TYPE SELECTION REPORT

For

Union Pacific Railroad Underpass Bridge
Milepost 178.90 Katy Eureka Sub
Hempstead Rd Widening
CSJ No. 8170-12-001
Harris County, Texas

Introduction
The Texas Department of Transportation (TxDOT) is preparing Plans, Specifications, and Estimates (PS&E) for the horizontal widening and vertical depressing of Hempstead Road in Houston, Texas. The proposed widening of Hempstead Road will expand the existing roadway from a narrow 4-lane section without shoulders to a 6-lane section with a median and sidewalks. This requires replacing the three existing Union Pacific Railroad (UPRR) underpass bridges located between Kansas Street and the Washington/Hempstead Road split. The existing middle UPRR underpass bridge consists of a single span approximately 50 feet long structure with steel plate girders designed and constructed in 1934. This report consists of a technical write-up documenting the justification of the rolled steel girder design for the proposed UPRR bridge replacement.

Geometric conditions of the site and proposed mainline bridge
The proposed bridge layout allows for the wider depressed street. The bridge will be constructed in the same location as the existing bridge and will accommodate the same existing single track. The number of spans will be increased from one to two, with rolled steel beams to span the NB and SB travelways. The roadway widening cuts into existing sideslopes of the slightly depressed existing section, requiring longitudinal retaining walls on both sides of the roadway. The proposed vertical alignment modification makes the retaining walls that much deeper. The transverse separation between the retaining walls will be 98 feet, and the railroad will cross the lowered roadway at about the same present zero degree skew angle. The abutments will be integrated with local drilled shaft retaining walls in the zone of railroad live load influence. Outside of this zone, a drilled shaft retaining wall with smaller diameter drilled shafts will be used.

The existing vertical clearance under the UPRR bridges north and south of this middle UPRR bridge is posted at 13'-10". A combination of lowering Hempstead Rd and maintaining a shallow top of rail to bottom of girder depth is required to accommodate the current vertical clearance requirements in the UPRR-BNSF Guidelines for Grade Separations. Hempstead Rd is being designed to be lowered the maximum approximately 5 ft, which is the max elevation change that still meets the geometric constraints of the site. Hempstead Road south of the bridges is currently under construction to tie to this lower vertical alignment. A pump station will be used to
manage drainage. The existing track profile grade does not have geometry conducive to a track raise. The existing track profile and maximum depth for lowering the roadway leaves only 7.2 ft effective structure depth from top of rail to bottom of girder at a vertical clearance of 17'-6", and 8.2 ft effective structure depth for 16'-6" vertical clearance. A deck girder structure spanning this same distance without a middle support would require an effective structure depth of approximately 12 ft, which clearly would be unacceptable.

The superstructure type that was chosen for this case is a concrete deck supported by rolled steel beams. This type of superstructure offers many advantages over a steel deck superstructure. Reasons for choosing this type of superstructure over steel plate decks include:

1- Vertical clearance exceeds 16-6" after being evaluated for typical trailer lengths that chord the roadway sag vertical curve.
2- The beams will perform more as a cohesive unit
3- A better composite action will be obtained yielding a stiffer structure
4- This is a more durable superstructure especially if/when the waterproofing fails
5- Should there be a need to repair the structure in the future, it would be less costly than the steel deck.

TxDOT has “Annotated Exceptions” to the UPRR-BNSF Grade Separation Guidelines.

Rule 25.74 of the Texas Administrative Code states:
(a) The department assumes the maintenance of railroad underpass substructure units, consisting of the piers, abutments and wingwalls but excluding any existing timber substructure for approach spans. Except as provided in subsection (b) of this section, the railroad companies have the maintenance responsibility for the underpass superstructure, including the beams, shoes, deck, waterproofing, and track structure.
(b) In the event of damage to the underpass superstructure, beams and/or deck, by highway traffic, the state will assume the cost of repairs. In such cases it will be necessary for the railroad representative and the district engineer to agree on the extent of repairs. Upon notification by the railroad company, an agreement will be prepared for execution and a job set up based on the estimated cost of repairs. This work will be performed by railroad forces or contract as may be agreed upon by the railroad representative and the district engineer. Work of an extreme emergency nature may be undertaken by the railroad company upon approval of the district engineer prior to execution of a formal state-railroad agreement to cover the proposed repairs. However, no work will be paid for by the state which is undertaken by the railroad company prior to issuance of a work order by the district engineer.
(c) These provisions for maintenance of underpass substructure units and assumption of costs for repair of damage to superstructure spans caused by highway traffic, as noted in subsection (b) of this section, apply only to underpass structures constructed or reconstructed after October 28, 1960.

As such, while the railroad still owns and maintains the mainline superstructure, TxDOT would normally bear the responsibility to address damage induced by traffic below.
However, since ownership and maintenance of the bridge will transfer to the City of Houston right after the bridge is built, all stated responsibilities of the state above will transfer to the City of Houston.

Site Photos

Existing Middle Bridge looking south
Existing Middle bridge looking west.