geologic mapping, cave dimensions, surface drainage basins, and water availability to assess the potential for a significant hydrogeological connection between the intersections project area and known area caves that could affect water quality, quantity, and protected species.

4. Conclusions

The proposed improvements for MoPac South at Slaughter Lane and La Crosse Avenue address operational and safety needs. The proposed underpasses:

- improve 2035 traffic operations at Slaughter Lane better than other solutions evaluated
- do not require additional ROW or changes in access for Slaughter Lane businesses compared to other innovative, at-grade solutions (e.g., roundabout, Town Center concept)
- provide safe pedestrian and bicycle facilities
- are substantially less costly than overpasses
- are preferable to an overpass option based on public input to date
- would require substantially fewer drilled shafts, which would extend over a smaller overall area, compared to overpasses
- would not disturb existing underground pipelines (Magellan to be further evaluated during final design)
- are subject to minimizing the depth of excavation during final design
- will comply with EAPP requirements
- are compliant with the 1990 Consent Decree

The proposed project poses a low risk for significant hydrogeological connections to sensitive caves, karst features and groundwater resources that could affect water quality, quantity, and protected species for the following reasons:

A) Risk of Cave and Karst Feature Encounters

- Caves and karst features are known to occur in the geologic units present in the project area; therefore, it is possible that karst voids will be intersected anywhere grading or down-cutting into bedrock occurs. Any voids encountered will be mitigated in accordance with state law using well defined mitigation procedures developed by both the TCEQ and the City of Austin, and project-specific solutions designed to maintain the flow and quality of groundwater.
- The proposed cut at Slaughter Lane occurs in the Grainstone member where laterally extensive caves are not normally found; however, the contact between the Grainstone and Kirschberg members occurs within four (4) feet of the proposed cut. The Grainstone/Kirschberg contact is known for some of the most laterally extensive cavernous zones within the Barton Springs Segment.
- More extensive caves may be encountered at the La Crosse Avenue cut, as it is in the Kirschberg member, which is known for laterally extensive caves. If caves are encountered during construction, approved mitigation measures and innovative engineered solutions would be applied to maintain water flow and quality.
- Based on analysis of cave dimensions near the project area, the majority of known caves is less than 100 feet in their longest segment and likely would not extend across the full width of either of the cut areas.

B) Water Quality

- The limits of construction of the proposed project are not located within the surface drainage basin of any known cave. While the upper reaches of the surface drainage basins of three caves – La Crosse Cave, Wildflower Cave and Windmill Flat Sink – are mapped within the ROW, current drainage patterns within the ROW direct runoff from the ROW away from these cave entrances. The current drainage patterns will remain the same along the ROW adjacent to the caves' surface drainage basins, so there will be no impacts to the surface drainage entering these caves from the ROW.
- Analysis of topography and hydrologic gradients to caves in the project area indicates that, with the exception of Baby Fox Cave, Buddy's Vault, Another Cave, and Slaughter Creek Cave, known caves are unlikely to be impacted by vadose (unsaturated) groundwater flows from the project area. Of these caves, only Baby Fox Cave is east of the ROW in the general direction of groundwater flow. Any impacts to groundwater within Baby Fox Cave would be mitigated by

water quality BMPs that treat all flows leaving the ROW once the proposed project is operational.

- Because Blowing Sink Cave intersects the phreatic (saturated, regional water table) zone, it is possible that the project could impact the phreatic portion of the cave, but unlikely that portions of the cave within the vadose zone will be impacted. Near La Crosse Avenue, Wildflower Cave, which is not a BCCP cave, is at approximately 2% gradient from the closest intersection cut at La Crosse Avenue, and is therefore unlikely to be impacted by the project. Again, any impacts to the phreatic groundwater within Blowing Sink Cave would be mitigated by water quality BMPs.

C) Water Quantity

- Engineered solutions will be implemented for subsurface voids encountered with evidence of significant groundwater flow.
- While the project will add approximately eight acres of new impervious cover over the Recharge Zone, proposed roadway improvements may help to sustain flow during droughts due to an overall increase in treated runoff released from water quality structures compared with existing conditions.
- Due to the relatively small footprint and drainage area of the proposed project relative to the potential subsurface drainage area of Blowing Sink Cave, it is unlikely that the proposed project would impact the quantity of water reaching Blowing Sink Cave in either the vadose or phreatic zones.
- Water quality BMPs are designed to create hydrographs with an extended period of discharge, which will benefit downstream recharge opportunities in the receiving waterways.ⁱⁱ

D) Protected Species

- No federally-listed karst invertebrate species are known from any caves or karst features within the proposed project ROW or within 1 mile of the proposed project.ⁱⁱⁱ
- No BCCP-protected caves containing species of concern are within the ROW.
- Analysis of topography and hydraulic gradient from the cut areas to the eight closest BCCP caves (within ~1 mile) indicates that it is unlikely that there will be vadose flow impacts to any BCCP-protected caves except Slaughter Creek Cave, which has a slight risk of being impacted during

cutting of the upper one (1) foot of bedrock at La Crosse Avenue based on the hydraulic gradient (12.1%). During the operation phase, Slaughter Creek Cave is unlikely to be impacted, as the hydraulic gradient will be reduced to 8.9%. It is important to note that Slaughter Creek Cave is west of the project area and groundwater flow is generally to the east. Based on the hydraulic gradient and location of Slaughter Creek Cave in relation to the La Crosse Avenue cut, it is very unlikely that the cave will be impacted by the proposed project. Based on the hydraulic gradients, no impacts to species of concern are anticipated in any other BCCP caves.

- Potential impacts to federally-listed *Eurycea* sp. salamanders in Blowing Sink Cave or Barton Springs are highly unlikely due to existing and proposed water quality BMPs that will treat any surface water flowing from the project area before it recharges the Barton Springs Segment of the Edwards Aquifer.
- The project will meet or exceed EAPP requirements; net total suspended solids removal will increase when compared to current conditions once the proposed project is operational.^{iv}
- All stormwater runoff will receive treatment before discharge to the environment; water quality BMPs are designed to attenuate increases in peak flow; detention ponds will provide downstream water quality benefits by helping to limit additional stream bank erosion.^v

ⁱ Zara Environmental LLC (Brian Cowan, P.G., Clover Clamons, P.G., Peter Sprouse). 2014. MoPac Intersections Project – Additional Geologic Studies – Draft. Prepared for Jacobs Engineering Inc.

ⁱⁱ K. Friese & Associates. 2014. MoPac Intersections Environmental Study Preliminary Water Quality Analysis and Design (Draft). Prepared for Jacobs Engineering Inc.

ⁱⁱⁱ Zara Environmental LLC. 2014. Draft: Karst Invertebrate and Salamander Technical Report MoPac Intersections Environmental Study, Austin, Travis County, Texas. Prepared for Jacobs Engineering Inc. 17 June 2014.

^{iv} K.Friese & Associates. 2014. (see endnote ii)

^v K.Friese & Associates. 2014 (see endnote ii).