IH-635 MANAGED LANES PROJECT, SEG. 3.2

Location:
Dallas, Texas

Owner:
Texas Department of Transportation

Client:
Ferrovial Agroman

Construction Cost:
$1 Billion

Construction Completion Date:
December, 2015

Project Description

This Public, Private, Partnership Project (P3) involved the construction of 4 miles of a 6 lane wide depressed tollway from Rosser Road to SH 75 on the north side of Dallas, Texas located in a dense established freeway corridor, in a heavily built environment. JSE was the lead consultant for this complex interstate reconstruction project. 8 lanes of freeway, 4 to 6 lanes of frontage roads and one major interchange were reconstructed. JSE completed all design work in 20 months.

This project was part of a the larger 17 mile LBJ Express project encompassing improvements along I-635 from Luna Road to Greenville Avenue, as well as on IH-35E between Loop 12 and Valwood Parkway. The LBJ Express combines the same number of general purpose lanes that exist today with continuous frontage roads and approximately 13 miles of new express managed toll lanes.

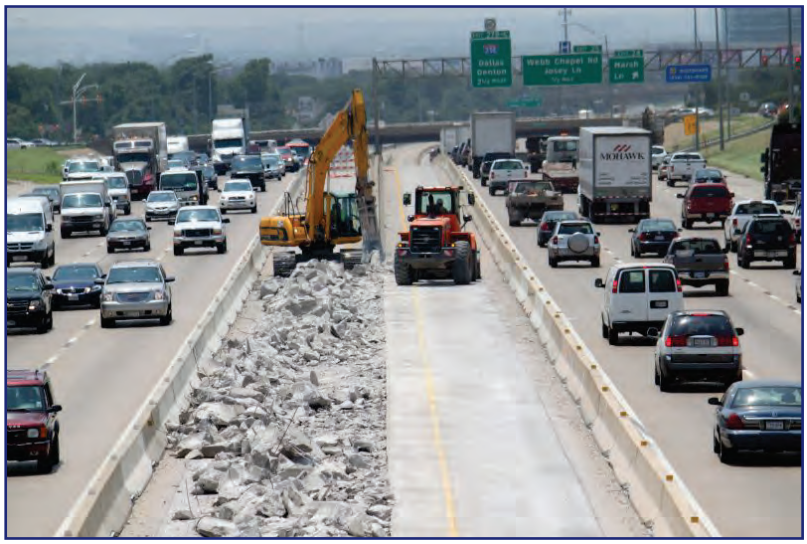
Almost all of the construction on this project is challenging because of the confined space and heavy daytime traffic in the project vicinity. As well as substantially structured mainlines, the additions of toll roadways involves slip lanes, direct connector ramps, and connections to three full-blown expressways at already complex expressway to expressway interchanges.

Civil Design Highlights

JSE provided the complete road design for 75 lane miles of managed toll lanes, freeway and frontage roads along with multiple cross streets, slip lanes and ramps. The design included many interchanges including the one complex interchange between IH-635 and the Dallas North Tollway (pictured to the right).

As part of the reconstruction and addition of the managed lanes, a new drainage system consisting of over 50 miles of pipe was designed in conjunction with the detention ponds and water quality features. JSE also completed the hydraulic study for a major stream crossing. The results of this study provided the bridge sizing for the stream crossing. Another unique drainage feature was the design of two aqueducts carrying storm water over the depressed managed lanes.

With the construction of this project, all traffic signals within the project limits were replaced, updated and connected to the new ITS system. JSE designed and detailed the components and signs associated with the new ITS system and it's connection to the larger LBJ Express project. Additionally, JSE performed the design and detailing of the new lighting system. All traffic signs throughout the project limits were replaced as part of the contract.



One of the most challenging aspects of the road design was the maintenance of traffic plan. Complex traffic maintenance plans to meet the stringent contract criteria that all lanes must remain in service for the duration of the construction were developed in cooperation with the contractor. All lanes remained open while completing the 30 foot deep excavation down the center of the existing highway.

<u>Key JSE Individuals and their project involvement:</u>

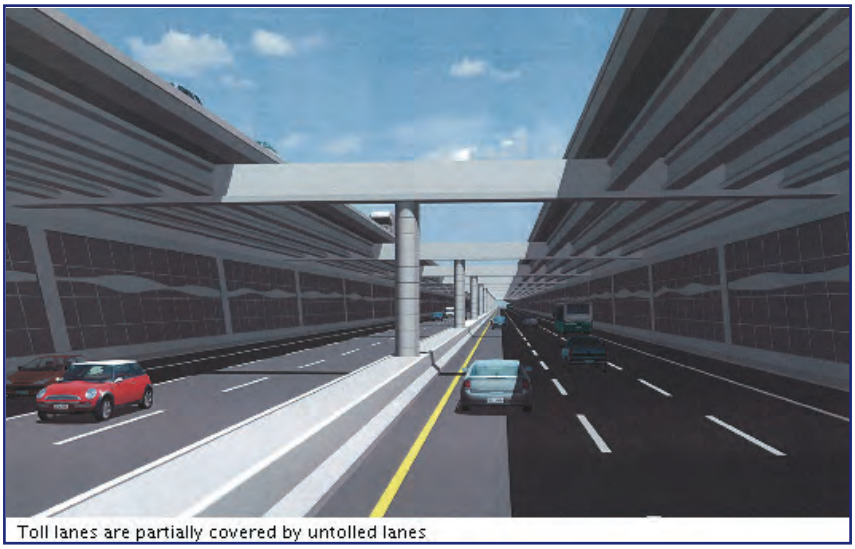
Bob Gray, PE – Overall Project Manager in charge of: road design, drainage design, traffic control plan, lighting & ITS.

Phil Kuntz, PE – Quality Control and Quality Assurance Manager providing technical support on: road design, drainage design, traffic control plan, lighting & ITS.

Structural Design Highlights

JSE provided structural engineering services for the design of 46 bridges and 2 million square feet of various types of retaining walls. Several existing bridges were strengthened, widened or repaired. Four interior piers of a multi-level structure had to be moved to fit the new lane arrangement.

The types of bridges designed on this project included steel beam and prestressed concrete bridges both in simple span arrangement and continuous arrangement. Most of the deck design also utilized partial depth prestressed deck panels to expedite construction.


Toll lanes are partially covered by untolled lanes

One of the more challenging portions or the project was the design of elevated lanes over the newly constructed depressed managed lanes. The deck for the elevated lanes was supported on beams and the adjacent embankment. JSE developed a solution that would allow differential movements between the elevated portions of deck and the adjacent portions of slab cast on grade. Due to the lengths of the straddle bents spanning the lower managed lanes, post-tensioning in these precast pier cap components was utilized in their design to minimize depth and provide a long term durable support system.

Due to the soil conditions present in the project limits deep foundations were generally utilized. These deep foundations were typically drilled shafts. The drilled shafts were founded in rock and relied on a combination of skin friction and end bearing to achieve capacity. If geometry dictated, group effects were also considered in their design. This foundation type was selected based on the soil type (clays) and close proximity to rock.

The retaining walls on the project included rock nail, MSE, cast-in-place and drilled shaft walls. At each retaining wall location a study was performed to determine what walls were feasible taking into account MOT constraints and limitations. Analyzing the economics of the wall alternates, JSE confirmed wall selection with

the contractor then proceeded to prepare the detailed final design of the wall.

The project also had to integrate existing structures into the reconstruction. JSE performed load rating analysis on some of these structures and made recommendations for repairs and/or replacements. When the contractor elected to repair structures, JSE prepared detailed strengthening calculations and rehabilitation plans. These plans involved deck and beam replacement, strengthening of decks with carbon fiber reinforcing and deck overlays.

Throughout the entire project corridor aesthetic criteria had to be maintained. JSE's bridge and retaining wall designs incorporated the overall aesthetic theme to maintain the architectural details that were promised to the local community. Additionally, all structures were outfit with the necessary components to carry electrical lines, intelligent transportation systems and accommodate sign services.

Key JSE individuals and their project involvement:

Javier Gauthier, PhD, PE, SE – Overall Structures Project Manager in charge of: bridge design, retaining wall design & plan review.

Brian Slagle, PE, SE – Quality Control and Quality Assurance Manager providing technical support on: bridge design & retaining wall design.

Demolilton of Existing Structures

Prior to various construction operations taking place, demolition of the existing structures in this project had to take place. JSE prepared the demolition analysis for the existing bridge structures to be removed. Working closely with the contractor, JSE developed and produced the controlled, staged removal demolition plans for all the structures.

All of the existing structures were located in an urban environment and were adjacent to or crossed existing roads that were maintaining traffic. The types of superstructures supported on concrete piers and abutments that were demolished included: concrete deck supported on continuous steel beams, concrete deck supported on prestressed I-beam and bulb-tee beams, and continuous reinforced concrete spline structures. All of the bridge structures were elevated and tied into existing concrete works. Removal of the foundations commenced to the point where existing portions would not interfere with new work.

The analysis performed on some of the structures concluded that in order to maintain stability during demolition, temporary shoring would be required to support the structure. When this was the case, JSE either provided the anticipated shoring loads for use with standard towers or in unique cases, JSE designed a shoring system for the contractor to use.

Another important consideration that was investigated in the demolition analysis was checking the capacity of the existing structures to support the construction loads from the demolition equipment to verify the structures could safely support the equipment during the staged removal. JSE considered not only the plan information, but looked at inspection reports to determine if additional consideration must be given to deteriorated components. In the event where traffic was maintained under structures that were being demolished, JSE designed protective sheeting to further ensure safety to the travelling public.

Where feasible, the material from the demolished structures was incorporated in the new construction. Steel removed for the existing bridges was also used for some temporary works or sent to other projects where it could be recycled for future use.

<u>Key JSE Individuals and their project involvement:</u>

Javier Gauthier, PhD, PE, SE – Structures Project Manager in charge of overseeing: structural modeling, demolition plan development & scheduling.

Brian Slagle, PE, SE – Quality Control and Quality Assurance Manager providing technical support on: structural modeling & demolition concepts / plans.