Appendix X: Construction Impacts

I-35 Capital Express Central Construction Vibrations Considerations Technical Memo

Roadway Construction Noise Analysis Report

Proposed Temporary Construction Noise Barriers

I-35 Capital Express Central Construction Vibrations Considerations Technical Memo

MEMO

June 1, 2023

To: Rebekah Dobrasko
Cultural Resources Section Director, TxDOT Environmental Affairs Division

Through: Tricia Bruck-Hoyt
Mobility 35 Environmental Task Lead

From: Colin Sessions
Mobility 35 Tunnel SME

Subject: I-35 Capital Express Central Construction Vibration Considerations Technical Memo

1. INTRODUCTION

The I-35 Capital Express Central project is located in the central region of the Austin metropolitan spanning a distance of approximately 8 miles along I-35 between US 290 East and SH 71/Ben White Boulevard.

1.1 Project Background

The proposed improvements include removing the existing I-35 decks, lowering the roadway, and adding two non-tolled high-occupancy vehicle managed lanes in each direction along I-35 from US 290 East to SH 71/Ben White Boulevard. The project will also reconstruct east-west cross-street bridges, add pedestrian and bicycle paths, and make additional safety and mobility improvements within the project limits. To facilitate lowering of the roadway significant open-cut excavations will be performed along with the construction of a drainage tunnel. Initially, three relatively shallow drainage tunnels were proposed, one along E. Cesar Chavez Street and two running parallel to I-35, one on the east side and one on the west side. However, to limit potential impacts to existing historic structures and reduce construction risks a deeper tunnel option in rock was selected. The drainage tunnel will be completed under a design-bid-build contract to be performed prior to the I-35 roadway lowering. Once the drainage tunnel is complete construction on the roadway lowering, which will also be completed under a design-bid-build contract, will begin. A brief description of the two projects can be found below.

I-35 will be depressed between approximately Airport Blvd and Lady Bird Lake. The depth of the excavation to lower the roadway varies with a maximum depth of approximately 65 feet. It is anticipated that drilled shafts will be used to support the excavation. The depressed roadway will be excavated utilizing either traditional excavation equipment or controlled blasting. The selection of allowable excavation methods will be determined by TxDOT during detailed design.

The drainage tunnel is anticipated to be excavated within the Austin Chalk and have a finished inside diameter between approximately 22 feet and 26 feet. Currently, the tunnels are anticipated to be supported and lined with precast concrete segments. At the downstream end of the tunnel a pump station will be installed to dewater the tunnel after a rainfall event. The tunnel is anticipated to be constructed utilizing two tunnel boring machines; one launched near the proposed pump station site located on the south side of E. Cesar Chavez near US-183 and the second near River Street and the I-35 south frontage road. The exact location of the tunnel launch shafts will be determined during detailed design.

Additionally, at this time eleven intake/access/pump station shafts are planned to convey near surface flows to the drainage tunnel and facilitate maintenance activities. These shafts are located in the following general areas. The exact locations will be determined during detailed design.

- Airport Retrieval Shaft: Southbound I-35 Frontage Road north of Airport Boulevard.
- Airport Drop Shaft: Southbound I-35 Frontage Road south of Airport Boulevard.
- Hancock Drop Shaft: Southbound I-35 Frontage Road between Airport Boulevard and E 46th Street.
- Edgewood Drop Shaft: Northbound I-35 Frontage Road between Edgewood and E 32th Street.
- Dean Keeton Drop Shaft: Northbound I-35 Frontage Road and E Dean Keeton Street.
- 15th Drop Shaft: Northbound I-35 Frontage Road and E 15th Street.
- 11th Drop Shaft: Northbound I-35 Frontage Road and E 11th Street.
- Brushy Drop Shaft: Brushy Street and Cesar Chavez Street. Cesar
- River Launch Shaft: East Avenue and E River Street
- Cesar Chavez Launch Shaft: Southwest quadrant of the US 183/Cesar Chavez/Airport Boulevard Interchange
- US 183 Pump Station: Southeast quadrant of the US 183/Cesar Chavez/Airport Boulevard Interchange

1.2 Purpose

The purpose of this memorandum is to review the 155 historic sites that were identified within the project vicinity and determine their susceptibility to damage during construction based on the anticipated construction activities. This memorandum will discuss the anticipated subsurface conditions, the historic structures, ground movements and vibrations from construction, and typical geotechnical instrumentation and monitoring that can be used during construction to monitor ground movement and vibrations. The recommendations presented in this memorandum are intended exclusively for the historical structures in the vicinity of the project.

Detailed design has not begun on the I-35 depression and is just getting started for the drainage tunnel. As a result, only preliminary geotechnical information is available at this time. Therefore, it is not possible to calculate specific anticipated ground movements, vibrations, or impacts to the historic structures. However, where possible, assumptions were made based on anticipated ground conditions and construction methods to provide a high-level estimation of impacts. During detailed design of each element a more detailed construction impact assessment should be performed.

2 ANTICIPATED SUBSURFACE CONDITIONS

2.1 General Geology

Austin, Texas is located on the boundary of the Edwards Plateau to the west and the Gulf Coastal Plains to the east and southeast. These physiographic provinces are separated by the Balcones Fault Zone (BFZ), a belt of inactive faults, which trends generally southwest to northeast through central Texas. The I-35 Capital Express Central project is approximately located on the eastern boundary of the BFZ. A review of the Geologic Atlas of Texas, Austin sheet published by the Bureau of Economic Geology indicates the project alignment lies within Alluvium (Qal), Terrace Deposits (Qt), High Gravel Deposits (Qhg), Ozan Formation (Ko) and Austin Chalk (Kau). The USGS Mineral Resources Online Spatial Data reference contains the following description of these geological formations.

The Alluvium includes deposits in modern channels of the Colorado River and tributary streams. This unit is generally composed of unconsolidated gravel, sand, silt, and clay. The maximum thickness of alluvium is about 20 feet in the area.

The Terrace Deposits generally consist of yellow to orange-brown sand, silt, clay, and/or gravel. The gravel is more prominent in the older, higher terraces and are mostly reworked limestone and chert fragments. The sand is typically composed of quartz. The average thickness of these deposits is 30 feet; however, the maximum thickness can be as much as 60 feet in the Austin area.

The High Gravel Deposits typically consists of an upper silty clay layer and a lower sand and gravel layer. The lower sand and gravel layer may be saturated with water. The gravels are typically reworked limestone and chert fragments. The High Gravel Deposits can be very shallow in the Austin area and the thickness is typically in the range of 5 to 25 feet.

The Ozan Formation (also referred to as Lower Taylor Marl) mainly consists of marly, calcareous clay that is light gray to brown in color. Variable amount of silt-size quartz and calcite fragments become more abundant as depth decreases. The thickness of the formation is about 600 feet in the area.

The underlying bedrock is primarily Cretaceous-aged limestone, chalk, and marl of the Austin Chalk (also referred to as the Austin Group). The Austin Chalk consists of light gray to white chalk, marly limestone, and limestone and ranges in thickness from 325 feet to 420 feet. The depositional environment of the Austin Chalk generally consisted of a shallow, open, marine shelf well removed from the shoreline. The limestone of the Austin Chalk varies from hard, fine-grained limestone to chalky and clayey limestone. Fossils and fossil shells are abundant throughout this formation.

2.2 General Subsurface Stratigraphy

Numerous geotechnical investigations have been conducted along the I-35 Capital Express Central project corridor. The following geotechnical reports were reviewed for the purpose of this study.

- Geotechnical Data Report, Capital Express Project, Texas Department of Transportation, Project no. 60586051, prepared by AECOM, August 17, 2020 (draft)
- Geotechnical Engineering Report, IH-35 Improvements at Riverside from Holly Street to North of Oltorf Street, Travis County, Texas, CSJ No. 0015-13-381, prepared by HVJ Associates, Inc., July 1, 2016
- Preliminary Geotechnical Engineering Report, Central 7 Comprehensive Project, I-35 – US 183 to Riverside Drive, Austin, Texas, CSJ No. 0015-13-388, prepared by Gorrondona & Associates, Inc., July 11, 2016
- Draft boring logs along the Cesar Chavez Street under TxDOT Contract No. 36-8IDP5121, CSJ No. 0015-13-428, prepared by Wood Environment and Infrastructure Solutions, Inc., drilled in August and September 2022.

The general subsurface conditions along the project alignment are discussed below. The general subsurface conditions were based on limited boring information; variations can occur in areas not covered by the borings.

Fill: Fill was encountered in most borings where previous construction activities have occurred. The fill mostly consists of lean clay, fat clay, and clayey sand with varying amounts of sand and gravel.

Native Soil: Native soils primarily consist of lean clay (CL), fat clay (CH), poorly graded sand (SP), silty sand (SM), clayey sand (SC), and clayey gravel (GC). The natural soils include Alluvium, Terrace Deposits, High Gravel Deposits and Ozan Formation as well as residual soils from Austin Chalk.

Bedrock: Bedrock from the Austin Chalk formation was encountered in the majority of the borings. The upper zone of the bedrock is typically decomposed limestone underlain by hard to very hard, light gray, limestone.

2.3 Anticipated Conditions for the Drainage Tunnel

The drainage tunnel elevation was set to maximize the amount of tunnel in the Austin Chalk. However, the tunnel launch shafts and the intake/access shafts will be excavated from the ground surface down to the tunnel elevation so they will pass through a range of soil and weathered rock conditions before reaching the Austin Chalk. At the shaft locations native soils, as described above, could be encountered up to depths of approximately 50 feet.

2.4 Anticipated Conditions for I-35 Depression

The highway depression will begin at existing grade and extend through a wide range of soil and rock conditions. The boring logs indicated fill materials may be present up to a depth of 13 feet below existing

grades. The natural soils below the fill consist of mostly clays (CL or CH) with layers or seams of clayey sand (SC) and silty sand (SM). Clayey gravels (GC) are present at some borings near the soil/rock interface; many of the gravels encountered are resulted from the weathered rock. Limestone was encountered in the majority of the borings and the depths may range between 5 to 55 feet below existing grades. Generally, the rock surface raises as the project advances north of Lady Bird Lake. Unconfined compressive strengths of the rock were between 10 and 380 tsf and the RQD was between 0 and 100 percent. Groundwater appears to be about 10 to 40 feet below existing grades.

The excavation depth for the depressed lanes may be as deep as 65 feet below existing grades. Based on the boring information, the highway depression may encounter clays, sands, gravels, and limestone below the water table.

3 HISTORIC STRUCTURES IN THE PROJECT VICINITY

There are a total of 114 properties along East Cesar Chavez Street that can be categorized as a significant building under one of the National Register of Historic Places (NRHP) categories. Almost all the buildings constructed before 1930 (92 in number) have a pier and beam type of foundation and have either an asphalt shingle roof or a metal roof with decorations. There are 14 structures built before 1930 that are more than one story height, that may need special attention during the construction phase. Detailed information about the buildings is provided in the attached Appendix to this report along with a map showing their locations.

Along the I-35 corridor there are a total of 41 properties that have a designated NRHP category. Four of these properties are parks or cemeteries with minimal structures. There is a 2-story warehouse structure built in 1880 that may require specific attention. The remaining structures follow a similar pattern as in East Cesar Chavez Street, with the older buildings mostly having pier and beam type of foundation along with asphalt shingle roof and newer buildings having concrete foundation along with flat roofs.

Due to the age of the buildings and the expanse of the corridor, a large variety of building systems are currently present. The following definitions are provided to help describe the variety of building systems present.

- Foundation – the load bearing elements directly supporting load-bearing walls or columns. The term "Foundation" in this section does not include the slab-on-grade except for structures where the slab and foundation are monolithic (typically for small residential-type structures) or connected to each other with rigid attachments.
- Slab-on-grade – the concrete slab at or nearest the ground elevation. The slab is supported directly by the ground below it and does not necessarily communicate with the surrounding foundation, except in cases where the slab-on-grade and foundation are monolithic or connected to each other with rigid attachments.
- Deep foundation systems (often called "pier and beam system") – foundations consisting of drilled or driven steel or concrete elements extending either to bedrock or to stiff soil stratums with substantial load-bearing capacity. Structural beams are present near grade level to support building walls and columns and transfer those loads directly to the deep foundation elements. Structures on deep foundations are typically resilient to variations in moisture content, loading, settlement, or vibration excitations near the surface but can be affected by vibration excitations within the bedrock or bearing stratum.
- Shallow foundation systems – foundations founded near (typically within 4 feet) of the ground surface. Shallow foundations are considered highly susceptible to variations in moisture content, loading, settlement, and vibration excitations at or near the surface.

3.1 Potential Risks Based on Planned Construction

3.1.1 Subgrade Settlement

Settlement of the subgrade can result from changes in moisture content, load redistribution and long-term consolidation of the subgrade soils. Section 6 discussed building settlement limits. Based on historical performance data, buildings subjected to these settlement limits typically perform well with little to no indication of cosmetic cracking of brittle elements and with no effect on the building structural systems. Buildings with shallow foundations and buildings with deep foundations containing an isolated slab-on-grade subjected to higher degrees of settlement historically demonstrate cracking of Architectural finishes, cracked foundation slabs, cracked masonry veneers, sticking exit doors and even potentially structural distress or loosening of structural connections.

Construction settlement limits should be set by the final designer in the construction documents. A continuous monitoring system should be designed and implemented during construction to ensure construction activities are not inducing settlements at the historic structures above the limits prescribed in Section 6.

3.1.2 Vibration

Near-source and far-source vibrations can both have substantial impacts on a building structure, irrespective of whether the building has a deep or shallow foundation system. All existing buildings inherently contain a set of natural characteristics that characterize the building's dynamic response (displacement, velocity and acceleration) when subjected to an external vibration excitation. The critical characteristic is the building's natural frequency, which describes the frequency in cycles per second (Hertz) of lateral oscillations when a building is subjected to ground motion. The natural frequency of the building as compared to the frequency of the vibration excitation will determine the magnitudes of the resulting displacement, velocity and acceleration of the building as it goes through several cycles of lateral oscillation. When the building's natural frequency and the external vibration frequency align or are in close proximity to each other, a phenomenon termed as resonance occurs and the building response is largely amplified and can cause several degrees of damage to a building structure. In historic building practice and post-event evaluation, it has been found that the Peak Particle Velocity (PPV) in the subgrade is the most tangible predictor of potential damage to a building. PPV is difficult to predict analytically due to the variation in subgrade, adjacencies, etc. and should be captured via a testing program. To effectively mitigate potential building distress to the existing structures, a testing and monitoring program should be implemented as described in Section 6.

4 GROUND SETTLEMENTS DUE TO EXCAVATIONS

Excavations, whether they take place from the ground surface or within a tunnel, can result in the loosening of soil around the excavation which can result in surface settlements. Excavations for tunnel shafts and the roadway constructions may use either sloped or braced excavations, which may cause ground movement in the vicinity of the construction. Due to site constraints, it is currently anticipated that most surface excavations exceeding approximately five feet in depth will be performed with braced excavations. The magnitude of ground movements from surface excavations will vary depending on, but not limited to, ground conditions, support stiffness, excavation depth, groundwater table and support watertightness, and workmanship.

Tunneling-induced ground movements are an area of great importance, particularly for risk management of construction impacts induced on existing structures in urban projects. The magnitude of the induced ground movements depends on several factors, including but not limited to the depth and volume of underground works, soil and groundwater conditions, the presence and nature of building foundations and third-party assets, and the workmanship and means and methods.

4.1 Ground Settlement Analysis for Excavations from Surface

Prior to performing any excavations, careful design is required not to adversely impact the historic structures in the vicinity. If a sloped excavation is used, a minimum required factor of safety of 1.5 should be satisfied when a limit equilibrium-based slope stability analysis is performed. In the limit equilibrium analysis, soil strata and

groundwater conditions must be properly modeled, and the selected calculation method must satisfy both force and moment equilibriums (e.g., Spencer Method). The above analysis should take into account the surcharge effect of the historic structures or any other structures nearby. Temporary loads due to vehicles or construction equipment should also be considered where applicable. The slope stability analysis should be performed in accordance with AASHTO LRFD Bridge Design Specifications, 9th Edition, Section 11.6.3.7 or other industry accepted guidelines. The above limit equilibrium analysis does not estimate the ground deformations. If desired, a soil-structure interaction analysis (e.g., finite element method) may be performed to estimate the ground movement during sloped excavations.

When temporary support of excavation (SOE) is required to support the excavations, various types of SOE systems may be considered including sheet pile walls, soldier pile and lagging walls, secant walls, and diaphragm walls. Similar to the sloped excavation design, the SOE design should properly model the soil strata and the associated soil properties, groundwater conditions, and all possible surcharge effects including existing structures, live traffic, equipment loads, etc. The SOE analysis should be performed in accordance with AASHTO LRFD Bridge Design Specifications, 9th Edition, Sections 11.8 and 11.9 or other industry accepted guidelines.

The magnitude and extent of the movements depend upon depth, width, and length of excavation, duration between excavation and concrete placement, and the margin of safety against trench instability, which is critically dependent upon the level of the support fluid relative to the groundwater level, changes in groundwater conditions, the stiffness of the wall, the properties of the soil (i.e., strength and stiffness) and the sequence and methods of construction. Movements will also occur as the ground arches horizontally between adjacent panels. This latter effect can significantly impact the magnitude of ground movements.
The approach proposed by New and Bowers (1994) and further developed by New (2017) based on field observations can be adopted to estimate the Zone of Influence (ZOI) and the ground movements induced by excavation:

$$S_d = \alpha H \left(1 - \frac{d}{nH}\right)^2$$

Where

S_d is the settlements at a distance d from the SOE wall
α is an empirical constant dependent on ground conditions, type of wall, and construction method
n is a multiple of the SOE depth to estimate the distance d from the SOE wall where the settlements tend to zero
d is the distance from the SOE wall
H is the maximum depth of excavation.

Typical values of surface movement at wall, α (percent of wall depth), and distance behind wall to negligible movement, n (multiple of wall depth) are presented in Table 1 from the Construction Industry Research and Information Association (CIRIA) Report No. 760, “Guidance on Embedded Retaining Wall Design” which summarizes the magnitude and extent of the monitored ground movements for walls installed with good workmanship.

Table 1 – Ground Surface Movements due to Bored Pile and Diaphragm Wall Installation in Competent Ground

Wall Type	Horizontal Movements		Vertical Movements	
	α (% of wall depth)	n (multiple of wall depth)	α (% of wall depth)	n (multiple of wall depth)
Bored Piles				
Contiguous	0.04	1.5	0.04	2.0
Secant	0.08	1.5	0.05	2.0
Diaphragm Walls				
Planar	0.05	1.5	0.05	1.5
Counterfort	0.10	1.5	0.05	1.5

Notes:

1. Maximum surface movement occurs close to the wall and is calculated as a percentage of the pile depth/diaphragm wall trench depth, as appropriate.
2. Extent of movement is calculated non-dimensionally by dividing by the pile depth/diaphragm wall trench depth, as appropriate.

Source: CIRIA C760

A preliminary calculation has been performed to understand the order of magnitude and extent of the potential settlements induced by the anticipated construction activities. Based on the assumptions of a rigid support system (e.g., secant piles embedded in rock) and of more flexible support of excavation (e.g., liner plates and ribs) in mixed soil and rock, the magnitude of the induced settlements is anticipated to have a minimum impact on the surrounding existing structures. Similarly to the distribution presented in Figure 2, the maximum settlement occurs at the edge of the SOE and decreases away from it. At an average distance of approximately 75 feet from the excavation support the settlements tend to be zero.

The above movement values should be considered typical values and should be used only for preliminary design purposes. A detailed analysis should be performed during detailed design after the geotechnical investigation is substantially completed, and the proposed construction methods are better established.

4.2 Ground Settlement Analysis for Tunnels

Tunnel excavations can result in settlement when the material above the tunnel no longer has the capacity to support the weight of the ground above it. This is most likely to occur in unconsolidated soil and highly fractured rock. The lowering of the groundwater table can also result in soil consolidation which can result in surface settlements.

Buildings located near construction areas as well as along tunnel alignments can experience several types of deformation and damage depending on the construction type, stiffness, openings, and joints.

Ground movements induced by tunnel construction can be described by a Gaussian Error function in the transverse direction and a Cumulative Error function in the longitudinal direction (Attewell and Woodman, 1982).

Figure 1 shows the typically induced settlement trough generated above a tunnel excavation.

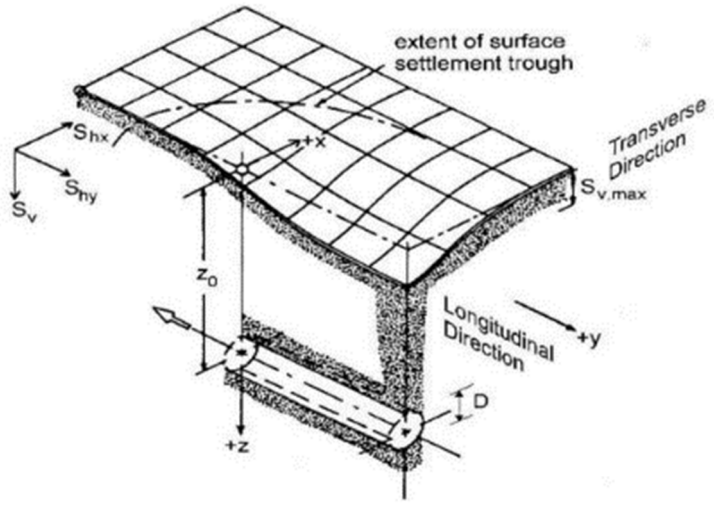


Figure 1 – Settlement above Advancing Tunnel
Source: Adapted from Attewell et al. (1986)

According to the procedure outlined by Peck (1969), O'Reilly and New (1982), and further developed by New and O'Reilly (1991), the settlement trough that develops immediately after the tunnel has been excavated can be described as:

$$S_v = S_{max} \cdot \exp\left(\frac{-y^2}{2i^2}\right)$$

where,

S_v is the settlement calculated along a generic transversal section of the tunnel
S_{max} is the maximum settlement along the tunnel centerline
y is the horizontal distance from the centerline
i is the horizontal distance from the tunnel centerline to the point of inflection on the settlement trough expressed as a linear function of the depth to the tunnel centerline and generally independent of the construction method. O'Reilly and New (1982) [16] proposed the following relationship between **i** and **z_0** according to the soil conditions:

$$i = K \cdot z_0$$

where,

k is the settlement trough width parameter function of the soil conditions. Generally, for tunnels in clay, and sands or gravels, may be taken as approximately 0.50 and 0.25, respectively (Mair et al 1996)

z_0 is the tunnel axis depth below the ground surface

Damages to existing structures can also result from horizontal tensile strains; therefore, a prediction of horizontal movement is required. Assuming that the vector of ground movement is directed towards the tunnel axis and considering the vertical and horizontal components, S_v and S_h, of the vector, O'Reilly and New (1982) suggested computing the horizontal movement as:

$$S_h = \frac{y}{z_0} S_v$$

The horizontal ground strain is determined by differentiating S_h with respect to the horizontal distance from the tunnel centerline y.

The relation between the settlement trough, horizontal movements and horizontal strains occurring at ground level is shown in Figure 2.

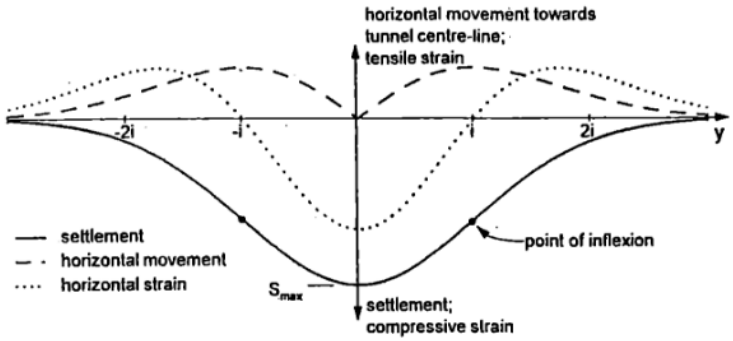


Figure 2 – Transverse Settlement Trough
Source: Mair et al. (1996)

Calculations were performed along the drainage tunnel to estimate the preliminary order of magnitude of settlements induced by the anticipated tunneling activities. Based on the assumption of competent Austin Chalk ground movements along the tunnel are anticipated to be very low and not result in any meaningful impact to the identified historic structures. However, detailed analysis should be performed during detailed design after the geotechnical investigation is substantially completed and the proposed construction methods are better established.

4.3 Mitigation Measures for Ground Movements

The best and most cost-effective mitigation methods to limit ground movements is by selecting appropriate construction methods. For sloped excavations, the slope should be kept as flat as possible. The site drainage should be properly designed such that all surface water can be effectively collected or diverted away from the construction area. Soil erosion, particularly soil erosion near the slope toe, should be avoided.

The purpose of the SOE systems is to limit the lateral deflection of the SOE and hence reduce the likelihood of ground deformations. As a result, SOE system preference should be given to the walls that are more rigid such as secant pile walls and diaphragm walls. This is particularly the case for deep excavations with higher risk of ground movements. For deep excavations using secant pile walls, considerations should be given to using large diameter drilled shafts with high strength concrete and embedded structural steel beam reinforcements.

Soil nail walls are generally not recommended near the historic buildings as the soil nails are considered passive reinforcements which would require some soil movement to mobilize the resistance. Sheet pile walls are another type of flexible wall system which may yield more ground movement than rigid walls. Soil or rock anchors can be used as tieback which may reduce the wall deflection hence to reduce the ground movement potential. However, such tieback may need construction easement or even right-of-way outside of the excavation footprint.

Soldier pile and lagging walls are considered semi-rigid walls. To minimize the ground deformation for soldier pile and lagging walls, increasing the diameter of the soldier piles and/or reducing the spacing of the soldier piles can typically reduce the ground movement behind the walls. Tieback (e.g., soil or rock anchors) can be added to the soldier pile and lagging walls to increase the wall stiffness.

If dewatering is required, the designed dewatering system should be able to lower the groundwater level at least two feet below the bottom of the excavation and to permit the proposed work be completed “in the dry”. The dewatering design should limit the dewatering zone out of the zone of influence of historic buildings to protect the structures from settling due to changed groundwater conditions.

For tunnel construction, the selection of an appropriate TBM for the ground conditions is the first and most important step to limit ground movements. Timely installation of the appropriate tunnel initial ground support will also reduce the likelihood of ground movement.

Even after utilizing appropriate construction methods, there may be the potential for damage induced by the construction activities on an existing structure. Therefore, it is essential to identify mitigation and remedial measures to maintain the serviceability and structural integrity of the structure. Mitigation measures can be classified as measures that directly influence the response of an existing structure, or that can mitigate the impact induced by the construction activities on the existing structure.

Mitigation methods may include strengthening the ground around the existing structures prior to the proposed construction activities. The most common method of strengthening of the ground is by grouting. Multiple grouting techniques are available depending on the geologic conditions and required design strength, but all grouting methods aim to strengthen the existing ground to allow it to support additional loading. Alternatively, the structure itself can be strengthened to allow it to safely sustain the additional stresses or accommodate deformations induced by ground movements. One examples of strengthening the structure is underpinning the foundation so it bears on a strong soil/rock stratum making it less susceptible to near surface ground movements. Underpinning methods for the historic buildings may include compaction grouting, jet grouting, micropiles, and helical piles.

A comprehensive geotechnical instrumentation and monitoring system should be implemented during the installation of the SOE and during excavations and other construction activities to monitor the movements to and around the historic buildings, as discussed in Section 6 of this memo.

5 GROUND VIBRATIONS

The construction methods associated with conventional excavations or underground tunneling will induce ground vibrations in the vicinity of the construction. The magnitude of the induced ground vibrations depends on several factors, including but not limited to the type and size of the construction equipment, distance from the vibration source, geology, stratigraphy and groundwater conditions, and the historic building structural system.

5.1 Ground Vibration Analysis for Excavations

Construction during excavations may generate ground vibrations that may adversely impact the historic structures in the vicinity. The peak particle velocity (PPV) is widely accepted as the most appropriate descriptor for predicting potential building damage. Prior to the excavation, the potential sources of ground vibrations (e.g., construction equipment) should be identified and studies should be performed to estimate the PPV at the historic buildings. The study should be based on how the vibration waves propagate from the source to the buildings with the specific soil or rock conditions along the wave travel distance. The study should also consider the effects of low frequency/high amplitude vs. high frequency/low amplitude construction activities. Generally, low frequency/high amplitude excitations result in greater potential damage to a building structure due to potential resonance with a typical building period. Vibration impacts are considered low risk if construction activities conform to the PPV limits given in Section 6.

Wiss (1981) proposed a simplified model to estimate the PPV based on a best fit of field data with the following equation:

$$V = kD^{-n}$$

Where:

V = PPV of the seismic wave
k = value of velocity at one unit of distance
D = distance from the vibration source
n = attenuation rate

Based on the above Wiss propagation model, Caltrans (2013) discussed the vibration amplitudes induced by pile drivers, hydraulic breakers, and other construction equipment. The following table presents reference PPV values at 25 feet from the vibration source based on Caltrans (2013). The PPV values at a different distance from the source may be estimated based on the reference values and equations provided in Caltrans (2013).

Table 2 – Typical PPVs for Common Construction Equipment

Equipment	Reference PPV (inch/sec) at 25 feet
Vibratory roller	0.210
Large bulldozer	0.089
Caisson drilling	0.089
Loaded trucks	0.076
Jackhammer	0.035
Small bulldozer	0.003
Crack-and-seat operations	2.40
Typical Impact Pile Driver	0.65
Large Impact Pile Driver	1.80
Vibratory Pile Driver	0.65
Hydraulic Breaker	0.24

The above PPV values should be considered typical values and should be used only for preliminary design purposes. A detailed analysis should be performed during detailed design after the geotechnical investigation is substantially completed and the proposed construction methods are better established.

5.2 Ground Vibration Analysis for Tunnels

There are several references available in the literature that provide vibration impact induced by TBM tunneling operations, both in rock and soft ground. While most references simply state that vibrations resulting from tunneling in the soft ground are not of significant concern to the adjacent existing structures, and that boring through rock might produce vibration with significantly less attenuation and therefore the vibrations might propagate for greater distances than soft ground, some case histories exist from which to draw a more quantitative conclusion.

Raine and Ho (2009) provided a review of TBM tunnel vibration measurements for tunnels in Hong Kong, both in rock and soft ground. It provided a range of PPV within which the lower end would be expected to apply to soft ground tunnels. For a distance of 10m (32.8 feet) the expected range of PPV is 0.3 mm/s to 3.0 mm/s (0.012 in/s to 0.118 in/s) – with soft ground tunnels at the lower end of this range. Assuming that the upper bound for soft ground tunnels is the mean of this range, it can be reasonably assumed that no vibration from soft ground tunnels exceeds a PPV of 1.5 mm/s (0.059 in/s). For tunnels in rock the PPV could reasonably be assumed to fall into a range of approximately 1.5 mm/s to 3.0 mm/s (0.059 in/s to 0.118 in/s). The Austin Chalk is a relatively soft rock so PPVs could be expected to fall on the lower end of this range.

Speakman and Lyons (2009) provided a typical vertical vibration spectrum for a 12.4m (40.7 feet) diameter earth pressure balance machine (EPBM) operating in soft ground in Figure 3.

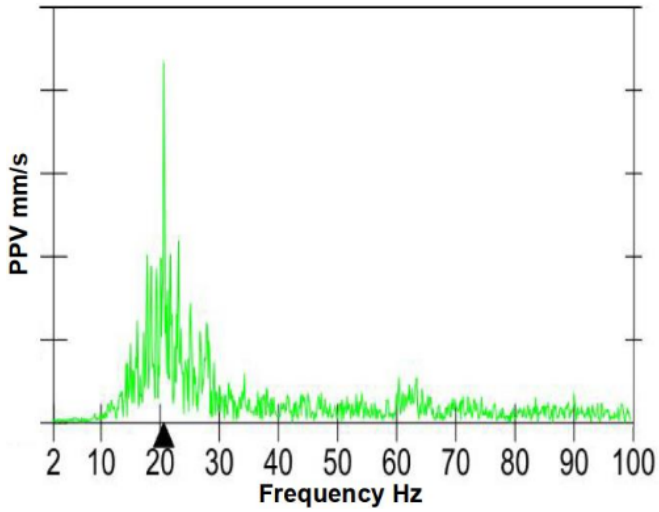


Figure 3 – Typical TBM Frequency Spectra
Source: Speakman and Lyons (2009)

The dominant frequency tends to reduce with distance since the lower frequency components have undergone fewer cycles and lost proportionally less energy.

The vibration propagation will largely depend upon the source frequency and the local ground properties. Figure 4 presents a typical TBM propagation curve for EPBM in soft ground at the dominant frequency.

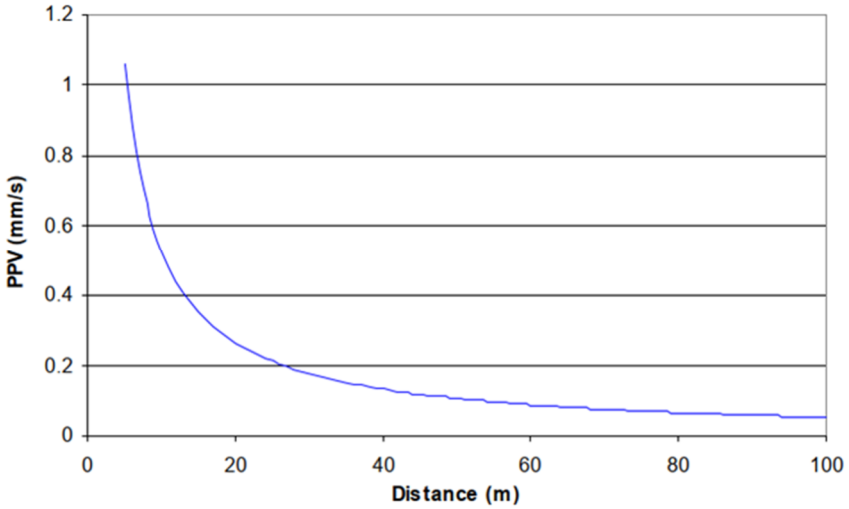


Figure 4 – Typical TBM Vibration Propagation
Source: Speakman and Lyons (2009

It can be observed that beyond a distance of 10m (32.8 ft) from the source, the PPV is below 0.6 mm/s (0.024 in/s).

Orr and Rahman (2008) provided case histories with both soft ground and rock vibration curves. The soft ground curve shows an upper limit vibration of 1.0 mm/s (0.039 in/s) at a distance of 10m (32.8 ft).

The Transportation Research Laboratory (TRL) Report 429 (2000) provides ground vibration data from tunneling operations classified according to different geology conditions. Figure 5 shows an upper limit vibration PPV measured at 10m (32,8 ft) for the most adverse rock tunnel case history of 2 mm/s (0.08 in/s).

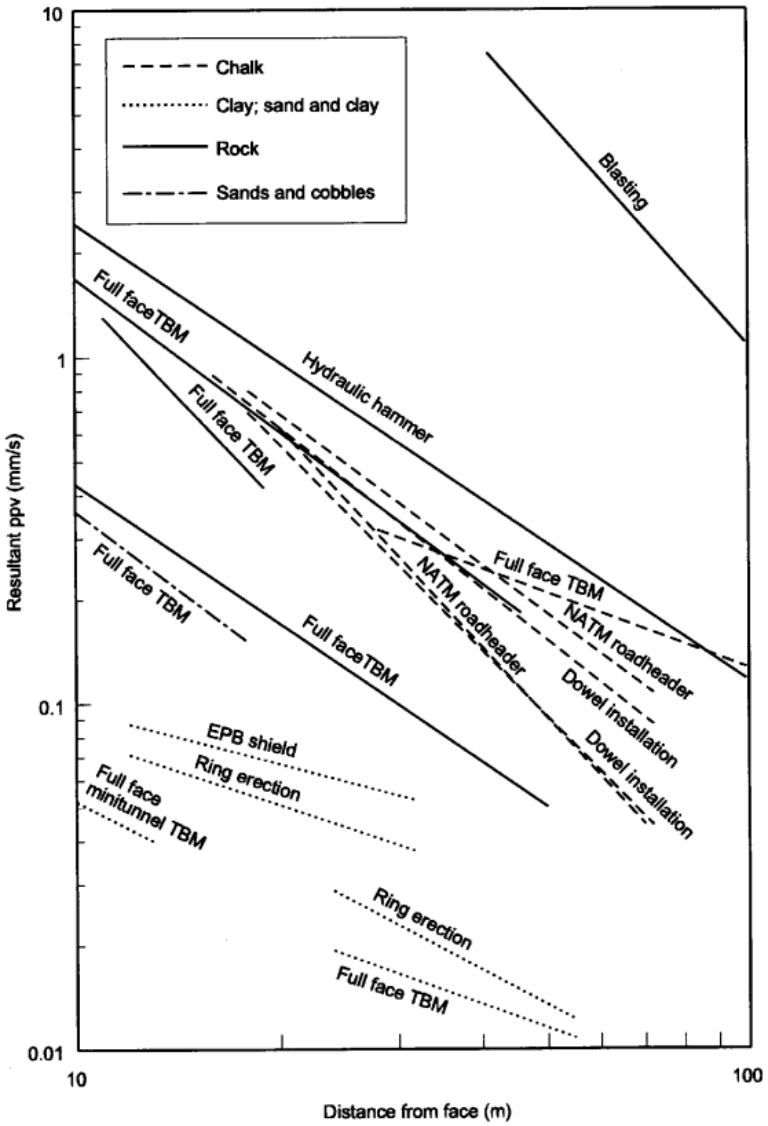


Figure 5 – Ground Vibration Data from Tunneling Operations classified according to Geology
Source: Speakman and Lyons (2009)

The above PPV values should be considered as typical values and should be used only for preliminary design purposes. Detailed analysis should be performed during detailed design after the geotechnical investigation is substantially completed and the proposed construction methods are better established.

The National Cooperative Highway Research Program (NCHRP) conducted a study (NCHRP 25-25/Task 72) to address the potential effects to historic buildings adjacent to transportation projects. Within this report they performed an extensive literature review to determine vibration limits that other projects have set around the world. Table 3 provides a summary of those values. Generally, the maximum PPVs ranged from 0.2 in/s to 0.5 in/s. However, some were as low as 0.1 in/s and as high as 2 in/s.

Table 3– Summary of Vibration Limits (NCHRP 25-25/Task 72)

Reference Source	Remarks on Vibration Source	Remarks on Building or Structure	Remarks on Type of Damage	Vibration Limit - PPV (inches/sec)
British Standards Institute (1993)	All (including blasting)	Unreinforced or light framed structures	Cosmetic	0.6 to 2.0† (historic buildings may require special consideration)
Sedovic (1984)	All	Historic buildings in good state of maintenance	--	0.5
City of New York City (1988); Esrig and Ciancia (1981)	Blasting, pile driving and vehicular traffic	Structures which are designated NYC landmarks, or located within an historic district or listed on the NHRP	--	0.5
Whiffin and Leonard (1971)	Traffic	Buildings with plastered walls and ceilings	Architectural damage and risk of structural damage	0.4 to 0.6
Rudder (1978)	Traffic	All	Structural damage possible	0.4
City of Toronto (2008)	All (blasting not mentioned)	All buildings	--	0.3 to 1.0† (lower limits may be identified by professional engineer)
Konon and Schuring (1985)	Transient	Historic buildings	Cosmetic	0.25 to 0.5†
Swiss Standards Association (1992)	All (blasting, construction equipment, and road traffic)	Historic and protected buildings	--	0.2 to 0.5†
Federal Transit Administration (2006)	All	Non-engineered timber and masonry buildings	--	0.2
Sedovic (1984)	All	Historic or architecturally important buildings in deteriorated state of maintenance	--	0.2
Whiffin and Leonard (1971)	Traffic	Buildings with plastered walls and ceilings	Threshold of risk of architectural damage	0.2
Feilden (2003)	All	All buildings	Threshold for structural damage	0.2
Rudder (1978)	Traffic	All	Minor damage possible	0.2
Konon and Schuring (1985)	Steady state	Historic buildings	Cosmetic	0.13 to 0.25†
Deutsches Institut für Normung DIN 4150-3 (1999)	All	Buildings of great intrinsic value	Any permanent effect that reduces serviceability	0.12 to 0.4†
Federal Transit Administration (2006)	All	Buildings extremely susceptible to vibration	--	0.12
American Association of State Highway and Transportation Officials (2004)	All	Historic sites and other critical locations	Threshold for cracks (cosmetic)	0.12
Esteves (1978)	Blasting	Special care, historical	--	0.1 to 0.4††
Rudder (1978)	Traffic	All	Threshold of structural damage	0.1
Whiffin and Leonard (1971)	Traffic	Buildings with plastered walls and ceilings	Virtually no risk of architectural damage	0.1
Feilden (2003)	All	All buildings	Threshold for plaster cracking	0.08
Whiffin and Leonard (1971)	Traffic	Ruins and ancient monuments	--	0.08

† frequency-dependent criteria
†† depending on soil type and frequency

5.3 Mitigation Measures for Ground Vibrations

Vibration reduction at the source. Most construction equipment (i.e., earthwork moving and compaction) does not cause a serious vibration concern. However, impact pile driving and controlled blasting can be a significant source of vibration at construction sites. Wherever possible, using non-displacement piles (e.g., steel H piles) typically would reduce vibration magnitude as compared to displacement piles (e.g., concrete piles) or pre-drilled into the rock. Vibratory pile drivers many times produce similar vibration amplitudes to those of impact pile drivers because a resonance can occur as the vibratory pile driver starts up and shut down. One alternative to conventional vibratory pile drivers is a resonance-free vibrator, or variable eccentric moment vibrator. These vibrators do not vibrate during start up and shut down, thereby avoiding the excessive vibrations that are commonly associated with traditional vibratory units. In addition, both impact pile driver and vibratory pile driver can induce settlement in sandy materials and hence should be avoided wherever possible. Instead, cast-in-place piles such as drilled shafts, auger cast piles or drilled micropiles can be considered which greatly reduce the ground vibrations. If controlled blasting is utilized, the charge per delay should be carefully considered based on the rock conditions, depth, and proximity to existing historic structures. Construction activities that cause high levels of vibration should be staggered so that multiple sources of vibration are not occurring at once. Regardless of the excavation methods, the PPVs at the historic structures should not exceed the recommended values presented in Section 6.

Vibration reduction away from the source. Wave barriers can interfere the vibration transmission path between the source and the receiver which can also be considered to protect the historic buildings from the ground vibration concern. The purpose of a barrier is to reflect or absorb wave energy, thereby reducing the propagation of energy between a source and a receiver. A wave barrier is typically a trench, or a thin wall made of sheet piles or similar structural members. The depth and width of a wave barrier must be proportioned to the wavelength of the wave intended for screening. Experience indicates the depth of a wave barrier may be at least two-thirds of the seismic wavelength to be screened. The length of the barrier should be sufficient to protect the entire historic building(s).

As anticipated in Section 4.3 and discussed in Section 6, a comprehensive geotechnical instrumentation and monitoring system is a critical mitigation measure to be implemented prior to the commencement of any construction activities to monitor the vibration and potential impacts induced to the historic structures.

6 Geotechnical Instrumentation and Monitoring

All efforts should be made to mitigate the adverse effects of excavation and tunnel construction by using modern techniques, procedures, and products. It is also essential to put in place a mitigation plan even when the deformation or vibration levels are below the values at which damage to the historic structures are expected to occur. Mitigation methods shall include measures both before and during construction. Before the construction, design efforts should be taken to minimize the adverse effects on the historic structures as discussed above. During construction, a ground movement and vibration monitoring plan should be implemented which should monitor the levels of deformations and vibrations throughout the construction process. A well designed and executed geotechnical instrumentation plan can detect potential issues early during construction to allow the construction means and methods to be modified prior to any damage occurring to any historic buildings.

A pre-construction condition survey should be conducted documenting initial conditions and determining the nature (i.e., fragile, historic, sensitive, etc.) of all historic buildings within the zone of influence. The pre-construction condition survey should comprise of notes, digital photographs, and digital videos sufficient to accurately and appropriately document the preconstruction condition of each historic structure. All defects must be noted and recorded. Similarly, a post-construction survey should be conducted at the completion of the construction activities. The final conditions of each historic structure should be accurately and appropriately documented by using notes, digital photographs, and digital videos.

Although the deformation or vibration levels may be estimated with some confidence, an instrumentation and monitoring plan must be developed and implemented during construction. Tiltmeters (TMs), Deformation Monitoring Points (DMPs), and Structural Monitoring Points (SMPs) can be used to monitor any tilting, slanting, and/or leaning of the historic buildings. For any existing cracks identified during the pre-construction survey,

crackmeters can be installed to monitor the development of cracks during construction. Each historic building should have sufficient instrumentation devices attached such that any deformations or movements due to construction activities can be accurately monitored and recorded. Baseline readings of the instrumentation should be taken at least 7 days prior to the commencement of any excavation. Once excavations commenced, regularly scheduled reading should be taken based on the location of the structure relative to the construction activities taking place.

Ground vibration is typically measured with a sensor that produces an electrical signal that is proportional to the amplitude of the ground motion. These sensors are called transducers including velocity transducers (seismometers) and acceleration transducers (accelerometers) are the most widely used transducers for measuring ground vibrations. The transducers can be combined into a triaxial array to simultaneously measure vibration in three orthogonal axes.

At each historic building where vibration monitoring is determined necessary, at least two transducers should be installed near the corners of the buildings that are closest to the vibration source(s). The transducers must be firmly mounted on the surface slab of concrete or asphalt, or firmly set in undisturbed soil at a horizontal distance about 3 to 6 feet away from the building facades. Baseline readings should be taken at least 7 days prior to any excavation to establish the ambient vibrations occurring at the site. Once excavations commenced, the monitoring shall consist of a continuous recording of the maximum single-component peak particle velocities for one-minute intervals or less.

Factors like the mass balance against excavated volume loss and backfilling grouting can be monitored directly through tunnel software systems installed on Pressurized TBMs. These factors are paramount to determining the amount of ground loss and mitigating potential settlement issues.

Additionally, Tunnel Diameter Monitoring Points could be installed on the inside surface of the tunnel liner as soon as the TBM is cleared of the installation location. Tunnel diameter measurements shall be performed as soon as practical after the monitoring points are installed. The measuring locations should be regularly spaced with additional points at any critical locations identified.

The geotechnical instrumentation and monitoring system must provide appropriate thresholds and limiting values to protect the historic buildings. The threshold value is defined as the level at which corrective measures are required, including procedural modifications that will allow construction to continue without reaching the specified limiting value. Limiting value is defined as the level at which no further deformation of the structures being monitored is permitted. The determination of the threshold and limiting values should be studied which largely depend on the tolerance of the historic structures. Based on our experience with ground movement control, the threshold value is typically between 0.25 and 0.5 inches while the limiting value is between 0.5 and 1 inch. Based on our experience on ground vibration control, the threshold PPV value is typically between 0.1 and 0.2 inches per second while the limiting value is typically between 0.3 to 0.5 inches per second. However, threshold and limiting values for this project should be developed based on a detailed review of the historic buildings and the proposed construction methods. A contingency plan is required which should address the mitigation measures to be implemented if threshold values are exceeded. If the limiting values are exceeded, all construction activities must be suspended. An effective communication plan should also be in place such that rapid communication of instrumentation results to the owner can happen in case of emergency.

During construction the construction management (CM) team should oversee all construction activities to ensure the contractor performs the work according to the Contract Documents, approved submittals, and industry best practices.

7 CONCLUSION

The I-35 Capital Express Central project is a large construction project that will have an impact on the surrounding area during construction. This memorandum specifically addresses the potential impact to the 155 historic sites that have been identified along the proposed tunnel alignments and roadway improvements. This memorandum presented a high-level discussion of the geotechnical conditions and historic buildings

along the project. Preliminary information was provided regarding ground settlement, ground vibrations, and geotechnical instrumentation and monitoring.

It is recommended that a more detailed analysis of surface settlements and ground vibrations be performed during detailed design that is tailored to the anticipated ground conditions and construction methods. As discussed above, a detailed geotechnical instrumentation plan should be developed to monitor settlement and vibration during construction. The historic buildings should be studied in more detail to determine the appropriate threshold and limiting values to prevent damage to the buildings.

8 REFERENCES

1. AECOM, 2020. Geotechnical Data Report, Capital Express Project, Texas Department of Transportation, Project no. 60586051, August 17, 2020 (draft).
2. American Association of State Highway and Transportation Officials (AASHTO), 2020. LRFD Bridge Design Specifications, 9th Edition.
3. Amick, H. and Gendreau, M., 2000. Construction Vibrations and their Impact on Vibration-Sensitive Facilities. Proceedings, ASCE Construction Congress 6, Orlando, FL.
4. Attewell, P.B. and Woodman, J.P. "Predicting the Dynamics of Ground Settlement and its derivatives caused by Tunnelling in Soil." Ground Engineering. 1982. 13-22, 36.
5. Attewell, P.B., Yates, J., Selby, A.R. Soil Movements Induced by Tunnelling and Their Effects on Pipelines and Structures. Thomson Science and Professional, 1987.
6. Bureau of Economic Geology, Geologic Atlas of Texas, Austin sheet, 1974.
7. Burland, J.B. "Assessment Methods used in Design." J Burland, J R Standing, F M Jardine (eds). Building Response to Tunnelling: Case Studies from Construction of the Jubilee Line Extension, London. Volume 1: Projects and Methods, SP200. London: CIRIA and Thomas Telford, 2001. 23-43.
8. Clough, G.W., O'Rourke, M. "Construction Induced Movements of In Situ Walls." Specialty Conference on Design and Performance of Earth Retaining Structures (1990): 439-470.
9. Cording, E., Long, J., Son, M., Laefer, D., Ghahreman, B. "Assessment of Excavation-Induced Building Damage." In: R Finno, Y M A Hashash, P Arduino (eds) Earth Retention Conference 3, Washington DC, USA. Reston, VA, USA: American Society of Civil Engineers, 2010. 101-120.
10. FTA Report No. 0123: Transit Noise and Vibration Impact Assessment Manual. Federal Transit Administration 2018.
11. Gaba, A, Hardy, S, Doughty, L, Powrie, W, Selemetas, D. CIRIA C760: Guidance on Embedded Retaining Wall Design. London: CIRIA, 2017.
12. Gaba, A.R., Simpson, B., Powrie, W., Beadman, D.R. Embedded Retaining Walls: Guidance for Economic Design. Funders Report/CP/96. London: CIRIA, 2002.
13. Gorrondona & Associates, Inc. 2016. Preliminary Geotechnical Engineering Report, Central 7 Comprehensive Project, I-35 – US 183 to Riverside Drive, Austin, Texas, CSJ No. 0015-13-388, July 11, 2016.
14. Guglielmetti, V., Grasso, P., Mahtab, A., Xu, S., Geodata S.p.A. Mechanized Tunnelling in Urban Areas: Design Methodology and Construction Control. London, UK: Taylor & Francis, 2007.
15. Hiller, D. M. and Crabb, G. I., 2000. TRL Report 429: Groundborne Vibration Caused by Mechanised Construction Works. Transport Research Laboratory, Crowthorne.
16. HVJ Associates, Inc. 2016. Geotechnical Engineering Report, IH-35 Improvements at Riverside from Holly Street to North of Oltorf Street, Travis County, Texas, CSJ No. 0015-13-381, July 1, 2016.
17. Mair, R.J., Taylor, R.N., Burland, J.B. "Prediction of Ground Movements and Assessment of Risk of Building Damage due to Bored Tunnelling." Geotechnical Aspects of Underground Construction in Soft Ground. Balkema, Rotterdam: Mair & Taylor (eds), 1996. 713-718.
18. NCHRP 25-25/Task 72. “Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Project.” Prepared by Wilson, Ihrig & Associates, Inc., ICF International, and Simpson, Gumpertz, & Heger, Inc., September 2012.

19. New, B. M., O'Reilly, M. P. "Tunnelling Induced Ground Movements: Predicting Their Magnitude and Effect." Proceedings of the 4th International Conference on Ground Movements and Structures. Cardiff, 1991.
20. New, B.M. "Settlements due to Shaft Construction." Tunnels and Tunnelling International (September 2017): 16-17.
21. New, B.M., Bowers, K.H. "Ground Movement Model Validation at the Heathrow Express Trial Tunnel." Proceedings of Tunnelling '94 Symposium. London: Chapman and Hall, July 1994. 301-329.
22. O'Reilly, M.P., New, B.M. "Settlements above Tunnels in the United Kingdom - their Magnitude and Prediction." Proceedings of Tunnelling '82 Symposium. London: Institute of Mining & Metallurgy, 1982. 173-188.
23. Peck, R.B. "Deep Excavations and Tunnelling in Soft Ground." 7th International Conference, SMFE. Mexico City, 1969. 225-290. State of the Art Volume.
24. Speakman, C. and Lyons, S, 2009. Tunnelling Induced ground-borne noise modeling. Proceedings of ACOUSTICS 2009.
25. Transportation and Construction Vibration Guidance Manual. CT-HWANP-RT-13-069.25.3. California, Department of Transportation (CALTRANS), September 2013.
26. Wiss, J. F. 1981. Construction vibrations: state-of-the-art. Journal of the Geotechnical Division 107 (GT2): 167-181.
27. Wood Environment and Infrastructure Solutions, Inc. 2022. Draft boring logs along the Cesar Chavez Street under TxDOT Contract No. 36-8IDP5121, CSJ No. 0015-13-428, drilled in August and September 2022.

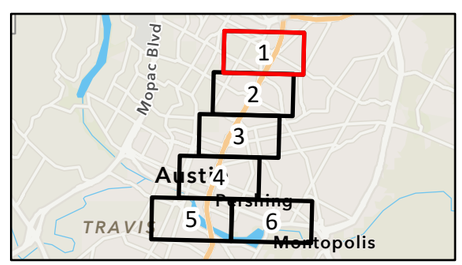
Appendix

Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District

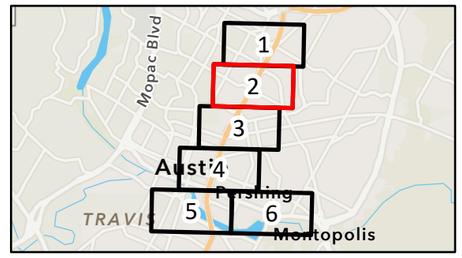


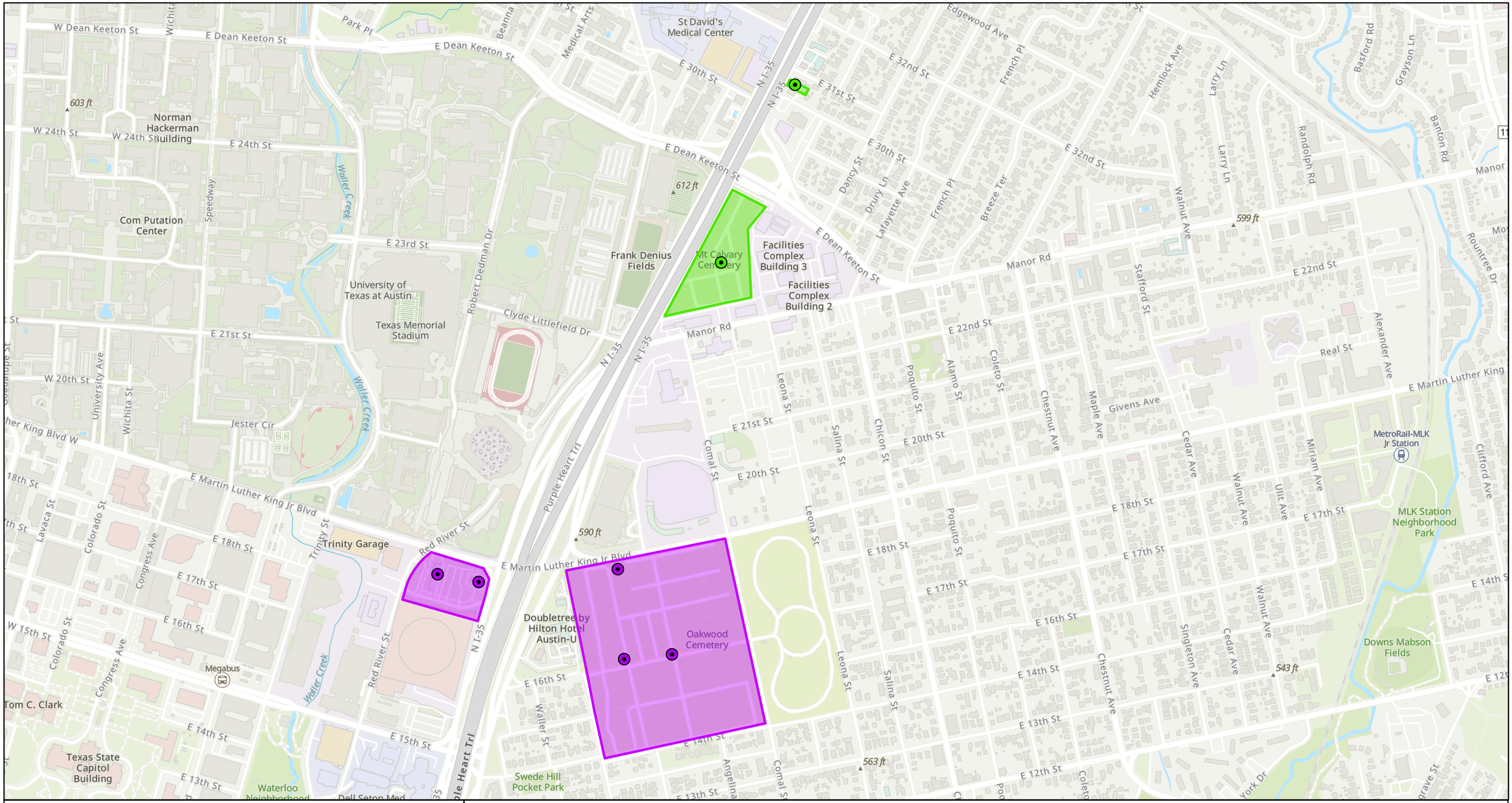
Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District



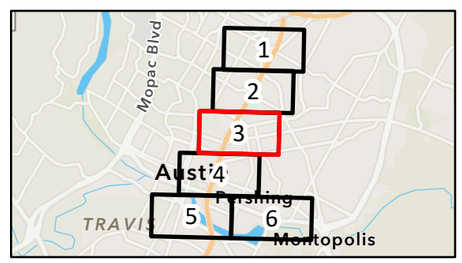


Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District

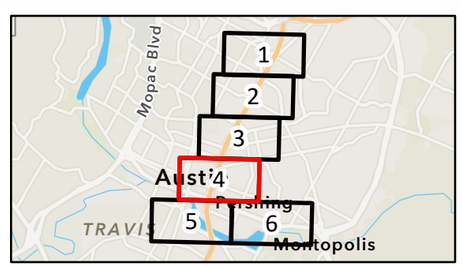


Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District

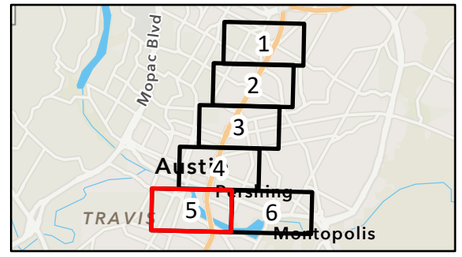


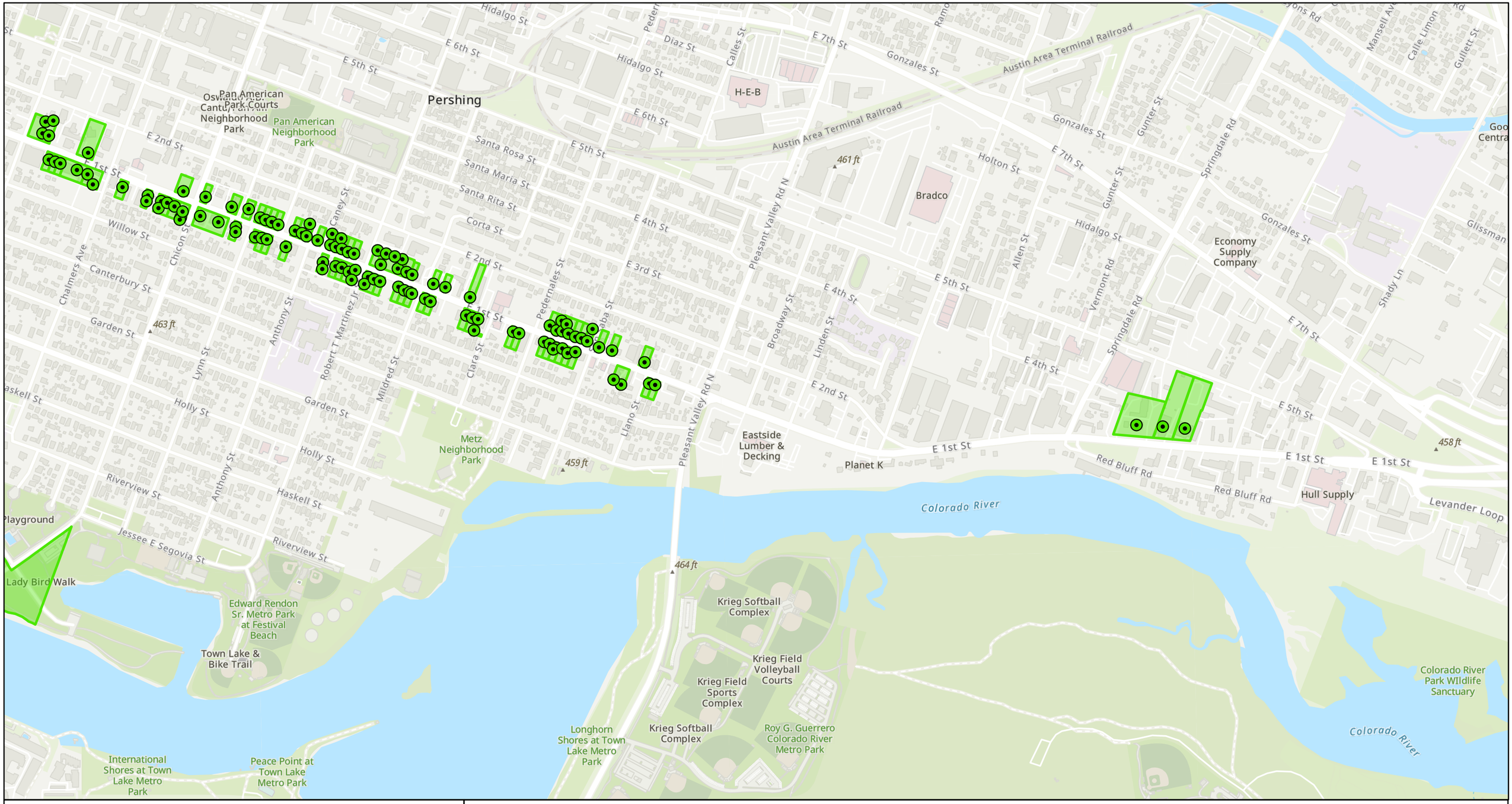
Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District



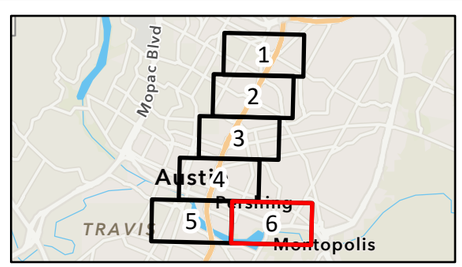


Historic Resource Locations
I-35 Capital Express Central
Construction Vibration Considerations
Technical Memo

0 500 1,000 2,000 Feet

Legend

- Listed Resource
- Eligible Resource
- Listed District
- Eligible District



Resource Num	Address	NR Criteria	Build Date	Style / Form	Foundation Type	Roof Type	Stories	Notes
103	4613 North Interstate Highway 35	A, C	1950	Ranch	N/A	Asphalt-shingle roof	One-story	
109	1100 Bentwood Road	A, C	1954	Ranch	N/A	Asphalt-shingle roof	One-story	
119	4505 North Interstate Highway 35	A, C	1948	Ranch	N/A	Asphalt-shingle roof	One-story	
121	4503 North Interstate Highway 35	A, C	1948	Ranch	N/A	Asphalt-shingle roof	One-story	
144	4408 Airport Boulevard	A, C	1948	Ranch	N/A	Asphalt-shingle roof	One-story	
145	4406 Airport Boulevard	A, C	1949	Ranch	N/A	Metal roof	One-story	
150	1202 Crestwood Road	A, C	1950	Ranch	N/A	Metal roof	One-story	
167	4202 Bradwood Road	A, C	1941	Ranch	Pier and beam foundation	Asphalt-shingle roof	One-story	Stone and fiber cement cladding
179	4000 North Interstate Highway 35	A, C	1957	Contemporary	Concrete foundation	Flat roof and overhanging eaves	One-story	
200	3810 North Interstate Highway 35	A, C	1964	No Style	Concrete slab foundation	Flat roof	One-story	
235	3509 North Interstate Highway 35	A	1930	Bungalow	N/A	Asphalt-shingle roof	One and one Half-story	
295	3009 North Interstate Highway 35	A, C	1923	Bungalow	Pier and beam foundation	hip-on-side-gable roof with eave overhangs	One and one Half-story	Doric wood columns
317	East side, 2600-2700 block North Interstate Highway 35	A	1879; 1916	FUNERARY/cemetery	N/A			
320	709 East Martin Luther King, Jr. Boulevard	A, C	1857	Italianate	Masonry foundation	Metal roof with decorative brackets	Two-story	Stone and brick siding
321	1601 Navasota Street	C	1839	FUNERARY/cemetery	N/A			
360	809 East 9th Street	C	1906	Folk Victorian	Pier and beam foundation	Metal roof	One-story	
387	721 East 6th Street	A, C	1920	No Style	N/A	Flat roof with parapet	One-story	
388	723 East 6th Street	A, C	1920	No Style	N/A	Flat roof with parapet	One-story	
389	725 East 6th Street	A, C	1910	No Style	N/A	Flat roof with parapet	One-story	
392	501 North Interstate Highway 35	A	c.1900	No Style	Stone foundation	Flat, membranous roof	One-story	Rubble limestone construction
400	807 East 4th Street	A, C	c.1880	INDUSTRY/warehouse	N/A	Flat, membranous roof	Two-story	Rubble limestone construction
402	900 East 3rd Street	C	1912	Folk Victorian	Pier and beam foundation	Flat roof	One-story	
403	4301 North Interstate Highway 35	A	1913	No Style	Brick masonry foundation	Side-gable metal roofs	Two-and-one-half-story	
404	200 North Interstate Highway 35	A	1929	RECREATION/park	N/A			
405	200 Brushy Street	A, C	1964	Modernist	Concrete foundation	Flat roof	One-story	Cream brick structure
408	100 North Interstate Highway 35			No Style	Concrete foundation	Flat roof	Two-story	
410	901 East 2nd Street	A, C	1912	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	Gable-on-hip residence
411	903 East 2nd Street	A, C	1920	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	Cross-hip residence
412	905 East 2nd Street	A, C	1906	No Style	N/A	Metal roof	Two-story	
413	907 East 2nd Street	A, C	1904	No Style	N/A	Metal roof	Two-story	
417	902 Willow Street	C	1911	Ranch	N/A	Asphalt-shingle roof	One-story	
418	904 Willow Street	C	1900	Bungalow	N/A	Metal roof	One and one Half-story	
420	901 Willow Street	C	1908	Folk Victorian	Pier and beam foundation	Asphalt-shingle roof	One-story	
422	808 Spence Street	C	1928	Bungalow	Pier and beam foundation	Pyramidal-roof bungalow	One-story	
433	901 Spence Street	C	c.1917	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	
439	902 Taylor Street	C	c.1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
442	907 Taylor Street	C	c.1925	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
462	Town Lake Park System, Waller Creek to Fiesta Gardens	A, C	c.1973	RECREATION/park	N/A			
1001	1000 East Cesar Chavez Street	A, C	1899	Queen Anne	Pier and beam foundation	Metal hip roof with lower cross gables	Two-story	
1002	1004 East Cesar Chavez Street	A, C	1915	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1003	1006 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1004	1010 East Cesar Chavez Street	A, C	c.1885	Folk Victorian	Pier and beam foundation	Asphalt-shingle roof	One-story	
1005	1100 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1006	1102 East Cesar Chavez Street	A, C	1930	Bungalow	N/A	Metal roof	One and one Half-story	
1007	1108 East Cesar Chavez Street	A, C	1925	No Style	N/A	N/A - flat roof	One-story	Brick masonary construction
1009	1114 East Cesar Chavez Street	A, C	1900	No Style	N/A	N/A - flat roof	One-story	Brick masonary construction
1013	1204 East Cesar Chavez Street	A, C	1951	No Style	Concrete slab foundation	N/A - flat roof	One-story	Concrete block masonary construction
1015	1201 East Cesar Chavez Street	A, C	1964	No Style	Concrete slab foundation	N/A - flat roof	One-story	Brick and concrete wall
1016	1205 East Cesar Chavez Street	A, C	1915	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1017	1207 East Cesar Chavez Street	A, C	1920	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1019	1211 East Cesar Chavez Street	A, C	1928	Craftsman	Pier and beam foundation	Metal roof	One-story	
1020	1300 East Cesar Chavez Street	A, C	1910	Bungalow	Pier and beam foundation	Metal roof	One and one Half-story	Wood and asbestos siding
1021	1302 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	Wood and asbestos siding
1022	1304 East Cesar Chavez Street	A, B, C	1920	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	Horizontal wood siding
1023	1306 East Cesar Chavez Street	A, C	1920	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	Horizontal wood siding
1024	1308 East Cesar Chavez Street	A, C	1915	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	Asbestos siding
1025	1312 East Cesar Chavez Street	A, C	1950	No Style	Concrete slab foundation	N/A - flat roof	One-story	Brick and concrete-block masonry walls

Resource Num	Address	NR Criteria	Build Date	Style / Form	Foundation Type	Roof Type	Stories	Notes
1026	1301 East Cesar Chavez Street	A, C	1898	Queen Anne	Pier and beam foundation	Asphalt-shingle roof	Two-story	
1027	1303 East Cesar Chavez Street	A, C	1921	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1028	1305 East Cesar Chavez Street	A, C	1928	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1031	1400 East Cesar Chavez Street	A, C	c.1925	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	Religious Facility
1032	1402 East Cesar Chavez Street	A, C	1899	Queen Anne	Masonry foundation	Asphalt-shingle roof	Two-story	Ashlar limestone walls
1033	1408 East Cesar Chavez Street	A, C	1905	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1034	1410 East Cesar Chavez Street	A, C	1905	Folk Victorian	Pier and beam foundation	Asphalt-shingle roof	One-story	
1036	1401 East Cesar Chavez Street	A, C	1948	No Style	Concrete slab foundation	Flat roof	One-story	Concrete block construction
1037	1403 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1038	1405 East Cesar Chavez Street	A, C	1891	Folk Victorian	Pier and beam foundation	Metal roof	One-story	
1040	1409 East Cesar Chavez Street	A, C	1922	Bungalow	N/A	Asphalt-shingle roof	One-story	
1041	1602 East Cesar Chavez Street	A, C	1903	Queen Anne	Pier and beam foundation	Metal roof with deck on top of hip	Two-and-one-half-story	
1042	1634 East Cesar Chavez Street	A, C	1948	No Style	Concrete slab foundation	Flat roof	One-story	
1043	1607 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1044	1609 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Metal roof	One and one Half-story	
1045	1611 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1046	1615 East Cesar Chavez Street	A, B, C	c.1930, 1959	FUNERARY/Mortuary			One-story	
1047	1621 East Cesar Chavez Street	A, C	1974	Gas Station	Concrete slab foundation	Flat roof	One-story	
1049	1808 East Cesar Chavez Street	A, C	1925	Craftsman	Pier and beam foundation	Metal roof	Two-story	
1051	1703 East Cesar Chavez Street	A, C	1912	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1053	1717 East Cesar Chavez Street	A, C	1916	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1055	1803 East Cesar Chavez Street	A, C	1922	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1056	1805 East Cesar Chavez Street	A, C	1928	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1057	1807 East Cesar Chavez Street	A, C	1893	Folk Victorian	Pier and beam foundation	Metal roof	Two-story	
1058	98 Chicon Street	A, C	1927	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	
1059	1900 East Cesar Chavez Street	A, C	1938	No Style				Restaurant
1060	1910 East Cesar Chavez Street	A, C	1962	No Style	Concrete slab foundation	Flat roof	One-story	
1061	1901 East Cesar Chavez Street	A, C	c.1965	No Style	Concrete slab foundation	Flat roof	One-story	
1062	1911 East Cesar Chavez Street	A, C	1910	Bungalow	Pier and beam foundation	Metal roof	One-story	
1063	1913 East Cesar Chavez Street	A, C	1916	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1064	2000 East Cesar Chavez Street	A, C	c.1910	Folk Victorian	Pier and beam foundation	Metal roof	One-story	
1066	2008 East Cesar Chavez Street	A, C	c.1920	Craftsman	Pier and beam foundation	Metal roof	One-story	
1067	2012 East Cesar Chavez Street	A, C	1920	Craftsman	Pier and beam foundation	Metal roof	One-story	
1068	2016 East Cesar Chavez Street	A, C	c.1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1069	2020 East Cesar Chavez Street	A, C	c.1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1070	2001 East Cesar Chavez Street	A, C	1941	No Style	N/A	Flat roof	One-story	
1071	2005 East Cesar Chavez Street	A, C	1924	No Style	Pier and beam foundation	Metal roof	One-story	
1072	2009 East Cesar Chavez Street	A, C	1906	Bungalow	Pier and beam foundation	Metal roof	One-story	
1074	2023 East Cesar Chavez Street	A, C	1910	Bungalow	Pier and beam foundation	Metal roof	One-story	
1076	2028 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1077	2032 East Cesar Chavez Street	A, C	1912	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1078	2036 East Cesar Chavez Street	A, C	1924	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1079	2044 East Cesar Chavez Street	A, C	1912	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1081	2109 East Cesar Chavez Street	A, C	1908	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1083	2117 East Cesar Chavez Street	A, C	1926	American Foursquare	Pier and beam foundation	Asphalt-shingle roof	Two-story	
1084	2121 East Cesar Chavez Street	A, C	1928	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1085	2125 East Cesar Chavez Street	A, C	1908	No Style	Pier and beam foundation	Asphalt-shingle roof	Two-story	
1086	2131 East Cesar Chavez Street	A, C	1935	No Style	Concrete slab foundation	Flat roof	One-story	
1087	2100 East Cesar Chavez Street	A, C	1928	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1088	2104 East Cesar Chavez Street	A, C	1922	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1089	2108 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1090	2112 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1091	2116 East Cesar Chavez Street	A, C	1921	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1092	101 Robert T. Martinez, Jr. Street	A, C	c.1920	No Style	Concrete slab foundation	Metal roof	One-story	
1093	2204 East Cesar Chavez Street	A, C	1930	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1094	2214 East Cesar Chavez Street	A, C	1936	Tudor Revival	Pier and beam foundation	Asphalt-shingle roof	One-story	
1095	2220 East Cesar Chavez Street	A, C	1940	Transitional Ranch	Pier and beam foundation	Asphalt-shingle roof	One-story	

Resource Num	Address	NR Criteria	Build Date	Style / Form	Foundation Type	Roof Type	Stories	Notes
1096	2226 East Cesar Chavez Street	A, C	1925	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1098	2201 East Cesar Chavez Street	A, C	1912	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1099	2203 East Cesar Chavez Street	A, C	1917	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1100	2205 East Cesar Chavez Street	A, C	1916	Bungalow	Pier and beam foundation	Hip roof	One-story	
1101	2211 East Cesar Chavez Street	A, C	1917	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1102	2213 East Cesar Chavez Street	A, C	1905	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1103	96 Mildred Street	A, C	1960	No Style	Concrete slab foundation	Flat roof	One-story	
1104	2300 East Cesar Chavez Street	A, C	1955	No Style	Concrete slab foundation	Flat roof	One-story	
1106	2304 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Metal roof	One-story	
1108	2324 East Cesar Chavez Street	A, C	1945	No Style	Concrete slab foundation	Flat roof	One-story	
1110	2301 East Cesar Chavez Street	A, C	1916	American Foursquare	Pier and beam foundation	Metal roof	Two-story	
1111	2303 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1113	2329 East Cesar Chavez Street	A, C	1926	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1114	2331 East Cesar Chavez Street	A, C	1926	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1115	2335 East Cesar Chavez Street	A, C	1926	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1118	2407 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	
1119	2409 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One and one Half-story	
1121	2502 East Cesar Chavez Street	A, C	1932	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1122	2504 East Cesar Chavez Street	A, C	1932	Bungalow	Pier and beam foundation	Metal roof	One-story	
1123	2506 East Cesar Chavez Street	A, C	1928	Bungalow	Pier and beam foundation	Metal roof	One-story	
1124	2508 East Cesar Chavez Street	A, C	1930	Tudor Revival	Pier and beam foundation	Asphalt-shingle roof	One-story	
1125	2510 East Cesar Chavez Street	A, C	1925	Spanish Colonial Revival	Pier and beam foundation	Flat roof	One-story	
1126	2512 East Cesar Chavez Street	A, C	1930	Minimal Traditional	Pier and beam foundation	Asphalt-shingle roof	One-story	
1127	2514 East Cesar Chavez Street	A, C	1925	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1129	2503 East Cesar Chavez Street	A, C	1920	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1130	2505 East Cesar Chavez Street	A, C	1920	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1131	2507 East Cesar Chavez Street	A, C	1926	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1132	2509 East Cesar Chavez Street	A, C	1926	Bungalow	Pier and beam foundation	Metal roof	One-story	
1133	2511 East Cesar Chavez Street	A, C	1930	Bungalow	Pier and beam foundation	Metal roof	One-story	
1134	2513 East Cesar Chavez Street	A, C	1926	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1135	2600 East Cesar Chavez Street	A, C	1930	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1137	2604 East Cesar Chavez Street	A, C	1944	No Style	Pier and beam foundation	Asphalt-shingle roof	One-story	
1142	2609 East Cesar Chavez Street	A, C	1973	No Style	Concrete slab foundation	Asphalt-shingle roof	Two-story	
1144	2614 East Cesar Chavez Street	A, C	1936	Craftsman	Pier and beam foundation	Asphalt-shingle roof	One-story	
1147	2701 East Cesar Chavez Street	A, C	1930	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1148	2703 East Cesar Chavez Street	A, C	1930	Bungalow	Pier and beam foundation	Asphalt-shingle roof	One-story	
1172	4704 East Cesar Chavez Street		c.1948	Ranch		Asphalt-shingle roof	One-story	
1137	4822 East Cesar Chavez Street		1940	No Style		Metal roof	One-story	
1174	4824 East Cesar Chavez Street		1940	No Style		Metal roof	One-story	
N/A	Moonlight Tower - NE corner of Lynn and Canterbury Street	A,C	c.1895					
1030 A	1311 East Cesar Chavez Street	A, B, C	1937	No Style	N/A	N/A - flat roof	One-story	
1030 B	1311 East Cesar Chavez Street	A, B, C	1937	Minimal Traditional	Pier and beam foundation	Asphalt-shingle roof	One-story	
163 A	4301 North Interstate Highway 35	C	c.1960	A-Frame Church	N/A	Asphalt-shingle roof	One-story	Multiple similar buildings
163 B	4301 North Interstate Highway 35	C	c.1890	Folk Victorian	Pier and beam foundation	Metal roof and horizontal wood siding	Two-story	Multiple similar buildings
163 C	4301 North Interstate Highway 35	C	c.1960	No Style	N/A	Steep pitched roof with asphalt shingles	One-story	Multiple similar buildings

Notes

Resource Num: Refers to the number from I-35 Capital Express Central Project from US 290 West/SH 71 Draft Environmental Impact statement. https://www.txdot.gov/projects/hearings-meetings/austin/i35-capital-express-central-project-02-09-22.html

NR Criteria: Refers to the building eligibility criteria for historic status based on NRHP evaluation.

No Style: Refers to buildings that doesn't have a definite construction style associated to them.

N/A in foundation type refers to buildings in which there is no mention of the foundation type in the reports.

Roadway Construction Noise Analysis Report

Roadway Construction Noise Analysis Report

I-35 Capital Express Central Project

0015-13-388
Austin District

May 2023

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 9, 2019, and executed by FHWA and TxDOT.

Table of Contents

Introduction

The State proposes to construct improvements to Interstate Highway 35 (I-35) from United States Highway 290 (US 290) East to US 290 West/State Highway (SH) 71, in Austin, Travis County (referred to as the I-35 Capital Express Central Project [Project]). The proposed Project measures approximately eight miles and includes removing the existing I-35 decks, lowering the roadway, and adding two non-tolled high-occupancy vehicle (HOV) managed lanes in each direction. The Project would also reconstruct east-west cross-street bridges, add pedestrian and bicycle paths, and make additional safety and mobility improvements within the project limits.

This analysis presents the results of the construction noise assessment for the Project including an estimation of construction noise resulting from Project construction activities, an evaluation of potential impacts, and a discussion of measures to minimize temporary construction noise levels. This Construction Noise Analysis Report is summarized in the FEIS.

Fundamentals of Sound

Sound is defined as vibrations that are transmitted through a medium (such as air) and is the objective cause of hearing. Sound pressure is commonly measured in decibels and is expressed as "dB." Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dB(A)."

The sound descriptor used to measure construction noise is as follows:

- L_{10} is the sound pressure level, on an energy basis, that would occur during the highest ten percent of the time.

Noise generated by Project-related construction activities would vary based on the noise levels generated by individual pieces of construction equipment, the type and amount of equipment operating at any given time, the timing and duration of construction activities, the proximity of nearby noise-sensitive receptors, and the presence or lack of shielding in between the noise source(s) and noise-sensitive receptors including existing sound walls. Construction noise levels would also vary at each Project location depending on the specific construction activities being implemented. Construction noise would primarily result from the operation of heavy construction equipment and the movement of heavy trucks and mobile equipment.

Methodology

The I-35 Capital Express Central Project (CapEx C) will be constructed in six phases which are color coded. See **Attachment A (Map Figures).**

- CapEx C University (From US 290 E to MLK)
- CapEx C Downtown (From MLK to Holly St)
- CapEx C Lady Bird Lake (Holly St to US 290 W/SH 71)
- CapEx C MLK Bridges @ MLK
- Cap Metro Airport Bridge @ Airport Blvd and Cap Metro 4th Street Bridge @ 4th St
- Drainage Tunnels (From Airport Blvd to Holly St) and Drainage Tunnel along Cesar Chavez St

A panel of construction engineers gathered to define the construction phases and developed a list of the construction equipment that would likely be used during construction for each of the phases. That list was utilized in the analysis of the construction noise. See Attachment B (Equipment Data). The equipment list is contained in the Federal Highway Administration (FHWA) 2006 Roadway Construction Noise Model Version 1.1, published January 2006.

The adjacent noise receivers were obtained from the approved Traffic Noise Technical Report appendix of the Draft Environmental Impact Statement and were evaluated for potential construction noise impacts.

The FHWA Roadway Construction Noise MODEL (RCNM 1.1) (FHWA 2006) was used to predict construction noise levels for each activity and at each project location based on the type of construction equipment and the construction phase. All listed noise levels are maximum A-weighted sound pressure levels at various distances based on the closest receptor to construction activities.

The construction noise analysis includes the following elements:

- Identification of land use activity areas (receivers) that might be impacted by construction noise.
- A review of construction activities, equipment, and durations based on the various construction phases.
- Determination of the noise levels at receivers based on the equipment proposed for construction using RCNM 1.1. The receivers may experience construction noise from one or more of the construction phases as some of them overlap in the length of the project.
- The RCNM 1.1 was used to calculate L_{10} and L_{10} exceedances for Daytime, Evening and Nighttime noise levels at receivers.
    - L_{10} is the noise level that would occur during the highest ten percent of the time. L_{10} in the model has default noise limit criteria for residential receivers for daytime, evening and nighttime noise levels.
    - Daytime is defined as 7 AM to 6 PM, Evening is defined as 6 PM to 10 PM and Nighttime is defined as 10 PM to 7 AM.
- Consideration and evaluation of measures to reduce noise impacts through Best Management Practices.

Analysis

The RCNM 1.1 was used to calculate L_{10} and L_{10} exceedances for Daytime, Evening and Nighttime noise levels at receivers. L_{10} is the noise level that would occur during the highest ten percent of the time that the equipment is in use.

The various construction phases are color coded to correspond to the exhibit shown in **Attachment A (Map Figures).** The receivers, distance to the Project, L_{10} and L_{10} exceedances for Daytime, Evening and Nighttime noise levels are shown in **Table 1** and in **Attachment A (Map Figures).**

The noise limit criteria were set using the default criteria established in the RCNM, This is based in the studies conducted with the Central Artery/Tunnel project in Boston, Massachusetts. As part of this project noise prediction calculations were developed and used as the base for development if RCNM. In this construction noise screening tool, there were default noise limit criteria set for residential, commercial and industrial properties The model evaluated the noise levels for an absolute noise level which is the noise

level that occurs during the use of the equipment as opposed to a comparison to another noise level. These noise limit criteria are defined as:

Residential (such as single-family homes, multifamily residential properties, churches, cemeteries, schools and medical facilities)

- Daytime: a maximum of 90 dBA
- Evening: a maximum of 80 dBA
- Nighttime: a maximum of 83 dBA

Commercial (such as offices, restaurants, public institutional facilities, recording studio)

- Daytime: a maximum of 80 dBA
- Evening: Not Applicable
- Nighttime: Not Applicable

Industrial (there were no industrial sites that were modeled)

- Daytime: a maximum of 85 dBA
- Evening: Not Applicable
- Nighttime: Not Applicable

Based on the noise limit criteria, once the model has run, if the resulting noise level is higher than the noise limit criteria, the result would be determined to be an exceedance. Once it has been determined that an exceedance has occurred, the location will be evaluated for recommendations for construction mitigation efforts, if appropriate.

Table 1. Receivers, Construction Phases, L10 and Exceedances Noise Levels

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R1.	Hotel	39	CapEx-C University (US290E to MLK)	1 – Demo	93.8	3.8	3.8	10.8
				2 – Roadway Excavation	93.8	3.8	3.8	10.8
				3 – Relocate Utilities	93.8	3.8	3.8	10.8
				4 – Construct NB Lanes	93.8	3.8	3.8	10.8
				5 – Construct SB Lanes	93.8	3.8	3.8	10.8
R2.	Hotel	230	CapEx-C University (US290E to MLK)	1 – Demo	78	None	None	None
				2 – Roadway Excavation	78.4	None	None	None
				3 – Relocate Utilities	77.5	None	None	None
				4 – Construct NB Lanes	79.2	None	None	None
				5 – Construct SB Lanes	78.8	None	None	None
				1 – Demo	81.8	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R3.	Hotel	154	CapEx-C University (US290E to MLK)	2 – Roadway Excavation	81.8	None	None	None
				3 – Relocate Utilities	81.8	None	None	None
				4 – Construct NB Lanes	81.8	None	None	None
				5 – Construct SB Lanes	81.8	None	None	None
R4.	Restaurant	66	CapEx-C University (US290E to MLK)	1 – Demo	89.2	None	N/A	N/A
				2 – Roadway Excavation	89.2	None	N/A	N/A
				3 – Relocate Utilities	89.2	None	N/A	N/A
				4 – Construct NB Lanes	89.2	None	N/A	N/A
				5 – Construct SB Lanes	89.2	None	N/A	N/A
R5.	Restaurant	56	CapEx-C University (US290E to MLK)	1 – Demo	90.6	0.6	N/A	N/A
				2 – Roadway Excavation	90.6	0.6	N/A	N/A
				3 – Relocate Utilities	90.6	0.6	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	90.6	0.6	N/A	N/A
				5 – Construct SB Lanes	90.6	0.6	N/A	N/A
R6.	Hotel	9	CapEx-C University (US290E to MLK)	1 – Demo	106.5	16.5	16.5	23.5
				2 – Roadway Excavation	106.5	16.5	16.5	23.5
				3 – Relocate Utilities	106.5	16.5	16.5	23.5
				4 – Construct NB Lanes	106.5	16.5	16.5	23.5
				5 – Construct SB Lanes	106.5	16.5	16.5	23.5
R7.	Hotel	103	CapEx-C University (US290E to MLK)	1 – Demo	85.3	None	None	2.3
				2 – Roadway Excavation	85.3	None	None	2.3
				3 – Relocate Utilities	85.3	None	None	2.3
				4 – Construct NB Lanes	85.3	None	None	2.3
				5 – Construct SB Lanes	85.3	None	None	2.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R8.	Park	60	CapEx-C University (US290E to MLK)	1 – Demo	85	None	None	2
				2 – Roadway Excavation	85.1	None	None	2.1
				3 – Relocate Utilities	84.2	None	None	1.2
				4 – Construct NB Lanes	85.1	None	None	2.1
				5 – Construct SB Lanes	85.5	None	None	2.5
R9.	Multifamily Residential	9	CapEx-C University (US290E to MLK)	1 – Demo	101.5	11.5	11.5	18.5
				2 – Roadway Excavation	101.6	11.6	11.6	18.6
				3 – Relocate Utilities	100.7	10.7	10.7	17.7
				4 – Construct NB Lanes	101.6	11.6	11.6	18.6
				5 – Construct SB Lanes	102	12	12	19
R10.	Single-family Residential	26	CapEx-C University (US290E to MLK)	1 – Demo	92.3	2.3	2.3	9.3
				2 – Roadway Excavation	92.3	2.3	2.3	9.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 – Relocate Utilities	91.5	1.5	1.5	8.5
				4 – Construct NB Lanes	92.3	2.3	2.3	9.3
				5 – Construct SB Lanes	92.7	2.7	2.7	9.7
R11.	Single-family Residential	79	CapEx-C University (US290E to MLK)	1 – Demo	82.6	None	None	None
				2 – Roadway Excavation	82.6	None	None	None
				3 – Relocate Utilities	82.6	None	None	None
				4 – Construct NB Lanes	82.6	None	None	None
				5 – Construct SB Lanes	83.1	None	None	0.1
R12.	Multifamily Residential	73	CapEx-C University (US290E to MLK)	1 – Demo	83.3	None	None	0.3
				2 – Roadway Excavation	83.3	None	None	0.3
				3 – Relocate Utilities	83.3	None	None	0.3
				4 – Construct NB Lanes	83.3	None	None	0.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Construct SB Lanes	83.8	None	None	0.8
R12.	Multifamily Residential	73	Cap Metro Airport @ Airport Blvd	1 – Demo	87.3	None	None	4.3
				2 – Drill Shafts	81.3	None	None	None
				3 – Columns, Bents, & Deck	85.3	None	None	2.3
				4 – Construct NB/SB Lanes	83.8	None	None	0.8
				5 – Relocate Utilities	81.6	None	None	None
R13.	Single-family Residential	15	CapEx-C University (US290E to MLK)	1 – Demo	96.7	6.7	6.7	13.7
				2 – Roadway Excavation	97.1	7.1	7.1	14.1
				3 – Relocate Utilities	97.9	7.9	7.9	14.9
				4 – Construct NB Lanes	97.9	7.9	7.9	14.9
				5 – Construct SB Lanes	97.5	7.5	7.5	14.5
R13.	Single-family Residential	15		1 – Pump Sta. Shaft Construction	103.7	13.7	13.7	20.7

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
			Drainage Tunnel (Airport Blvd to Holly St)	2 – Pump Sta. Tunnel Excavation	93.8	3.8	3.8	10.8
				3 – Pump Station Construction	102.9	12.9	12.9	19.9
				4 – Intermed. Shaft Construction	97	7	7	14
				5 – Recovery Shaft Construction	97.1	7.1	7.1	14.1
				6 – Shaft Construction	103.7	13.7	13.7	20.7
				7 – Tunnel Excavation	103.7	13.7	13.7	20.7
				8 – Concrete Lining	103.7	13.7	13.7	20.7
R13.	Single-family Residential	15	Cap Metro Airport @ Airport Blvd / SB Deck Retrofit (Airport Blvd to MLK)	1 – Demo	101 / 101	11 / 11	11 / 11	18 / 18
				2 – Drill Shafts	95 / 95	5 / 5	5 / 5	12 / 12
				3 – Columns, Bents, & Deck	99.1 / 99.1	9.1 / 9.1	9.1 / 9.1	16.1 / 16.1
				4 – Construct NB/SB Lanes	97.5 / 97.5	7.5 / 7.5	7.5 / 7.5	14.5 / 14.5

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	95.4 / 95.4	5.4 / 5.4	5.4 / 5.4	12.4 / 12.4
R14.	Multifamily Residential	27	CapEx-C University (US290E to MLK)	1 – Demo	91.6	1.6	1.6	8.6
				2 – Roadway Excavation	92	2	2	9
				3 – Relocate Utilities	91.1	1.1	1.1	8.1
				4 – Construct NB Lanes	92.8	2.8	2.8	9.8
				5 – Construct SB Lanes	92.4	2.4	2.4	9.4
R14.	Multifamily Residential	27	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	98.6	8.6	8.6	15.6
				2 – Pump Sta. Tunnel Excavation	88.7	None	None	5.7
				3 – Pump Station Construction	97.8	7.8	7.8	14.8
				4 – Intermed. Shaft Construction	91.9	1.9	1.9	8.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	91.9	1.9	1.9	8.9
				6 – Shaft Construction	98.6	8.6	8.6	15.6
				7 – Tunnel Excavation	98.6	8.6	8.6	15.6
				8 – Concrete Lining	98.6	8.6	8.6	15.6
R14.	Multifamily Residential	27	SB Deck Retrofit (Airport to MLK)	1 – Demo	95.9	5.9	5.9	12.9
				2 – Drill Shafts	89.9	None	None	6.9
				3 -Columns, Bents, & Deck	94	4	4	11
				4 – Construct NB/SB Lanes	92.4	2.4	2.4	9.4
				5 – Relocate Utilities	90.3	0.3	0.3	7.3
R15.	Single-family Residential	28	CapEx-C University (US290E to MLK)	1 – Demo	91.3	1.3	1.3	8.3
				2 – Roadway Excavation	91.7	1.7	1.7	8.7
				3 – Relocate Utilities	90.8	0.8	0.8	7.8

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	92.5	2.5	2.5	9.5
				5 – Construct SB Lanes	92.1	2.1	2.1	9.1
R15.	Single-family Residential	28	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	98.2	8.2	8.2	15.2
				2 – Pump Sta. Tunnel Excavation	88.4	None	None	5.4
				3 – Pump Station Construction	97.4	7.4	7.4	14.4
				4 – Intermed. Shaft Construction	91.6	1.6	1.6	8.6
				5 – Recovery Shaft Construction	91.6	1.6	1.6	8.6
				6 – Shaft Construction	98.2	8.2	8.2	15.2
				7 – Tunnel Excavation	98.2	8.2	8.2	15.2
				8 – Concrete Lining	98.2	8.2	8.2	15.2

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R15.	Single-family Residential	28	Cap Metro Airport @ Airport Blvd / SB Deck Retrofit (Airport to MLK)	1 – Demo	95.6 / 95.6	5.6 / 5.6	5.6 / 5.6	12.6 / 12.6
				2 – Drill Shafts	89.6 / 89.6	None / None	None/ None	6.6 / 6.6
				3 -Columns, Bents, & Deck	93.6 / 93.6	3.6 / 3.6	3.6 / 3.6	10.6 / 10.6
				4 – Construct NB/SB Lanes	92.1 / 92.1	2.1 / 2.1	2.1 / 2.1	9.1 / 9.1
				5 – Relocate Utilities	90 / 90	None / None	None / None	7 / 7
R16.	Place of Worship	57	CapEx-C University (US290E to MLK)	1 – Demo	84.6	None	None	1.6
				2 – Roadway Excavation	84.6	None	None	1.6
				3 – Relocate Utilities	84.6	None	None	1.6
				4 – Construct NB Lanes	86.3	None	None	3.3
				5 – Construct SB Lanes	85.9	None	None	2.9
R16.	Place of Worship	57	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	92.1	2.1	2.1	9.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				2 – Pump Sta. Tunnel Excavation	82.2	None	None	None
				3 – Pump Station Construction	91.3	1.3	1.3	8.3
				4 – Intermed. Shaft Construction	85.4	None	None	2.4
				5 – Recovery Shaft Construction	85.4	None	None	2.4
				6 – Shaft Construction	92.1	2.1	2.1	9.1
				7 – Tunnel Excavation	92.1	2.1	2.1	9.1
				8 – Concrete Lining	92.1	2.1	2.1	9.1
R16.	Place of Worship	57	SB Deck Retrofit (Airport to MLK)	1 – Demo	89.4	None	None	6.4
				2 – Drill Shafts	83.4	None	None	0.4
				3 -Columns, Bents, & Deck	87.5	None	None	4.5
				4 – Construct NB/SB Lanes	85.9	None	None	2.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	83.8	None	None	0.8
R17.	Single-family Residential	34	CapEx-C University (US290E to MLK)	1 – Demo	90.4	0.4	0.4	7.4
				2 – Roadway Excavation	90.4	0.4	0.4	7.4
				3 – Relocate Utilities	90.4	0.4	0.4	7.4
				4 – Construct NB Lanes	90.4	0.4	0.4	7.4
				5 – Construct SB Lanes	90.4	0.4	0.4	7.4
R17.	Single-family Residential	34	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	96.6	6.6	6.6	13.6
				2 – Pump Sta. Tunnel Excavation	96.6	6.6	6.6	13.6
				3 – Pump Station Construction	96.6	6.6	6.6	13.6
				4 – Intermed. Shaft Construction	96.6	6.6	6.6	13.6

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	96.6	6.6	6.6	13.6
				6 – Shaft Construction	96.6	6.6	6.6	13.6
				7 – Tunnel Excavation	96.6	6.6	6.6	13.6
				8 – Concrete Lining	96.6	6.6	6.6	13.6
R17.	Single-family Residential	34	SB Deck Retrofit (Airport to MLK)	1 – Demo	93.9	3.9	3.9	10.9
				2 – Drill Shafts	87.9	None	None	4.9
				3 -Columns, Bents, & Deck	92	2	2	9
				4 – Construct NB/SB Lanes	90.4	0.4	0.4	7.4
				5 – Relocate Utilities	88.3	None	None	5.3
R18.	Single-family Residential	34	CapEx-C University (US290E to MLK)	1 – Demo	90.4	0.4	0.4	7.4
				2 – Roadway Excavation	90.4	0.4	0.4	7.4
				3 – Relocate Utilities	90.4	0.4	0.4	7.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	90.4	0.4	0.4	7.4
				5 – Construct SB Lanes	90.4	0.4	0.4	7.4
R18.	Single-family Residential	34	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	96.6	6.6	6.6	13.6
				2 – Pump Sta. Tunnel Excavation	96.6	6.6	6.6	13.6
				3 – Pump Station Construction	96.6	6.6	6.6	13.6
				4 – Intermed. Shaft Construction	96.6	6.6	6.6	13.6
				5 – Recovery Shaft Construction	96.6	6.6	6.6	13.6
				6 – Shaft Construction	96.6	6.6	6.6	13.6
				7 – Tunnel Excavation	96.6	6.6	6.6	13.6
				8 – Concrete Lining	96.6	6.6	6.6	13.6

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R18.	Single-family Residential	34	SB Deck Retrofit (Airport to MLK)	1 – Demo	93.9	3.9	3.9	10.9
				2 – Drill Shafts	87.9	None	None	4.9
				3 -Columns, Bents, & Deck	92	2	2	9
				4 – Construct NB/SB Lanes	90.4	0.4	0.4	7.4
				5 – Relocate Utilities	88.3	None	None	5.3
R19.	Single-family Residential	17	CapEx-C University (US290E to MLK)	1 – Demo	96.4	6.4	6.4	13.4
				2 – Roadway Excavation	96.4	6.4	6.4	13.4
				3 – Relocate Utilities	96.4	6.4	6.4	13.4
				4 – Construct NB Lanes	96.4	6.4	6.4	13.4
				5 – Construct SB Lanes	96.4	6.4	6.4	13.4
R19.	Single-family Residential	17	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	102.6	12.6	12.6	19.6

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				2 – Pump Sta. Tunnel Excavation	102.6	12.6	12.6	19.6
				3 – Pump Station Construction	102.6	12.6	12.6	19.6
				4 – Intermed. Shaft Construction	102.6	12.6	12.6	19.6
				5 – Recovery Shaft Construction	96.1	6.1	6.1	13.1
				6 – Shaft Construction	96.1	6.1	6.1	13.1
				7 – Tunnel Excavation	96.1	6.1	6.1	13.1
				8 – Concrete Lining	96.1	6.1	6.1	13.1
R19.	Single-family Residential	17	SB Deck Retrofit (Airport to MLK)	1 – Demo	99.9	9.9	9.9	16.9
				2 – Drill Shafts	93.9	3.9	3.9	10.9
				3 -Columns, Bents, & Deck	98	8	8	15
				4 – Construct NB/SB Lanes	96.4	6.4	6.4	13.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	94.3	4.3	4.3	11.3
R20.	Single-family Residential	34	CapEx-C University (US290E to MLK)	1 – Demo	90.4	0.4	0.4	7.4
				2 – Roadway Excavation	90.4	0.4	0.4	7.4
				3 – Relocate Utilities	90.4	0.4	0.4	7.4
				4 – Construct NB Lanes	90.4	0.4	0.4	7.4
				5 – Construct SB Lanes	90.4	0.4	0.4	7.4
R20.	Single-family Residential	34	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	96.6	6.6	6.6	13.6
				2 – Pump Sta. Tunnel Excavation	96.6	6.6	6.6	13.6
				3 – Pump Station Construction	96.6	6.6	6.6	13.6
				4 – Intermed. Shaft Construction	96.6	6.6	6.6	13.6

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	90	0	0	7
				6 – Shaft Construction	90	0	0	7
				7 – Tunnel Excavation	90	0	0	7
				8 – Concrete Lining	90	0	0	7
R20.	Single-family Residential	34	SB Deck Retrofit (Airport to MLK)	1 – Demo	93.9	3.9	3.9	10.9
				2 – Drill Shafts	87.9	None	None	4.9
				3 -Columns, Bents, & Deck	92	2	2	9
				4 – Construct NB/SB Lanes	90.4	0.4	0.4	7.4
				5 – Relocate Utilities	88.3	None	None	5.3
R21.	Multifamily Residential	24	CapEx-C University (US290E to MLK)	1 – Demo	93.4	3.4	3.4	10.4
				2 – Roadway Excavation	93.4	3.4	3.4	10.4
				3 – Relocate Utilities	93.4	3.4	3.4	10.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	93.4	3.4	3.4	10.4
				5 – Construct SB Lanes	93.4	3.4	3.4	10.4
R21.	Multifamily Residential	24	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	99.6	9.6	9.6	16.6
				2 – Pump Sta. Tunnel Excavation	99.6	9.6	9.6	16.6
				3 – Pump Station Construction	99.6	9.6	9.6	16.6
				4 – Intermed. Shaft Construction	92.9	2.9	2.9	9.9
				5 – Recovery Shaft Construction	93.1	3.1	3.1	10.1
				6 – Shaft Construction	93.1	3.1	3.1	10.1
				7 – Tunnel Excavation	93.1	3.1	3.1	10.1
				8 – Concrete Lining	93.1	3.1	3.1	10.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R21.	Multifamily Residential	24	SB Deck Retrofit (Airport to MLK)	1 – Demo	97	7	7	14
				2 – Drill Shafts	90.9	0.9	0.9	7.9
				3 -Columns, Bents, & Deck	95	5	5	12
				4 – Construct NB/SB Lanes	93.4	3.4	3.4	10.4
				5 – Relocate Utilities	91.3	1.3	1.3	8.3
R22.	Medical Facility	31	CapEx-C University (US290E to MLK)	1 – Demo	91.2	1.2	1.2	8.2
				2 – Roadway Excavation	91.2	1.2	1.2	8.2
				3 – Relocate Utilities	91.2	1.2	1.2	8.2
				4 – Construct NB Lanes	91.2	1.2	1.2	8.2
				5 – Construct SB Lanes	91.2	1.2	1.2	8.2
R22.	Medical Facility	31	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	97.4	7.4	7.4	14.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				2 – Pump Sta. Tunnel Excavation	97.4	7.4	7.4	14.4
				3 – Pump Station Construction	97.4	7.4	7.4	14.4
				4 – Intermed. Shaft Construction	90.7	0.7	0.7	7.7
				5 – Recovery Shaft Construction	90.8	0.8	0.8	7.8
				6 – Shaft Construction	97.4	7.4	7.4	14.4
				7 – Tunnel Excavation	87.5	None	None	4.5
				8 – Concrete Lining	87.5	None	None	4.5
R22.	Medical Facility	31	SB Deck Retrofit (Airport to MLK)	1 – Demo	94.7	4.7	4.7	11.7
				2 – Drill Shafts	88.7	None	None	5.7
				3 -Columns, Bents, & Deck	92.8	2.8	2.8	9.8
				4 – Construct NB/SB Lanes	91.2	1.2	1.2	8.2

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	89.1	None	None	6.1
R23.	School	98	CapEx-C University (US290E to MLK)	1 – Demo	81.2	None	None	None
				2 – Roadway Excavation	81.2	None	None	None
				3 – Relocate Utilities	81.2	None	None	None
				4 – Construct NB Lanes	81.2	None	None	None
				5 – Construct SB Lanes	81.2	None	None	None
R23.	School	98	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	87.4	None	None	4.4
				2 – Pump Sta. Tunnel Excavation	87.4	None	None	4.4
				3 – Pump Station Construction	87.4	None	None	4.4
				4 – Intermed. Shaft Construction	87.4	None	None	4.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	87.4	None	None	4.4
				6 – Shaft Construction	87.4	None	None	4.4
				7 – Tunnel Excavation	77.5	None	None	None
				8 – Concrete Lining	77.5	None	None	None
R23.	School	98	SB Deck Retrofit (Airport to MLK)	1 – Demo	84.7	None	None	1.7
				2 – Drill Shafts	78.7	None	None	None
				3 -Columns, Bents, & Deck	82.8	None	None	None
				4 – Construct NB/SB Lanes	81.2	None	None	None
				5 – Relocate Utilities	79.1	None	None	None
R24.	Hotel	48	CapEx-C University (US290E to MLK)	1 – Demo	87.4	None	None	4.4
				2 – Roadway Excavation	87.4	None	None	4.4
				3 – Relocate Utilities	87.4	None	None	4.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	87.4	None	None	4.4
				5 – Construct SB Lanes	87.4	None	None	4.4
R24.	Hotel	48	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	93.6	3.6	3.6	10.6
				2 – Pump Sta. Tunnel Excavation	93.6	3.6	3.6	10.6
				3 – Pump Station Construction	93.6	3.6	3.6	10.6
				4 – Intermed. Shaft Construction	93.6	3.6	3.6	10.6
				5 – Recovery Shaft Construction	93.6	3.6	3.6	10.6
				6 – Shaft Construction	93.6	3.6	3.6	10.6
				7 – Tunnel Excavation	83.7	None	None	0.7
				8 – Concrete Lining	83.7	None	None	0.7

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R24.	Hotel	48	SB Deck Retrofit (Airport to MLK)	1 – Demo	90.9	0.9	0.9	7.9
				2 – Drill Shafts	84.9	None	None	1.9
				3 -Columns, Bents, & Deck	84.9	None	None	1.9
				4 – Construct NB/SB Lanes	87.4	None	None	4.4
				5 – Relocate Utilities	85.3	None	None	2.3
R25.	Cemetery	169	CapEx-C University (US290E to MLK)	1 – Demo	76.5	None	None	None
				2 – Roadway Excavation	76.5	None	None	None
				3 – Relocate Utilities	76.5	None	None	None
				4 – Construct NB Lanes	76.5	None	None	None
				5 – Construct SB Lanes	76.5	None	None	None
R25.	Cemetery	169	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	82.6	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				2 – Pump Sta. Tunnel Excavation	82.6	None	None	None
				3 – Pump Station Construction	82.6	None	None	None
				4 – Intermed. Shaft Construction	82.6	None	None	None
				5 – Recovery Shaft Construction	82.6	None	None	None
				6 – Shaft Construction	82.6	None	None	None
				7 – Tunnel Excavation	82.6	None	None	None
				8 – Concrete Lining	82.6	None	None	None
R26.	School	106	CapEx-C University (US290E to MLK)	1 – Demo	80.5	None	None	None
				2 – Roadway Excavation	80.5	None	None	None
				3 – Relocate Utilities	80.5	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	80.5	None	None	None
				5 – Construct SB Lanes	80.5	None	None	None
R26.	School	106	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	86.7	None	None	3.7
				2 – Pump Sta. Tunnel Excavation	86.7	None	None	3.7
				3 – Pump Station Construction	86.7	None	None	3.7
				4 – Intermed. Shaft Construction	86.7	None	None	3.7
				5 – Recovery Shaft Construction	86.7	None	None	3.7
				6 – Shaft Construction	86.7	None	None	3.7
				7 – Tunnel Excavation	86.7	None	None	3.7
				8 – Concrete Lining	86.7	None	None	3.7

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R27.	School	193	CapEx-C University (US290E to MLK)	1 – Demo	75.3	None	None	None
				2 – Roadway Excavation	75.3	None	None	None
				3 – Relocate Utilities	75.3	None	None	None
				4 – Construct NB Lanes	75.3	None	None	None
				5 – Construct SB Lanes	75.3	None	None	None
R27.	School	193	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	81.5	None	None	None
				2 – Pump Sta. Tunnel Excavation	81.5	None	None	None
				3 – Pump Station Construction	81.5	None	None	None
				4 – Intermed. Shaft Construction	81.5	None	None	None
				5 – Recovery Shaft Construction	81.5	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				6 – Shaft Construction	81.5	None	None	None
				7 – Tunnel Excavation	81.5	None	None	None
				8 – Concrete Lining	81.5	None	None	None
R28.	School	91	CapEx-C University (US290E to MLK)	1 – Demo	81.9	None	None	None
				2 – Roadway Excavation	81.9	None	None	None
				3 – Relocate Utilities	81.9	None	None	None
				4 – Construct NB Lanes	81.9	None	None	None
				5 – Construct SB Lanes	81.9	None	None	None
R28.	School	91	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	88	None	None	5
				2 – Pump Sta. Tunnel Excavation	88	None	None	5
				3 – Pump Station Construction	88	None	None	5

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Intermed. Shaft Construction	88	None	None	5
				5 – Recovery Shaft Construction	88	None	None	5
				6 – Shaft Construction	88	None	None	5
				7 – Tunnel Excavation	88	None	None	5
				8 – Concrete Lining	88	None	None	5
R29.	School	43	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	87.1	None	None	4.1
				2 – Roadway Excavation	87.1	None	None	4.1
				3 – Relocate Utilities	87.1	None	None	4.1
				4 – Construct NB Lanes	87.6	None	None	4.6
				5 – Construct SB Lanes	87.6	None	None	4.6

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R29.	School	43	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	94.5	4.5	4.5	11.5
				2 – Pump Sta. Tunnel Excavation	94.5	4.5	4.5	11.5
				3 – Pump Station Construction	94.5	4.5	4.5	11.5
				4 – Intermed. Shaft Construction	94.5	4.5	4.5	11.5
				5 – Recovery Shaft Construction	94.5	4.5	4.5	11.5
				6 – Shaft Construction	94.5	4.5	4.5	11.5
				7 – Tunnel Excavation	94.5	4.5	4.5	11.5
				8 – Concrete Lining	94.5	4.5	4.5	11.5
R29.	School	43	MLK @ MLK	1 – Demo	91.9	1.9	1.9	8.9
				2 – Drill Shafts	85.9	None	None	2.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	89.9	None	None	6.9
				4 – Construct NB/SB Lanes	88.3	None	None	5.3
				5 – Relocate Utilities	86.2	None	None	3.2
R30.	Hotel	91	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	80.6	None	None	None
				2 – Roadway Excavation	80.6	None	None	None
				3 – Relocate Utilities	80.6	None	None	None
				4 – Construct NB Lanes	81.7	None	None	None
				5 – Construct SB Lanes	81.1	None	None	None
R30.	Hotel	91	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	88	None	None	5
				2 – Pump Sta. Tunnel Excavation	88	None	None	5
				3 – Pump Station Construction	88	None	None	5

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Intermed. Shaft Construction	88	None	None	5
				5 – Recovery Shaft Construction	88	None	None	5
				6 – Shaft Construction	88	None	None	5
				7 – Tunnel Excavation	88	None	None	5
				8 – Concrete Lining	88	None	None	5
R30.	Hotel	91	MLK @ MLK	1 – Demo	85.4	None	None	2.4
				2 – Drill Shafts	79.4	None	None	None
				3 -Columns, Bents, & Deck	83.4	None	None	0.4
				4 – Construct NB/SB Lanes	81.8	None	None	None
				5 – Relocate Utilities	79.7	None	None	None
				1 – Demo	63.8	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R31.	Cemetery	630	CapEx-C Downtown (Holly St to US290W/SH71)	2 – Roadway Excavation	63.8	None	None	None
				3 – Relocate Utilities	63.8	None	None	None
				4 – Construct NB Lanes	64.9	None	None	None
				5 – Construct SB Lanes	64.3	None	None	None
R31.	Cemetery	630	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	71.2	None	None	None
				2 – Pump Sta. Tunnel Excavation	71.2	None	None	None
				3 – Pump Station Construction	71.2	None	None	None
				4 – Intermed. Shaft Construction	71.2	None	None	None
				5 – Recovery Shaft Construction	71.2	None	None	None
				6 – Shaft Construction	71.2	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				7 – Tunnel Excavation	61.4	None	None	None
				8 – Concrete Lining	70.4	None	None	None
R31.	Cemetery	630	MLK @ MLK	1 – Demo	68.6	None	None	None
				2 – Drill Shafts	62.6	None	None	None
				3 -Columns, Bents, & Deck	66.6	None	None	None
				4 – Construct NB/SB Lanes	65	None	None	None
				5 – Relocate Utilities	62.9	None	None	None
R32.	Single-family Residential	29	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	90.5	0.5	0.5	7.5
				2 – Roadway Excavation	90.5	0.5	0.5	7.5
				3 – Relocate Utilities	90.5	0.5	0.5	7.5
				4 – Construct NB Lanes	91.7	1.7	1.7	8.7
				5 – Construct SB Lanes	91.1	1.1	1.1	8.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R32.	Single-family Residential	29	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	97.9	7.9	7.9	14.9
				2 – Pump Sta. Tunnel Excavation	97.9	7.9	7.9	14.9
				3 – Pump Station Construction	97.9	7.9	7.9	14.9
				4 – Intermed. Shaft Construction	97.9	7.9	7.9	14.9
				5 – Recovery Shaft Construction	97.9	7.9	7.9	14.9
				6 – Shaft Construction	97.9	7.9	7.9	14.9
				7 – Tunnel Excavation	97.9	7.9	7.9	14.9
				8 – Concrete Lining	97.9	7.9	7.9	14.9
R33.	Single-family Residential	42	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	87.3	None	None	4.3
				2 – Roadway Excavation	87.3	None	None	4.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 – Relocate Utilities	87.3	None	None	4.3
				4 – Construct NB Lanes	87.8	None	None	4.8
				5 – Construct SB Lanes	87.8	None	None	4.8
R33.	Single-family Residential	42	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	94.7	4.7	4.7	11.7
				2 – Pump Sta. Tunnel Excavation	94.7	4.7	4.7	11.7
				3 – Pump Station Construction	94.7	4.7	4.7	11.7
				4 – Intermed. Shaft Construction	94.7	4.7	4.7	11.7
				5 – Recovery Shaft Construction	94.7	4.7	4.7	11.7
				6 – Shaft Construction	94.7	4.7	4.7	11.7
				7 – Tunnel Excavation	94.7	4.7	4.7	11.7

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				8 – Concrete Lining	94.7	4.7	4.7	11.7
R34.	Multifamily Residential	17	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	95.2	5.2	5.2	12.2
				2 – Roadway Excavation	95.2	5.2	5.2	12.2
				3 – Relocate Utilities	95.2	5.2	5.2	12.2
				4 – Construct NB Lanes	95.7	5.7	5.7	12.7
				5 – Construct SB Lanes	95.7	5.7	5.7	12.7
R35.	Medical Facility	35	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	88.9	None	None	5.9
				2 – Roadway Excavation	88.9	None	None	5.9
				3 – Relocate Utilities	88.9	None	None	5.9
				4 – Construct NB Lanes	89.4	None	None	6.4
				5 – Construct SB Lanes	89.4	None	None	6.4
				1 – Demo	99.8	9.8	9.8	16.8

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R36.	Single-family Residential	10	CapEx-C Downtown (Holly St to US290W/SH71)	2 – Roadway Excavation	99.8	9.8	9.8	16.8
				3 – Relocate Utilities	99.8	9.8	9.8	16.8
				4 – Construct NB Lanes	100.3	10.3	10.3	17.3
				5 – Construct SB Lanes	100.3	10.3	10.3	17.3
R37.	Hotel	45	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	86.7	None	None	3.7
				2 – Roadway Excavation	86.7	None	None	3.7
				3 – Relocate Utilities	86.7	None	None	3.7
				4 – Construct NB Lanes	87.2	None	None	4.2
				5 – Construct SB Lanes	87.2	None	None	4.2
R38.	Multifamily Residential	6	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	103.6	13.6	13.6	20.6
				2 – Roadway Excavation	105.3	15.3	15.3	22.3
				3 – Relocate Utilities	104.2	14.2	14.2	21.2

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	104.7	14.7	14.7	21.7
				5 – Construct SB Lanes	104.7	14.7	14.7	21.7
R39.	Multifamily Residential	10	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	100.9	10.9	10.9	17.9
				2 – Roadway Excavation	100.9	10.9	10.9	17.9
				3 – Relocate Utilities	99.8	9.8	9.8	16.8
				4 – Construct NB Lanes	100.3	10.3	10.3	17.3
				5 – Construct SB Lanes	100.3	10.3	10.3	17.3
R40.	Hotel	126	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	78.9	None	None	None
				2 – Roadway Excavation	78.9	None	None	None
				3 – Relocate Utilities	77.8	None	None	None
				4 – Construct NB Lanes	78.3	None	None	None
				5 – Construct SB Lanes	78.3	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R41.	Multifamily Residential	5	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	106.3	16.3	16.3	23.3
				2 – Roadway Excavation	106.3	16.3	16.3	23.3
				3 – Relocate Utilities	106.3	16.3	16.3	23.3
				4 – Construct NB Lanes	106.3	16.3	16.3	23.3
				5 – Construct SB Lanes	106.3	16.3	16.3	23.3
R42.	Multifamily Residential	6	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	104.7	14.7	14.7	21.7
				2 – Roadway Excavation	104.7	14.7	14.7	21.7
				3 – Relocate Utilities	104.7	14.7	14.7	21.7
				4 – Construct NB Lanes	104.7	14.7	14.7	21.7
				5 – Construct SB Lanes	104.7	14.7	14.7	21.7
R43.	Single-family Residential	20	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	94.3	4.3	4.3	11.3
				2 – Roadway Excavation	94.3	4.3	4.3	11.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 – Relocate Utilities	94.3	4.3	4.3	11.3
				4 – Construct NB Lanes	94.3	4.3	4.3	11.3
				5 – Construct SB Lanes	94.3	4.3	4.3	11.3
R44.	Multifamily Residential	42	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	87.8	None	None	4.8
				2 – Roadway Excavation	87.8	None	None	4.8
				3 – Relocate Utilities	87.8	None	None	4.8
				4 – Construct NB Lanes	87.8	None	None	4.8
				5 – Construct SB Lanes	87.8	None	None	4.8
R45.	Public Institutional Structure	86	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	81.6	None	N/A	N/A
				2 – Roadway Excavation	81.6	None	N/A	N/A
				3 – Relocate Utilities	81.6	None	N/A	N/A
				4 – Construct NB Lanes	81.6	None	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Construct SB Lanes	81.6	None	N/A	N/A
R46.	Recording Studio	1	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	120.3	30.3	N/A	N/A
				2 – Roadway Excavation	120.3	30.3	N/A	N/A
				3 – Relocate Utilities	120.3	30.3	N/A	N/A
				4 – Construct NB Lanes	120.3	30.3	N/A	N/A
				5 – Construct SB Lanes	120.3	30.3	N/A	N/A
R47.	Multifamily Residential	62	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	84.5	None	None	1.5
				2 – Roadway Excavation	84.5	None	None	1.5
				3 – Relocate Utilities	84.5	None	None	1.5
				4 – Construct NB Lanes	84.5	None	None	1.5
				5 – Construct SB Lanes	84.5	None	None	1.5
				1 – Demo	88.7	None	None	5.7

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R47.	Multifamily Residential	62	Cap Metro 4th St. @ 4th St	2 – Drill Shafts	86.7	None	None	3.7
				3 -Columns, Bents, & Deck	86.7	None	None	3.7
				4 – Construct NB/SB Lanes	85.2	None	None	2.2
				5 – Relocate Utilities	83	None	None	0
R48.	Restaurant	9	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	101.2	11.2	N/A	N/A
				2 – Roadway Excavation	101.2	11.2	N/A	N/A
				3 – Relocate Utilities	101.2	11.2	N/A	N/A
				4 – Construct NB Lanes	101.2	11.2	N/A	N/A
				5 – Construct SB Lanes	101.2	11.2	N/A	N/A
R48.	Restaurant	9	Cap Metro 4th St. @ 4th St	1 – Demo	105.5	15.5	15.5	22.5
				2 – Drill Shafts	99.5	9.5	9.5	16.5
				3 -Columns, Bents, & Deck	103.5	13.5	13.5	20.5

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB/SB Lanes	101.9	11.9	11.9	18.9
				5 – Relocate Utilities	99.8	9.8	9.8	16.8
R49.	Multifamily Residential	30	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	90.8	0.8	0.8	7.8
				2 – Roadway Excavation	90.8	0.8	0.8	7.8
				3 – Relocate Utilities	90.8	0.8	0.8	7.8
				4 – Construct NB Lanes	90.8	0.8	0.8	7.8
				5 – Construct SB Lanes	90.8	0.8	0.8	7.8
R49.	Multifamily Residential	30	Cap Metro 4th St. @ 4th St	1 – Demo	95	5	5	12
				2 – Drill Shafts	89	None	None	6
				3 -Columns, Bents, & Deck	93	3	3	10
				4 – Construct NB/SB Lanes	91.5	1.5	1.5	8.5
				5 – Relocate Utilities	89.4	None	None	6.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R50.	Place of Worship	37	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	88.9	None	None	5.9
				2 – Roadway Excavation	88.9	None	None	5.9
				3 – Relocate Utilities	88.9	None	None	5.9
				4 – Construct NB Lanes	88.9	None	None	5.9
				5 – Construct SB Lanes	88.9	None	None	5.9
R51.	Park	55	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	85.5	None	None	2.5
				2 – Roadway Excavation	85.5	None	None	2.5
				3 – Relocate Utilities	85.5	None	None	2.5
				4 – Construct NB Lanes	85.5	None	None	2.5
				5 – Construct SB Lanes	85.5	None	None	2.5
R52.	Single-family Residential	13	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	98	8	8	15
				2 – Roadway Excavation	98	8	8	15

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 – Relocate Utilities	98	8	8	15
				4 – Construct NB Lanes	98	8	8	15
				5 – Construct SB Lanes	98	8	8	15
R52.	Single-family Residential	13	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	104.9	14.9	14.9	21.9
				2 – Pump Sta. Tunnel Excavation	95.1	5.1	5.1	12.1
				3 – Pump Station Construction	104.1	14.1	14.1	21.1
				4 – Intermed. Shaft Construction	98.2	8.2	8.2	15.2
				5 – Recovery Shaft Construction	98.4	8.4	8.4	15.4
				6 – Shaft Construction	104.9	14.9	14.9	21.9
				7 – Tunnel Excavation	95.1	5.1	5.1	12.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				8 – Concrete Lining	104.1	14.1	14.1	21.1
R53.	Public Institutional Structure	104	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	80	None	N/A	N/A
				2 – Roadway Excavation	80	None	N/A	N/A
				3 – Relocate Utilities	80	None	N/A	N/A
				4 – Construct NB Lanes	80	None	N/A	N/A
				5 – Construct SB Lanes	80	None	N/A	N/A
R53.	Public Institutional Structure	104	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	86.8	None	N/A	N/A
				2 – Pump Sta. Tunnel Excavation	86.8	None	N/A	N/A
				3 – Pump Station Construction	86	None	N/A	N/A
				4 – Intermed. Shaft Construction	80.2	None	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	80.3	None	N/A	N/A
				6 – Shaft Construction	86.8	None	N/A	N/A
				7 – Tunnel Excavation	77	None	N/A	N/A
				8 – Concrete Lining	86	None	N/A	N/A
R54.	Multifamily Residential	14	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	97.4	7.4	7.4	14.4
				2 – Roadway Excavation	97.4	7.4	7.4	14.4
				3 – Relocate Utilities	97.4	7.4	7.4	14.4
				4 – Construct NB Lanes	97.4	7.4	7.4	14.4
				5 – Construct SB Lanes	97.4	7.4	7.4	14.4
R54.	Multifamily Residential	14		1 – Pump Sta. Shaft Construction	104.3	14.3	14.3	21.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
			Drainage Tunnel (Airport Blvd to Holly St)	2 – Pump Sta. Tunnel Excavation	94.4	4.4	4.4	11.4
				3 – Pump Station Construction	103.5	13.5	13.5	20.5
				4 – Intermed. Shaft Construction	97.6	7.6	7.6	14.6
				5 – Recovery Shaft Construction	97.7	7.7	7.7	14.7
				6 – Shaft Construction	104.3	14.3	14.3	21.3
				7 – Tunnel Excavation	94.4	4.4	4.4	11.4
				8 – Concrete Lining	103.5	13.5	13.5	20.5
R55.	Single-family Residential	26	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	92	2	2	9
				2 – Roadway Excavation	92	2	2	9
				3 – Relocate Utilities	92	2	2	9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	92	2	2	9
				5 – Construct SB Lanes	92	2	2	9
R55.	Single-family Residential	26	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	98.9	8.9	8.9	15.9
				2 – Pump Sta. Tunnel Excavation	89	None	None	6
				3 – Pump Station Construction	98.1	8.1	8.1	15.1
				4 – Intermed. Shaft Construction	92.2	2.2	2.2	9.2
				5 – Recovery Shaft Construction	92.4	2.4	2.4	9.4
				6 – Shaft Construction	98.9	8.9	8.9	15.9
				7 – Tunnel Excavation	89	None	None	6
				8 – Concrete Lining	98.1	8.1	8.1	15.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R56.	Single-family Residential	53	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	85.8	None	None	2.8
				2 – Roadway Excavation	85.8	None	None	2.8
				3 – Relocate Utilities	85.8	None	None	2.8
				4 – Construct NB Lanes	85.8	None	None	2.8
				5 – Construct SB Lanes	85.8	None	None	2.8
R56.	Single-family Residential	53	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	92.7	2.7	2.7	9.7
				2 – Pump Sta. Tunnel Excavation	92.7	2.7	2.7	9.7
				3 – Pump Station Construction	92.7	2.7	2.7	9.7
				4 – Intermed. Shaft Construction	86	None	None	3
				5 – Recovery Shaft Construction	86.2	None	None	3.2

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				6 – Shaft Construction	86.2	None	None	3.2
				7 – Tunnel Excavation	86.2	None	None	3.2
				8 – Concrete Lining	91.9	1.9	1.9	8.9
R57.	Single-family Residential	46	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	91.3	1.3	1.3	8.3
				2 – Drill Shafts	85.3	None	None	2.3
				3 -Columns, Bents, & Deck	87.8	None	None	4.8
				4 – Construct NB/SB Lanes	87.8	None	None	4.8
				5 – Relocate Utilities	85.6	None	None	2.6
R57.	Single-family Residential	46	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	93.9	3.9	3.9	10.9
				2 – Pump Sta. Tunnel Excavation	93.9	3.9	3.9	10.9
				3 – Pump Station Construction	93.9	3.9	3.9	10.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Intermed. Shaft Construction	87.2	None	None	4.2
				5 – Recovery Shaft Construction	87.4	None	None	4.4
				6 – Shaft Construction	93.9	3.9	3.9	10.9
				7 – Tunnel Excavation	93.9	3.9	3.9	10.9
				8 – Concrete Lining	93.1	3.1	3.1	10.1
R58.	Single-family Residential	22	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	97.7	7.7	7.7	14.7
				2 – Drill Shafts	91.7	1.7	1.7	8.7
				3 -Columns, Bents, & Deck	92	2	2	9
				4 – Construct NB/SB Lanes	92	2	2	9
				5 – Relocate Utilities	92	2	2	9
R58.	Single-family Residential	22	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	100.3	10.3	10.3	17.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				2 – Pump Sta. Tunnel Excavation	100.3	10.3	10.3	17.3
				3 – Pump Station Construction	100.3	10.3	10.3	17.3
				4 – Intermed. Shaft Construction	93.6	3.6	3.6	10.6
				5 – Recovery Shaft Construction	93.8	3.8	3.8	10.8
				6 – Shaft Construction	100.3	10.3	10.3	17.3
				7 – Tunnel Excavation	100.3	10.3	10.3	17.3
				8 – Concrete Lining	99.5	9.5	9.5	16.5
R59.	Multifamily Residential	34	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	93.9	3.9	3.9	10.9
				2 – Drill Shafts	87.9	None	None	4.9
				3 -Columns, Bents, & Deck	88.3	None	None	5.3
				4 – Construct NB/SB Lanes	88.3	None	None	5.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	88.3	None	None	5.3
R59.	Multifamily Residential	34	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	96.6	6.6	6.6	13.6
				2 – Pump Sta. Tunnel Excavation	96.6	6.6	6.6	13.6
				3 – Pump Station Construction	96.6	6.6	6.6	13.6
				4 – Intermed. Shaft Construction	89.9	None	None	6.9
				5 – Recovery Shaft Construction	90	0	0	7
				6 – Shaft Construction	96.6	6.6	6.6	13.6
				7 – Tunnel Excavation	86.7	None	None	3.7
				8 – Concrete Lining	95.8	5.8	5.8	12.8
				1 – Demo	83.5	None	None	0.5

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R60.	Hotel	113	CapEx-C LBL (Holly St to US290W/SH71)	2 – Drill Shafts	77.5	None	None	None
				3 -Columns, Bents, & Deck	80	None	None	None
				4 – Construct NB/SB Lanes	80	None	None	None
				5 – Relocate Utilities	77.8	None	None	None
R60.	Hotel	113	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	86.1	None	None	3.1
				2 – Pump Sta. Tunnel Excavation	86.1	None	None	3.1
				3 – Pump Station Construction	86.1	None	None	3.1
				4 – Intermed. Shaft Construction	79.4	None	None	None
				5 – Recovery Shaft Construction	79.6	None	None	None
				6 – Shaft Construction	86.1	None	None	3.1

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				7 – Tunnel Excavation	76.3	None	None	None
				8 – Concrete Lining	85.3	None	None	2.3
R61.	Public Institutional Structure	24	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	97	7	N/A	N/A
				2 – Drill Shafts	90.9	0.9	N/A	N/A
				3 -Columns, Bents, & Deck	93.4	3.4	N/A	N/A
				4 – Construct NB/SB Lanes	93.4	3.4	N/A	N/A
				5 – Relocate Utilities	91.3	1.3	N/A	N/A
R61.	Public Institutional Structure	24	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	99.6	9.6	N/A	N/A
				2 – Pump Sta. Tunnel Excavation	99.6	9.6	N/A	N/A
				3 – Pump Station Construction	99.6	9.6	N/A	N/A
				4 – Intermed. Shaft Construction	92.9	2.9	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Recovery Shaft Construction	93.1	3.1	N/A	N/A
				6 – Shaft Construction	99.6	9.6	N/A	N/A
				7 – Tunnel Excavation	89.7	None	N/A	N/A
				8 – Concrete Lining	98.8	8.8	N/A	N/A
R62.	Park	31	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	94.7	4.7	4.7	11.7
				2 – Drill Shafts	88.7	None	None	5.7
				3 -Columns, Bents, & Deck	91.2	1.2	1.2	8.2
				4 – Construct NB/SB Lanes	91.2	1.2	1.2	8.2
				5 – Relocate Utilities	89.1	None	None	6.1
R62.	Park	31	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	97.4	7.4	7.4	14.4
				2 – Pump Sta. Tunnel Excavation	97.4	7.4	7.4	14.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 – Pump Station Construction	97.4	7.4	7.4	14.4
				4 – Intermed. Shaft Construction	97.4	7.4	7.4	14.4
				5 – Recovery Shaft Construction	90.8	0.8	0.8	7.8
				6 – Shaft Construction	90.8	0.8	0.8	7.8
				7 – Tunnel Excavation	90.8	0.8	0.8	7.8
				8 – Concrete Lining	96.6	6.6	6.6	13.6
R63.	Park	19	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	99	9	9	16
				2 – Drill Shafts	93	3	3	10
				3 -Columns, Bents, & Deck	95.4	5.4	5.4	12.4
				4 – Construct NB/SB Lanes	95.4	5.4	5.4	12.4
				5 – Relocate Utilities	93.3	3.3	3.3	10.3

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R63.	Park	19	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	101.6	11.6	11.6	18.6
				2 – Pump Sta. Tunnel Excavation	101.6	11.6	11.6	18.6
				3 – Pump Station Construction	101.6	11.6	11.6	18.6
				4 – Intermed. Shaft Construction	94.9	4.9	4.9	11.9
				5 – Recovery Shaft Construction	95.1	5.1	5.1	12.1
				6 – Shaft Construction	95.1	5.1	5.1	12.1
				7 – Tunnel Excavation	91.8	1.8	1.8	8.8
				8 – Concrete Lining	100.8	10.8	10.8	17.8
R64.	Park	43	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	91.9	1.9	1.9	8.9
				2 – Drill Shafts	85.9	None	None	2.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	88.3	None	None	5.3
				4 – Construct NB/SB Lanes	88.3	None	None	5.3
				5 – Relocate Utilities	86.2	None	None	3.2
R65.	Trail	339	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	74	None	None	None
				2 – Drill Shafts	67.9	None	None	None
				3 -Columns, Bents, & Deck	70.4	None	None	None
				4 – Construct NB/SB Lanes	70.4	None	None	None
				5 – Relocate Utilities	68.3	None	None	None
R66.	Multifamily Residential	8	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	106.5	16.5	16.5	23.5
				2 – Drill Shafts	100.5	10.5	10.5	17.5
				3 -Columns, Bents, & Deck	104.5	14.5	14.5	21.5
				4 – Construct NB/SB Lanes	103	13	13	20

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	100.8	10.8	10.8	17.8
R67.	Office	59	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	89.1	None	N/A	N/A
				2 – Drill Shafts	83.1	None	N/A	N/A
				3 -Columns, Bents, & Deck	87.2	None	N/A	N/A
				4 – Construct NB/SB Lanes	85.6	None	N/A	N/A
				5 – Relocate Utilities	83.5	None	N/A	N/A
R68.	Single-family Residential	112	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	83.6	None	None	0.6
				2 – Drill Shafts	77.6	None	None	None
				3 -Columns, Bents, & Deck	81.6	None	None	None
				4 – Construct NB/SB Lanes	80	None	None	None
				5 – Relocate Utilities	77.9	None	None	None
R69.	Single-family Residential	93	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	85.2	None	None	2.2
				2 – Drill Shafts	79.2	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	81.6	None	None	None
				4 – Construct NB/SB Lanes	81.6	None	None	None
				5 – Relocate Utilities	79.5	None	None	None
R70.	Office	142	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	86.5	None	N/A	N/A
				2 – Drill Shafts	80.9	None	N/A	N/A
				3 -Columns, Bents, & Deck	80.9	None	N/A	N/A
				4 – Construct NB/SB Lanes	80.9	None	N/A	N/A
				5 – Relocate Utilities	80.9	None	N/A	N/A
R71.	Multifamily Residential	35	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	93	3	3	10
				2 – Drill Shafts	93	3	3	10
				3 -Columns, Bents, & Deck	93	3	3	10
				4 – Construct NB/SB Lanes	93	3	3	10

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	93	3	3	10
R72.	Place of Worship	38	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	91.9	1.9	1.9	8.9
				2 – Drill Shafts	91.9	1.9	1.9	8.9
				3 -Columns, Bents, & Deck	94.4	4.4	4.4	11.4
				4 – Construct NB/SB Lanes	94.4	4.4	4.4	11.4
				5 – Relocate Utilities	92.3	2.3	2.3	9.3
R73.	Office	206	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	77.6	None	N/A	N/A
				2 – Drill Shafts	77.6	None	N/A	N/A
				3 -Columns, Bents, & Deck	77.6	None	N/A	N/A
				4 – Construct NB/SB Lanes	77.6	None	N/A	N/A
				5 – Relocate Utilities	77.6	None	N/A	N/A
R74.	Restaurant	96	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	84.3	None	N/A	N/A
				2 – Drill Shafts	84.3	None	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	84.3	None	N/A	N/A
				4 – Construct NB/SB Lanes	84.3	None	N/A	N/A
				5 – Relocate Utilities	84.3	None	N/A	N/A
R75.	Restaurant	59	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	88.5	None	N/A	N/A
				2 – Drill Shafts	88.5	None	N/A	N/A
				3 -Columns, Bents, & Deck	88.5	None	N/A	N/A
				4 – Construct NB/SB Lanes	88.5	None	N/A	N/A
				5 – Relocate Utilities	88.5	None	N/A	N/A
R76.	Multifamily Residential	64	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	87.8	None	None	4.8
				2 – Drill Shafts	87.8	None	None	4.8
				3 -Columns, Bents, & Deck	87.8	None	None	4.8
				4 – Construct NB/SB Lanes	87.8	None	None	4.8

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	87.8	None	None	4.8
R77.	Restaurant	60	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	92	2	N/A	N/A
				2 – Drill Shafts	92	2	N/A	N/A
				3 -Columns, Bents, & Deck	92	2	N/A	N/A
				4 – Construct NB/SB Lanes	88.3	None	N/A	N/A
				5 – Relocate Utilities	88.3	None	N/A	N/A
R78.	Hotel	7	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	107	17	17	24
				2 – Drill Shafts	107	17	17	24
				3 -Columns, Bents, & Deck	107	17	17	24
				4 – Construct NB/SB Lanes	107	17	17	24
				5 – Relocate Utilities	107	17	17	24
R79.	Hotel	139	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	81	None	None	None
				2 – Drill Shafts	81	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	81	None	None	None
				4 – Construct NB/SB Lanes	81	None	None	None
				5 – Relocate Utilities	81	None	None	None
R80.	Office	5	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	109.9	19.9	N/A	N/A
				2 – Drill Shafts	109.9	19.9	N/A	N/A
				3 -Columns, Bents, & Deck	109.9	19.9	N/A	N/A
				4 – Construct NB/SB Lanes	109.9	19.9	N/A	N/A
				5 – Relocate Utilities	109.9	19.9	N/A	N/A
R81.	Hotel	166	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	79.5	None	None	None
				2 – Drill Shafts	79.5	None	None	None
				3 -Columns, Bents, & Deck	79.5	None	None	None
				4 – Construct NB/SB Lanes	79.5	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Relocate Utilities	79.5	None	None	None
R82.	Multifamily Residential	26	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	95.6	5.6	5.6	12.6
				2 – Drill Shafts	95.6	5.6	5.6	12.6
				3 -Columns, Bents, & Deck	95.6	5.6	5.6	12.6
				4 – Construct NB/SB Lanes	95.6	5.6	5.6	12.6
				5 – Relocate Utilities	95.6	5.6	5.6	12.6
R83.	Public Institutional Structure	74	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	86.5	None	N/A	N/A
				2 – Drill Shafts	86.5	None	N/A	N/A
				3 -Columns, Bents, & Deck	86.5	None	N/A	N/A
				4 – Construct NB/SB Lanes	86.5	None	N/A	N/A
				5 – Relocate Utilities	86.5	None	N/A	N/A
R84.	Cemetery	586	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	68.5	None	None	None
				2 – Drill Shafts	68.5	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	68.5	None	None	None
				4 – Construct NB/SB Lanes	68.5	None	None	None
				5 – Relocate Utilities	68.5	None	None	None
R85.	School	459	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	70.7	None	None	None
				2 – Drill Shafts	70.7	None	None	None
				3 -Columns, Bents, & Deck	70.7	None	None	None
				4 – Construct NB/SB Lanes	70.7	None	None	None
				5 – Relocate Utilities	70.7	None	None	None
R91.	Multifamily Residential	16	CapEx-C University (US290E to MLK)	1 – Demo	101.2	N/A	N/A	N/A
				2 – Roadway Excavation	101.6	N/A	N/A	N/A
				3 – Relocate Utilities	100.7	N/A	N/A	N/A
				4 – Construct NB Lanes	102.4	N/A	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				5 – Construct SB Lanes	102	N/A	N/A	N/A
R92.	Single-family Residential	34	CapEx-C University (US290E to MLK)	1 – Demo	89.6	None	None	6.6
				2 – Roadway Excavation	89.6	None	None	6.6
				3 – Relocate Utilities	89.1	None	None	6.1
				4 – Construct NB Lanes	89.6	None	None	6.6
				5 – Construct SB Lanes	90.4	0.4	0.4	7.4
R93.	Single-family Residential	34	CapEx-C University (US290E to MLK)	1 – Demo	90.4	0.4	0.4	7.4
				2 – Roadway Excavation	90.4	0.4	0.4	7.4
				3 – Relocate Utilities	90.4	0.4	0.4	7.4
				4 – Construct NB Lanes	90.4	0.4	0.4	7.4
				5 – Construct SB Lanes	90.4	0.4	0.4	7.4

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R93.	Single-family Residential	34	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	96.6	6.6	6.6	13.6
				2 – Pump Sta. Tunnel Excavation	96.6	6.6	6.6	13.6
				3 – Pump Station Construction	96.6	6.6	6.6	13.6
				4 – Intermed. Shaft Construction	96.6	6.6	6.6	13.6
				5 – Recovery Shaft Construction	96.6	6.6	6.6	13.6
				6 – Shaft Construction	96.6	6.6	6.6	13.6
				7 – Tunnel Excavation	96.6	6.6	6.6	13.6
				8 – Concrete Lining	96.6	6.6	6.6	13.6
R93.	Single-family Residential	34	SB Deck Retrofit (Airport to MLK)	1 – Demo	93.9	3.9	3.9	10.9
				2 – Drill Shafts	87.9	None	None	4.9

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				3 -Columns, Bents, & Deck	87.9	None	None	4.9
				4 – Construct NB/SB Lanes	90.4	0.4	0.4	7.4
				5 – Relocate Utilities	88.3	None	None	5.3
R94.	Hotel	94	CapEx-C Downtown (Holly St to US290W/SH71)	1 – Demo	80.8	None	None	None
				2 – Roadway Excavation	80.8	None	None	None
				3 – Relocate Utilities	80.8	None	None	None
				4 – Construct NB Lanes	80.8	None	None	None
				5 – Construct SB Lanes	80.8	None	None	None
R94.	Hotel	94	Drainage Tunnel (Airport Blvd to Holly St)	1 – Pump Sta. Shaft Construction	87.7	None	None	4.7
				2 – Pump Sta. Tunnel Excavation	77.9	None	None	None
				3 – Pump Station Construction	77.9	None	None	None

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Intermed. Shaft Construction	81	None	None	None
				5 – Recovery Shaft Construction	81.2	None	None	None
				6 – Shaft Construction	87.7	None	None	4.7
				7 – Tunnel Excavation	77.9	None	None	None
				8 – Concrete Lining	86.9	None	None	3.9
R95.	Multifamily Residential	71	CapEx-C LBL (Holly St to US290W/SH71)	1 – Demo	86.9	None	None	3.9
				2 – Drill Shafts	86.9	None	None	3.9
				3 -Columns, Bents, & Deck	86.9	None	None	3.9
				4 – Construct NB/SB Lanes	86.9	None	None	3.9
				5 – Relocate Utilities	86.9	None	None	3.9
				1 – Demo	83.6	N/A	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
R96.	Multifamily Residential	121	CapEx-C University (US290E to MLK)	2 – Roadway Excavation	84	N/A	N/A	N/A
				3 – Relocate Utilities	83.6	N/A	N/A	N/A
				4 – Construct NB Lanes	84.8	N/A	N/A	N/A
				5 – Construct SB Lanes	84.4	N/A	N/A	N/A
R97.	Multifamily Residential	109	CapEx-C University (US290E to MLK)	1 – Demo	84.5	N/A	N/A	N/A
				2 – Roadway Excavation	84.9	N/A	N/A	N/A
				3 – Relocate Utilities	84	N/A	N/A	N/A
				4 – Construct NB Lanes	85.7	N/A	N/A	N/A
				5 – Construct SB Lanes	85.3	N/A	N/A	N/A
R98.	Multifamily Residential	110	CapEx-C University (US290E to MLK)	1 – Demo	84.4	N/A	N/A	N/A
				2 – Roadway Excavation	84.8	N/A	N/A	N/A
				3 – Relocate Utilities	83.9	N/A	N/A	N/A

					Results (dBA)			
					Calculated L_{10}	Daytime Exceedance From 7:00 am to 6:00 pm (DE)	Evening Exceedance From 6:00pm to 10:00 pm (EE)	Nighttime Exceedance From 10:00 pm to 7:00 am (NE)
Receiver	**Land Use**	**Ft. from ROW**	**Project(s)**	**Construction Phase**	**L_{10}**	**L_{10}**	**L_{10}**	**L_{10}**
				4 – Construct NB Lanes	85.6	N/A	N/A	N/A
				5 – Construct SB Lanes	85.2	N/A	N/A	N/A
R99.	Single-family Residential	191	CapEx-C University (US290E to MLK)	1 – Demo	79.6	N/A	N/A	N/A
				2 – Roadway Excavation	80	N/A	N/A	N/A
				3 – Relocate Utilities	79.1	N/A	N/A	N/A
				4 – Construct NB Lanes	80.8	N/A	N/A	N/A
				5 – Construct SB Lanes	80.4	N/A	N/A	N/A

Results

Based on the RCNM noise level estimates for various construction activities, construction would have impacts at the various receivers. In addition, as the Project includes nighttime activities to minimize traffic impacts associated with ramp and lane closures, it would not be consistent with local noise ordinances that limit construction to daytime hours. Construction would occur within TxDOT ROW and therefore is not subject to local ordinances. TxDOT would coordinate with the local municipalities, communities and residents to implement construction noise minimization measures where feasible to reduce impacts. Therefore, construction noise impacts for the I-35 Capital Express Central Project would not be significant.

Recommendations for Construction Noise Mitigation

This list provides a range of potential mitigation options to evaluate for the project, not every phase of the project would necessarily need to implement all options and this list is not necessarily comprehensive – there may be other options applicable to specific activities/projects. Developing mitigation solutions requires a collaborative approach involving the engineers, construction teams, noise control professional as well as the community. Based on the Construction Noise Analysis with impacts to the receivers, TxDOT will employ various Best Management Practices to minimize those impacts. See **Attachment C – Recommendations for Construction Noise Mitigation.**

Date of Public Knowledge Statement

A copy of this construction noise analysis will be included and summarized in the Final Environmental Impact Statement.

List of Attachments

A. Map figures

B. Equipment data

C. Recommendations for Construction Noise Mitigation

References

Federal Highway Administration (FHWA). 2006. Roadway Construction Noise Model Version 1.1. December 8.

Attachment A – Map Figures

CapEx Central DRAFT Schedule

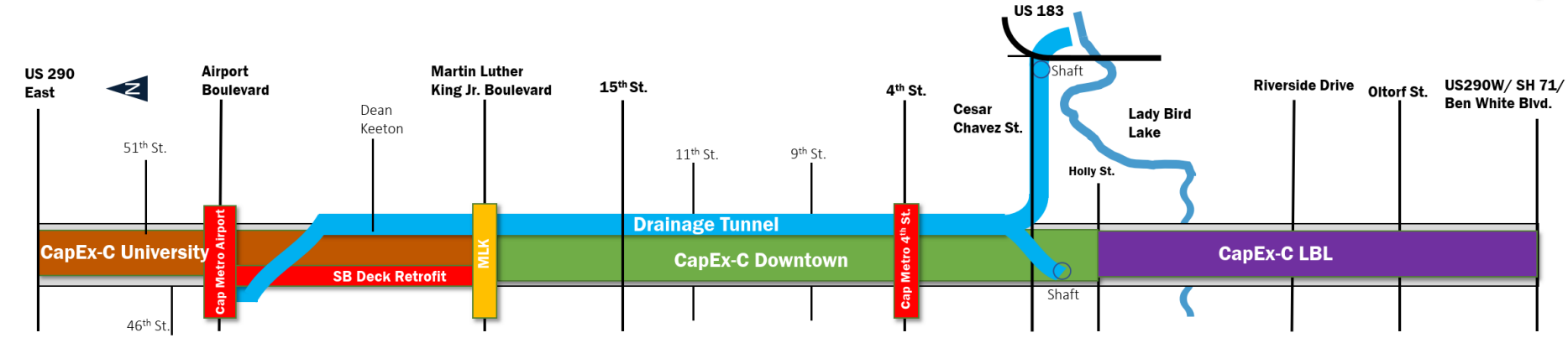
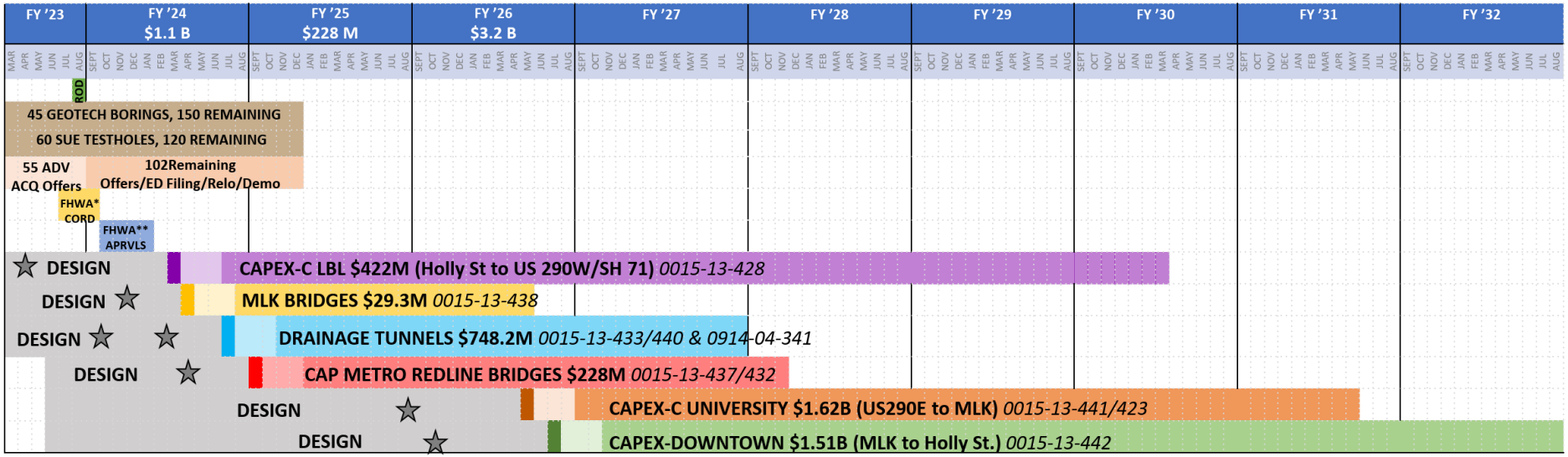


Diagram Not to Scale

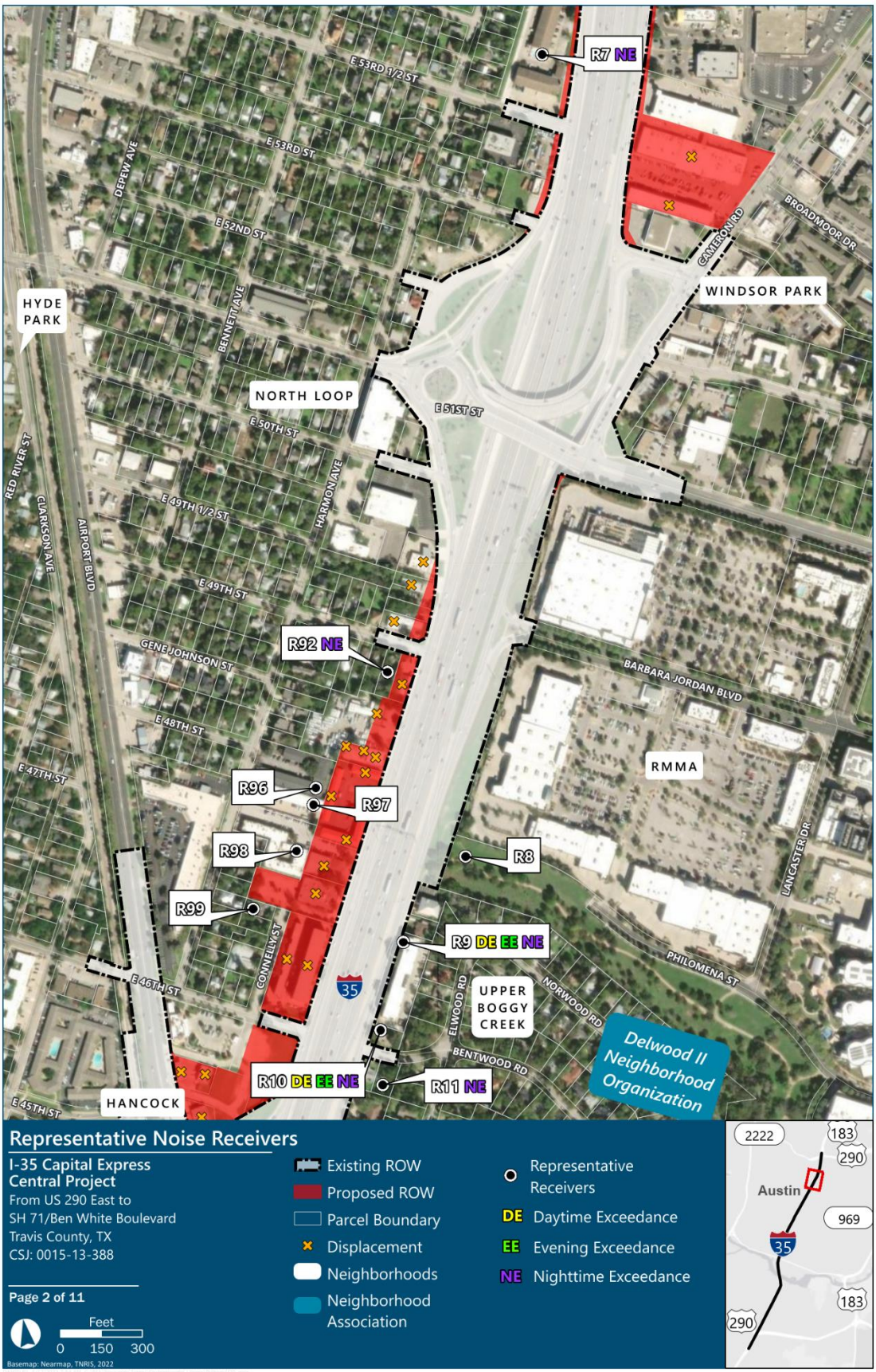
$4.56 B TOTAL 6 DESIGN BID BUILD PROJECTS *(CapEx Central 0015-13-388)*

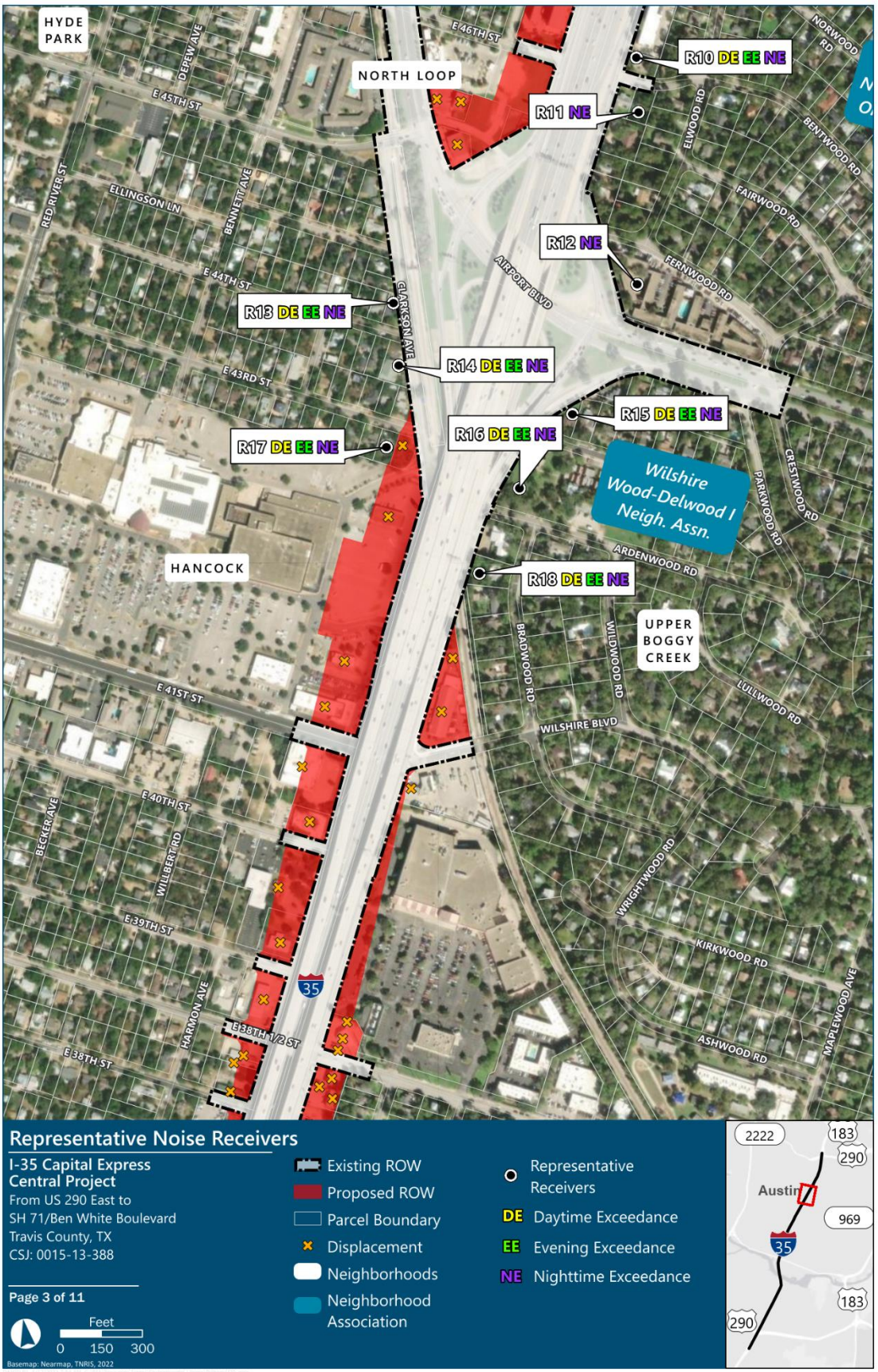


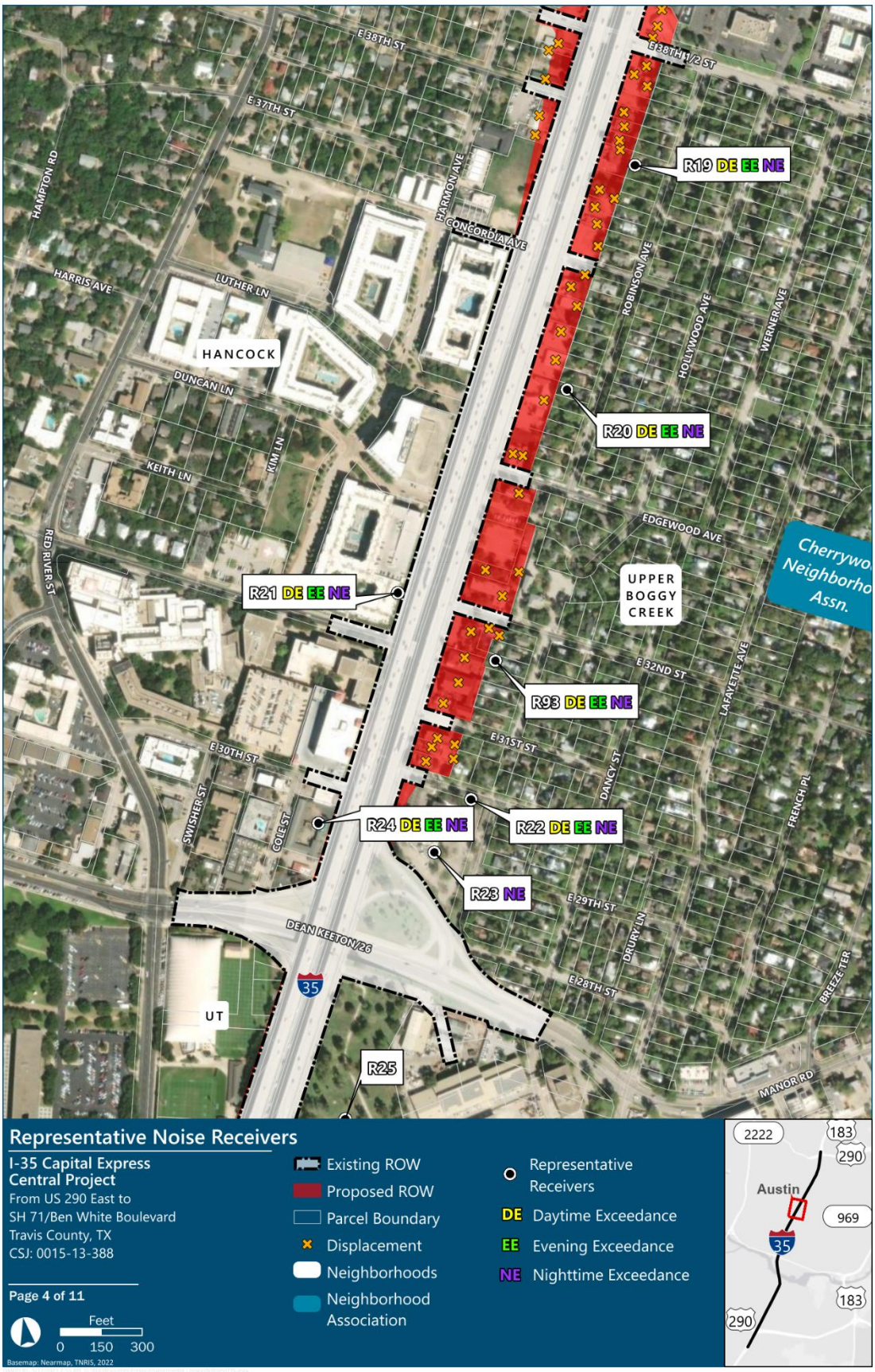
Notes:
* FHWA Risk Workshop and Cost and Schedule Risk Assessment (CSRA)
** FHWA approvals (IAJR, PMP, IFP, Design Exceptions)
SUE = Subsurface Utility Engineering
☆ AGC Industry Outreach Workshops start at 60% design for construction duration time saving opportunities for final designs. A 2nd Industry Outreach recommended for Drainage Tunnels after final plan submittal.

Update – 5/9/2023

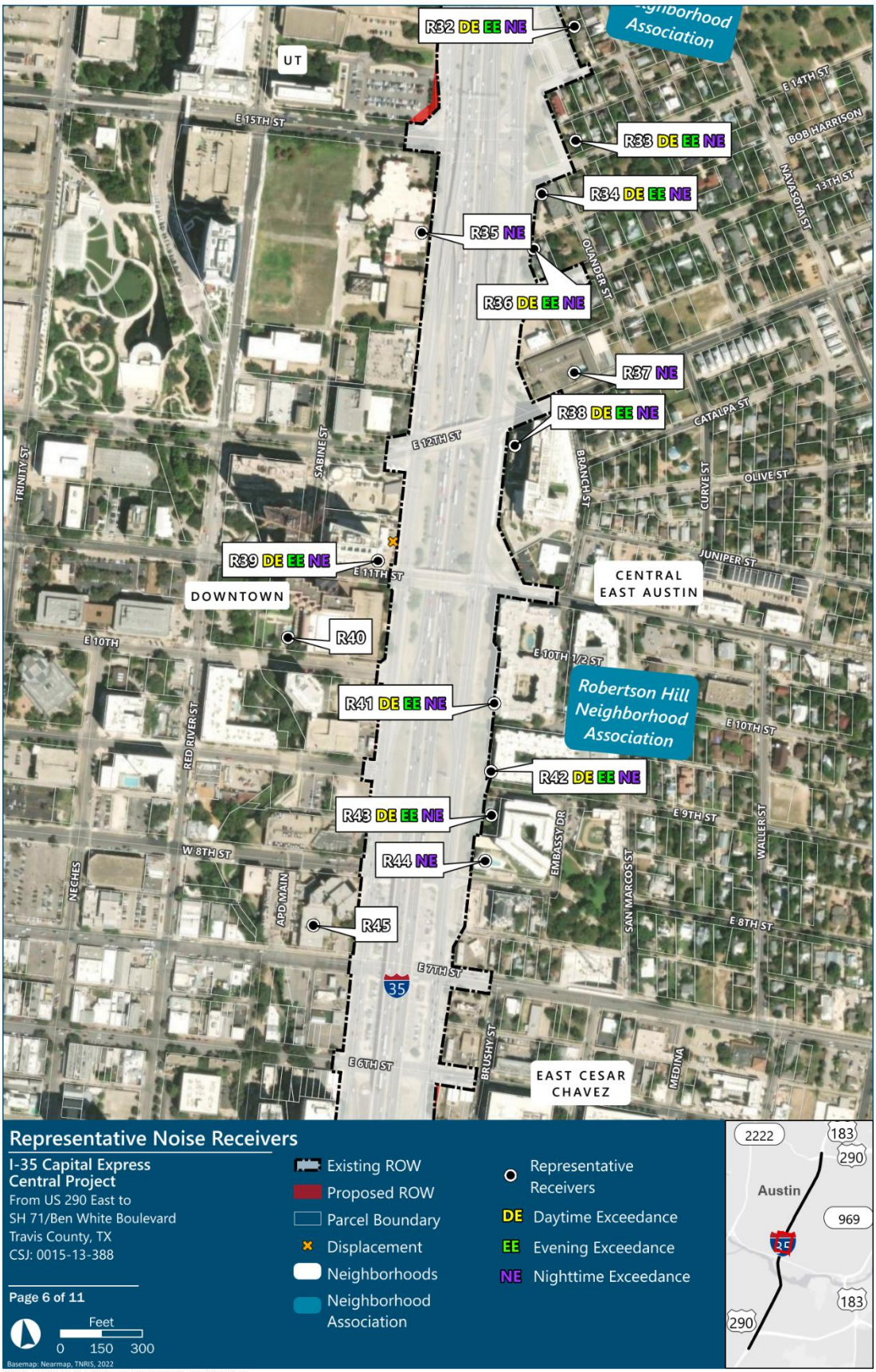

HIGHLAND
TIRADO ST
MIDDLE FISKVILLE RD
ST. JOHNS
Project Limit
290
35
R91
69
R1 DE EE NE
R2
R3
R4
CLAYTON LN
ROSEMONT ST
SHERIDAN AVE
REINLI ST
WINDSOR PARK
R5 DE
NORTH LOOP
E 56TH 1/2 ST
E 56TH ST
E 55TH 1/2 ST
R6 DE EE NE
HELEN ST
E 55TH ST
DENVER AVE
Ridgetop Neighborhood Association
CAMERON RD
CLOVERLEAF DR
E 54TH ST
HARMON AVE
CORONA DR
E 53RD 1/2 ST
R7 NE
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 1 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


R7 NE
E 53RD 1/2 ST
E 53RD ST
DEPEW AVE
E 52ND ST
BENNETT AVE
HYDE PARK
CAMERON RD
BROADMOOR DR
WINDSOR PARK
NORTH LOOP
E 51ST ST
E 50TH ST
RED RIVER ST
CLARKSON AVE
AIRPORT BLVD
E 49TH 1/2 ST
HARMON AVE
E 49TH ST
R92 NE
GENE JOHNSON ST
BARBARA JORDAN BLVD
E 48TH ST
E 47TH ST
RMMA
R96
R97
R98
R8
R99
LANCASTER DR
R9 DE EE NE
CONNELLY ST
PHILOMENA ST
E 46TH ST
35
ELWOOD RD
UPPER BOGGY CREEK
NORWOOD RD
Delwood II Neighborhood Organization
BENTWOOD RD
R10 DE EE NE
R11 NE
E 45TH ST
HANCOCK
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 2 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290

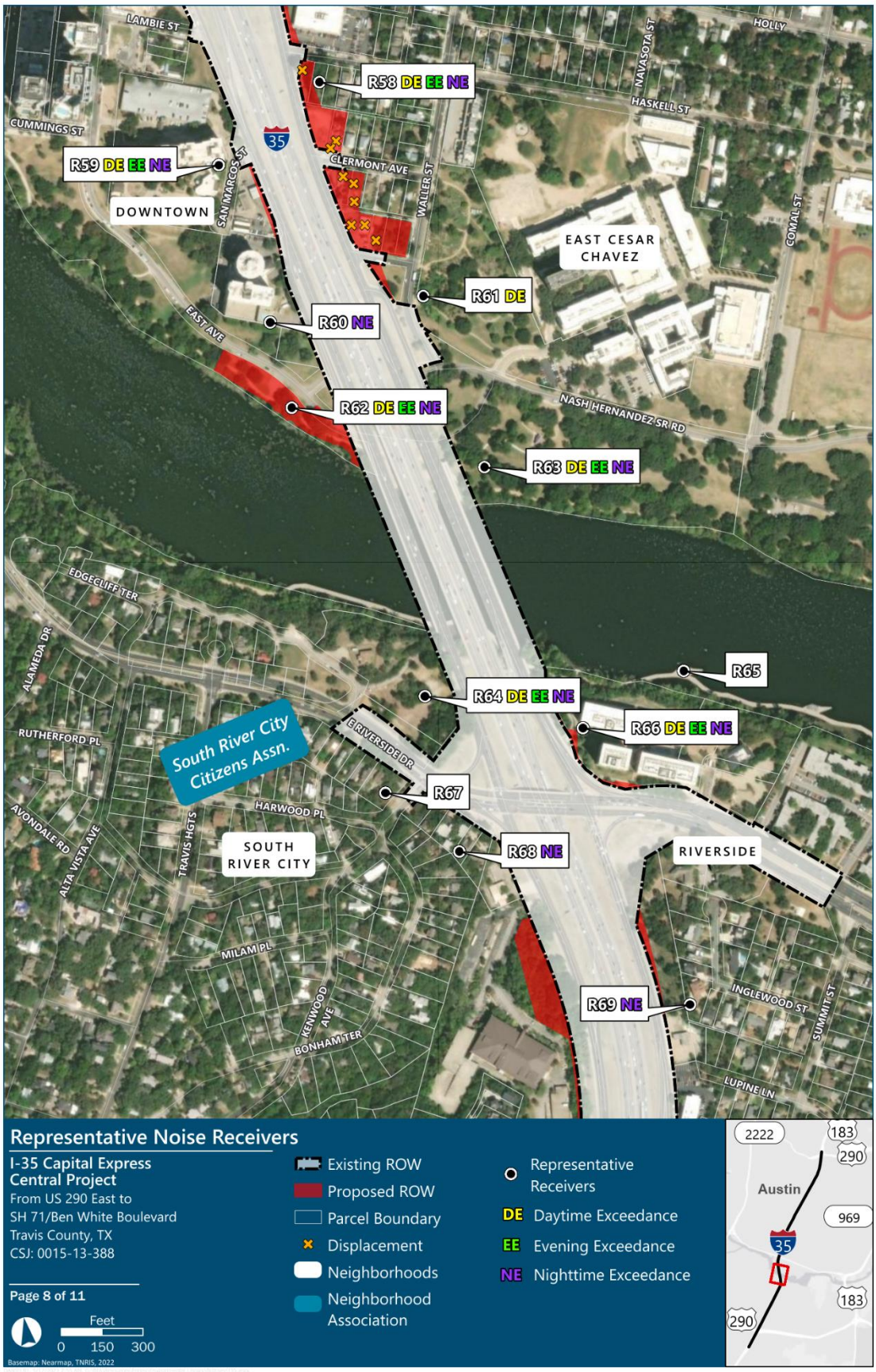

HYDE PARK
NORTH LOOP
HANCOCK
UPPER BOGGY CREEK
Wilshire Wood-Delwood I Neigh. Assn.
R10 DE EE NE
R11 NE
R12 NE
R13 DE EE NE
R14 DE EE NE
R15 DE EE NE
R16 DE EE NE
R17 DE EE NE
R18 DE EE NE
E 46TH ST
E 45TH ST
E 44TH ST
E 43RD ST
E 41ST ST
E 40TH ST
E 39TH ST
E 38TH 1/2 ST
E 38TH ST
DEPEW AVE
ELLINGSON LN
RED RIVER ST
BENNETH AVE
CLARKSON AVE
AIRPORT BLVD
NORWOOD RD
ELWOOD RD
BENTWOOD RD
FAIRWOOD RD
FERNWOOD RD
CRESTWOOD RD
PARKWOOD RD
ARDENWOOD RD
BRADWOOD RD
WILDWOOD RD
LULLWOOD RD
WILSHIRE BLVD
WRIGHTWOOD RD
KIRKWOOD RD
ASHWOOD RD
MAPLEWOOD AVE
BECKER AVE
WILLBERT RD
HARMON AVE
35
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 3 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


E 38TH ST
E 38TH 1/2 ST
E 37TH ST
HAMPTON RD
HARMON AVE
CONCORDIA AVE
HARRIS AVE
LUTHER LN
ROBINSON AVE
HOLLYWOOD AVE
WERNER AVE
HANCOCK
DUNCAN LN
KIM LN
KEITH LN
RED RIVER ST
EDGEWOOD AVE
UPPER BOGGY CREEK
Cherrywo Neighborho Assn.
E 32ND ST
LAFAYETTE AVE
E 31ST ST
DANCY ST
E 30TH ST
SWISHER ST
COLE ST
FRENCH PL
E 29TH ST
DEAN KEETON/26
DRURY LN
E 28TH ST
BREEZE TER
UT
35
MANOR RD
R19 DE EE NE
R20 DE EE NE
R21 DE EE NE
R93 DE EE NE
R24 DE EE NE
R22 DE EE NE
R23 NE
R25
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 4 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290

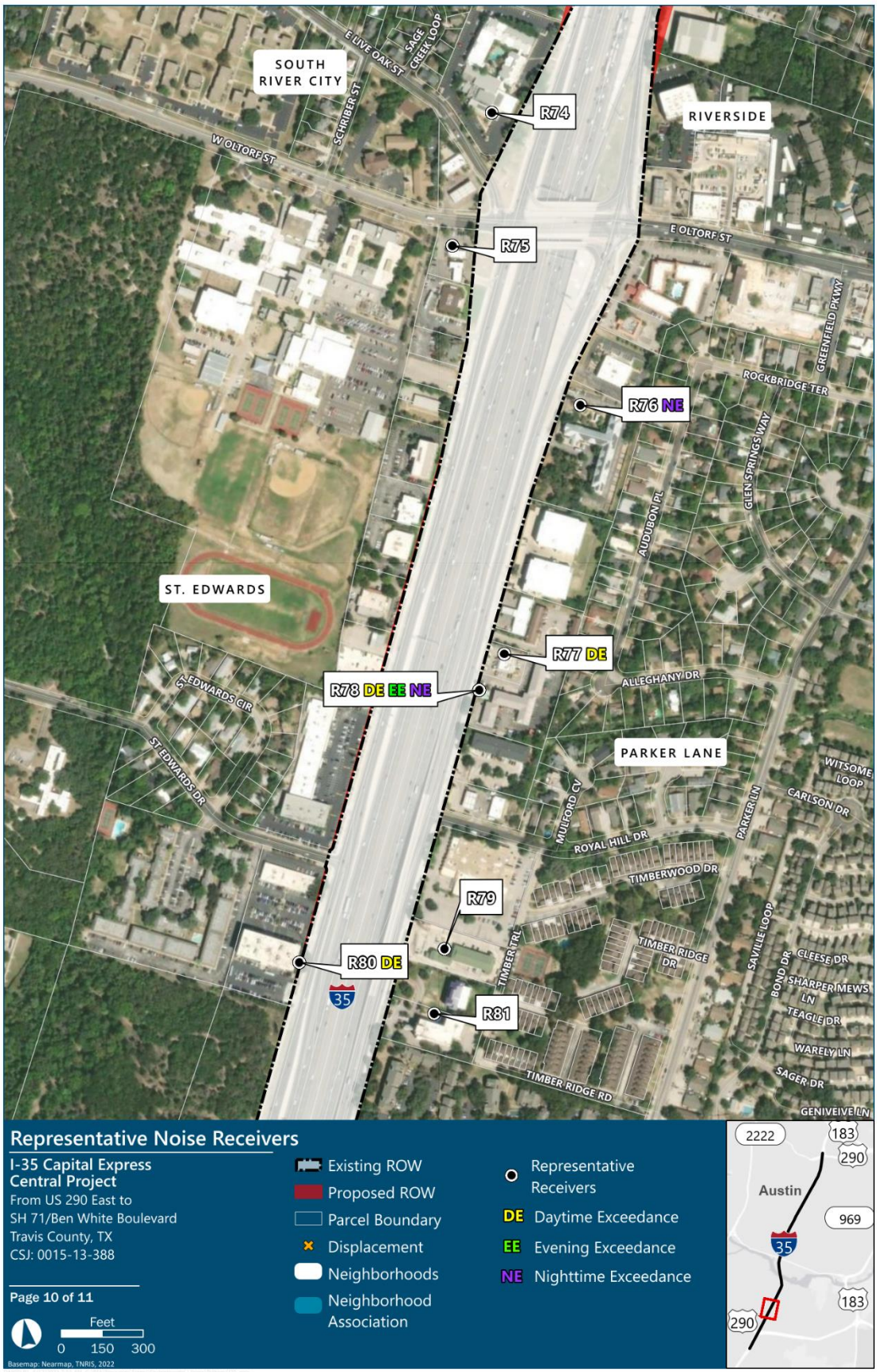

R25
R26 NE
R27
R28 NE
R29 DE EE NE
R30 NE
R31
R32 DE EE NE
E 23RD ST
ROBERT DEDMAN DR
CLYDE LITTLEFIELD DR
MANOR RD
LEONA ST
UPPER BOGGY CREEK
E 21ST ST
E 20TH ST
COMAL ST
CONCHO ST
UT
Moody
SAN JACINTO BLVD
RED RIVER ST
E MLK BLVD
W MLK BLVD
E 18TH ST
CENTRAL EAST AUSTIN
E 16TH ST
35
GLANDER ST
Swede Hill Neighborhood Association
WAVERLY ST
E 15TH ST
WALLER ST
E 14TH ST
BOB HARRISON
ANGELINA ST
DOWNTOWN
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 5 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290

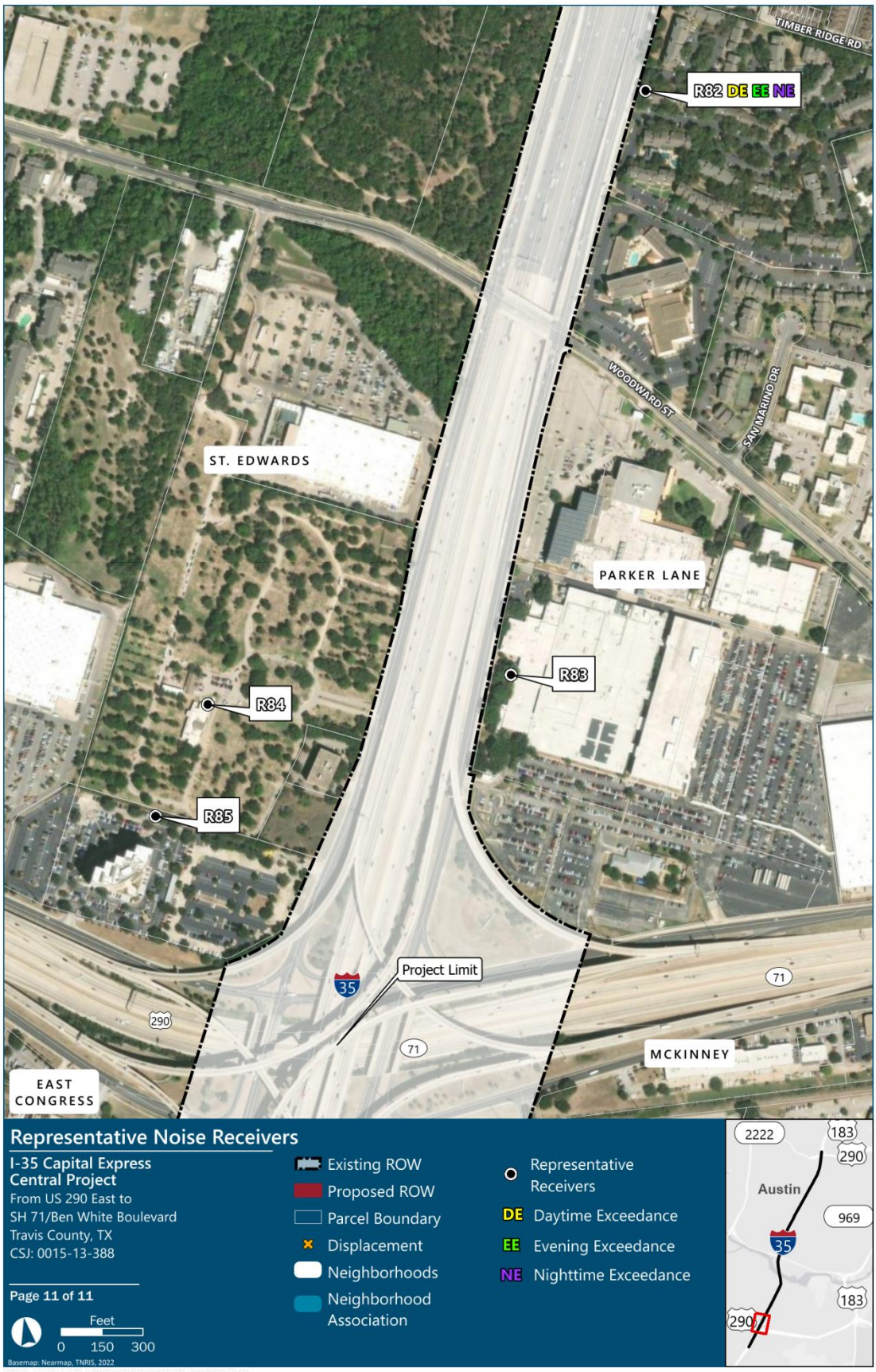

R32 DE EE NE
R33 DE EE NE
R34 DE EE NE
R35 NE
R36 DE EE NE
R37 NE
R38 DE EE NE
R39 DE EE NE
R40
R41 DE EE NE
R42 DE EE NE
R43 DE EE NE
R44 NE
R45
UT
E 15TH ST
E 14TH ST
BOB HARRISON
NAVASOTA ST
13TH ST
OLANDER ST
CATALPA ST
E 12TH ST
SABINE ST
TRINITY ST
BRANCH ST
CURVE ST
OLIVE ST
JUNIPER ST
E 11TH ST
DOWNTOWN
CENTRAL EAST AUSTIN
E 10TH
E 10TH 1/2 ST
Robertson Hill Neighborhood Association
E 10TH ST
RED RIVER ST
E 9TH ST
WALLER ST
EMBASSY DR
W 8TH ST
NECHES
APD MAIN
SAN MARCOS ST
E 8TH ST
E 7TH ST
35
E 6TH ST
BRUSHY ST
MEDINA
EAST CESAR CHAVEZ
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 6 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


E 7TH ST
E 6TH ST
E 5TH ST
E 4TH ST
E 3RD ST
E 2ND ST
NECHES
SABINE ST
TRINITY ST
RED RIVER ST
BRUSH ST
MEDINA
SAN MARCOS ST
WALLER ST
ATTAYAC ST
CESAR CHAVEZ
DRISKILL ST
DAVIS ST
WILLOW ST
SPENCE ST
CANTERBURY ST
RAINEY ST
GARDEN ST
RIVER ST
TAYLOR ST
CROSS ST
HOLLY
EAST AVE
LAMBIE ST
HASKELL ST
CENTRAL EAST AUSTIN
EAST CESAR CHAVEZ
DOWNTOWN
343
35
R46 DE
R47 NE
R48 DE EE NE
R49 DE EE NE
R50 NE
R51 NE
R52 DE EE NE
R53
R54 DE EE NE
R55 DE EE NE
R94 NE
R56 DE EE NE
R57 DE EE NE
R58 DE EE NE
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 7 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


LAMBIE ST
CUMMINGS ST
R58 DE EE NE
R59 DE EE NE
DOWNTOWN
SAN MARCOS ST
CLERMONT AVE
WALLER ST
NAVASOTA ST
HOLLY
HASKELL ST
COMAL ST
EAST CESAR CHAVEZ
R61 DE
R60 NE
EAST AVE
R62 DE EE NE
NASH HERNANDEZ SR RD
R63 DE EE NE
EDGECLIFF TER
ALAMEDA DR
R65
R64 DE EE NE
R66 DE EE NE
RUTHERFORD PL
South River City Citizens Assn.
E RIVERSIDE DR
R67
HARWOOD PL
AVONDALE RD
ALTA VISTA AVE
TRAVIS HGTS
SOUTH RIVER CITY
R68 NE
RIVERSIDE
MILAM PL
R69 NE
INGLEWOOD ST
SUMMIT ST
KENWOOD AVE
BONHAM TER
LUPINE LN
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 8 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


R95 NE
R70
R71A DE EE NE
R72 DE EE NE
R73
SOUTH RIVER CITY
RIVERSIDE
BONHAM TER
TRAVIS HGTS
REAGAN TER
CHELSEA LN
BETTY JO DR
MISSION RDG
LUPINE LN
UPLAND DR
SUNNY VALE ST
SUMMIT ST
ELMHURST DR
BELLAIRE DR
OAK HEIGHTS DR
TAYLOR GAINES ST
WOODLAND AVE
FAIRMOUNT AVE
KENWOOD AVE
GILLESPIE PL
FAIRLAWN LN
SYLVAN DR
DEERFIELD DR
FAWN DR
ANTLER DR
MATAGORDA ST
PARKER LN
MARIPOSA DR
FARMERS DR
ALGARITA AVE
GLENDALE PL
SAGE CREEK LOOP
E LIVE OAK ST
WINDOAK DR
35
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 9 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


SOUTH RIVER CITY
RIVERSIDE
ST. EDWARDS
PARKER LANE
E LIVE OAK ST
SAGE CREEK LOOP
SCHRIBER ST
W OLTORF ST
E OLTORF ST
GREENFIELD PKWY
ROCKBRIDGE TER
GLEN SPRINGS WAY
AUDUBON PL
ALLEGHANY DR
ST EDWARDS CIR
ST EDWARDS DR
MULFORD CV
ROYAL HILL DR
PARKER LN
WITSOME LOOP
CARLSON DR
TIMBERWOOD DR
TIMBER TRL
TIMBER RIDGE DR
SAVILLE LOOP
BOND DR
CLEESE DR
SHARPER MEWS LN
TEAGLE DR
WARELY LN
SAGER DR
GENIVEIVE LN
TIMBER RIDGE RD
R74
R75
R76 NE
R77 DE
R78 DE EE NE
R79
R80 DE
R81
35
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 10 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290


TIMBER RIDGE RD
R82 DE EE NE
WOODWARD ST
SAN MARINO DR
ST. EDWARDS
PARKER LANE
R83
R84
R85
Project Limit
35
290
71
71
MCKINNEY
EAST CONGRESS
Representative Noise Receivers
I-35 Capital Express Central Project
From US 290 East to SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388
Page 11 of 11
Feet
0 150 300
Basemap: Nearmap, TNRIS, 2022
Existing ROW
Proposed ROW
Parcel Boundary
Displacement
Neighborhoods
Neighborhood Association
Representative Receivers
DE Daytime Exceedance
EE Evening Exceedance
NE Nighttime Exceedance
2222
183
290
Austin
969
35
183
290

Attachment B – Equipment Data

CA/T equipment noise emissions and acoustical usage factors database.

CA/T Noise Emission Reference Levels and Usage Factors

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Spec 721.560 Lmax @ 50 ft (dBA, slow)	Actual Measured Lmax @ 50 ft (dBA, slow) (samples averaged)	No. of Actual Data Samples (Count)
All Other Equipment > 5 HP	No	50	85	-NA-	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	-NA-	0
Blasting	Yes	-NA-	94	-NA-	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	-NA-	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	-NA-	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	-NA-	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	-NA-	0
Tractor	No	40	84	-NA-	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44

Warning Horn	No	5	85	83	12
Welder / Torch	No	40	73	74	5

Source: Federal Highway Administration (FHWA). 2006. Roadway Construction Noise Model Version 1.1 January 2006

Attachment C – Recommendations for Construction Noise Mitigation

Recommendations for construction noise mitigation:
This list provides a range of potential mitigation options to evaluate for the project, not every phase of the project would necessarily need to implement all options and this list is not necessarily comprehensive – there may be other options applicable to specific activities/projects. Developing mitigation solutions requires a collaborative approach involving the engineers, construction teams, noise control professional as well as the community.

- Temporary noise barriers will be evaluated for the various construction phases of the project and where feasible the temporary noise barriers will be included in the plans at specific locations. TxDOT may maximize shielding by using barriers from existing stockpiles, shipping containers and site buildings, if available.
- Community notification – provide information to residences potentially effected by construction noise ahead of construction activities of anticipated impactful construction activities.
- Use of media – provide information to communities via a range of available media including websites, emails, community-based forums, newspaper, letterbox drops, etc.
- Be proactive in complaint resolution. Appoint a contact person. Develop a plan for receiving, managing, and responding to complaints in a timely manner. Consider a hotline or other point of contact for the community to ask questions or file a formal complaint.
- Restrict larger noise impact activities such as hoe ram, rock hammering or piling to daytime.
- Designated areas restricted from stockpiling will be part of the plans
- Locate Haul roads and site access as far as possible from noise sensitive receptors if practicable (TxDOT would limit the use of residential streets for haul roads).
- Consider locations to designate plant and stockpile locations.
- Construct proposed permanent noise barriers prior to roadway construction when feasible

Proposed Temporary Construction Noise Barriers

Temporary Noise Barriers

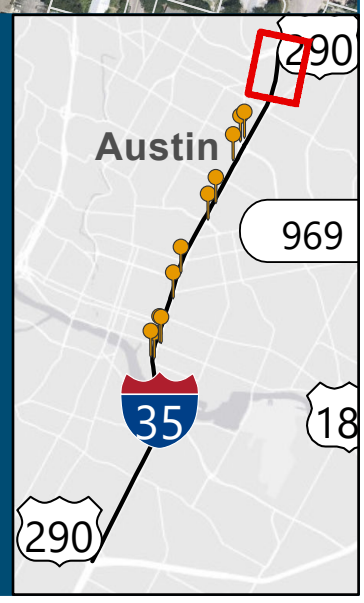
I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

Project Area
Location of Temporary Noise Barriers
Parcel Boundary
Neighborhoods
Neighborhood Association

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022



Temporary Noise Barriers

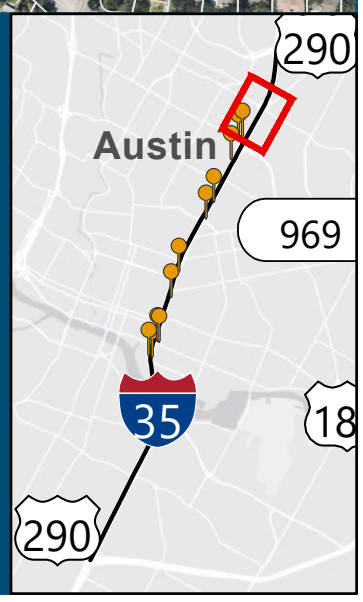
I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association



HYDE PARK
DEPEW AVE
BENNETT AVE
E 46TH ST
CONNELLY ST
NORTH LOOP
E 45TH ST
CLARKSON AVE
ELLINGSON LN
E 44TH ST
E 43RD ST
AIRPORT BLVD
35
ELWOOD RD
NORWOOD RD
Delwood II Neighborhood Organization
RMMA
BENTWOOD RD
PARKWOOD RD
FERNWOOD RD
FAIRWOOD RD
UPPER BOGGY CREEK
Wilshire Wood-Delwood I Neigh. Assn.
CRESTWOOD RD
ARDENWOOD RD
WILDWOOD RD
WILSHIRE BLVD
WRIGHTWOOD RD
LULLWOOD RD
BRADWOOD RD
KIRKWOOD RD
ASHWOOD RD
RED RIVER ST
E 41ST ST
HANCOCK
E 40TH ST
WILLBERT RD
BECKER AVE
E 39TH ST
HARMON AVE
E 38TH 1/2 ST
E 38TH ST
ROBINSON AVE
HOLLYWOOD AVE
WERNER AVE
LAFAYETTE AVE

Temporary Noise Barriers

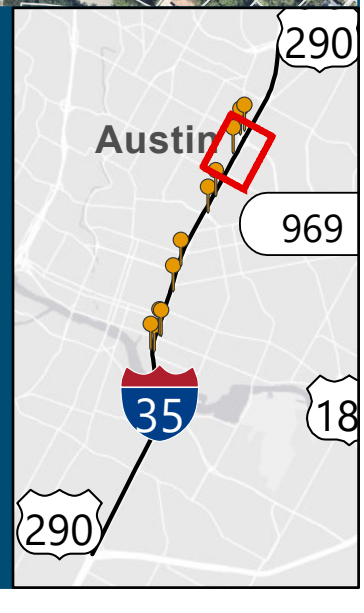
I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

Project Area
Location of Temporary Noise Barriers
Parcel Boundary
Neighborhoods
Neighborhood Association

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

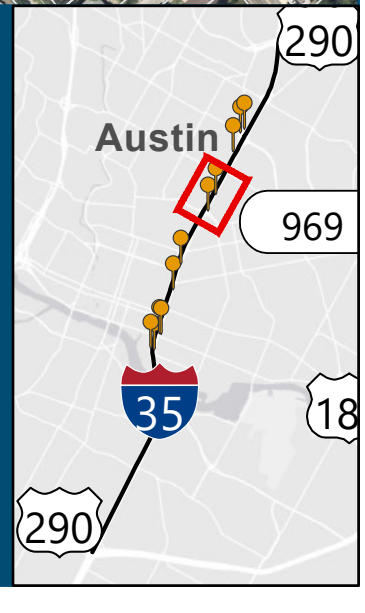


Temporary Noise Barriers

I-35 Capital Express Central Project

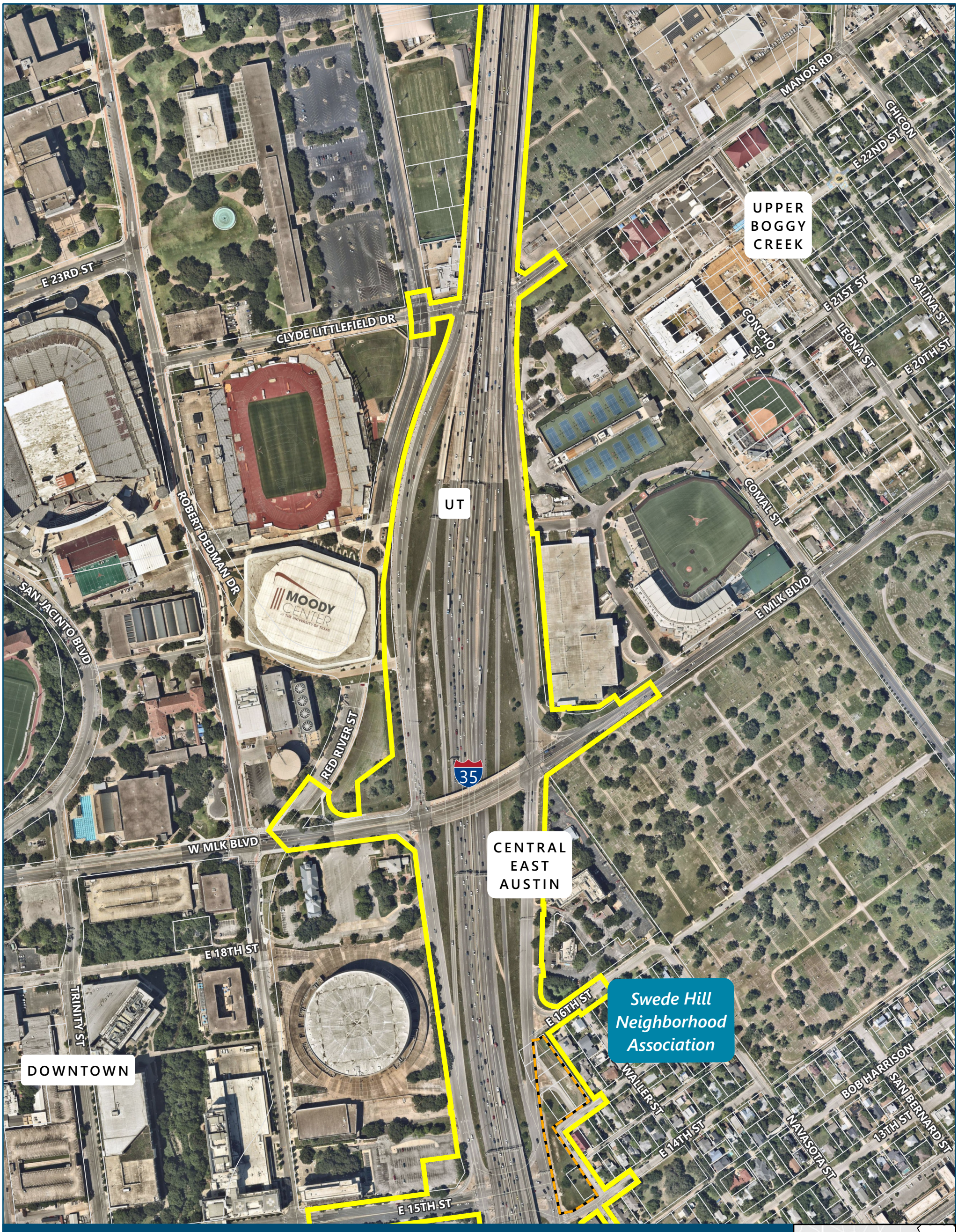
From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association



Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022



Temporary Noise Barriers

I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

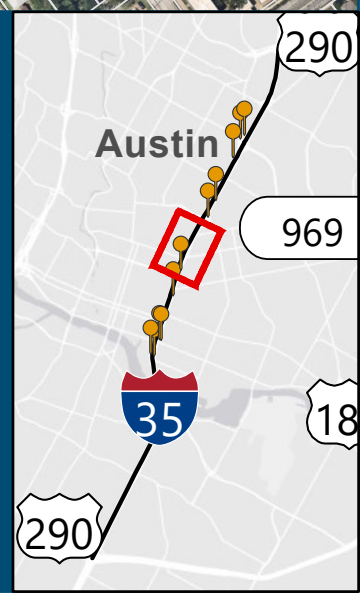
Project Area

Location of Temporary Noise Barriers

Parcel Boundary

Neighborhoods

Neighborhood Association



Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

Swede Hill Neighborhood Association

Robertson Hill Neighborhood Association

UT

DOWNTOWN

CENTRAL EAST AUSTIN

EAST CESAR CHAVEZ

E 15TH ST

E 14TH ST

E 13TH ST

E 12TH ST

E 11TH ST

E 10TH 1/2 ST

E 10TH ST

E 10TH

E 9TH ST

W 8TH ST

E 8TH ST

E 7TH ST

E 6TH ST

E 5TH ST

WALLER ST

BOB HARRISON

SAN BERNARD ST

OLANDER ST

CURVE ST

CATALPA ST

NAVASOTA ST

OLIVE ST

MYRTLE ST

JUNIPER ST

BRANCH ST

SABINE ST

TRINITY ST

RED RIVER ST

NECHES

APD MAIN

EMBASSY DR

SAN MARCOS ST

LYDIA ST

BRUSHY ST

MEDINA

ATTAYAC ST

35

Temporary Noise Barriers

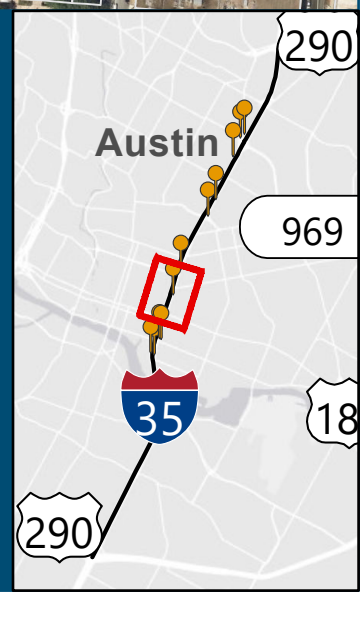
I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

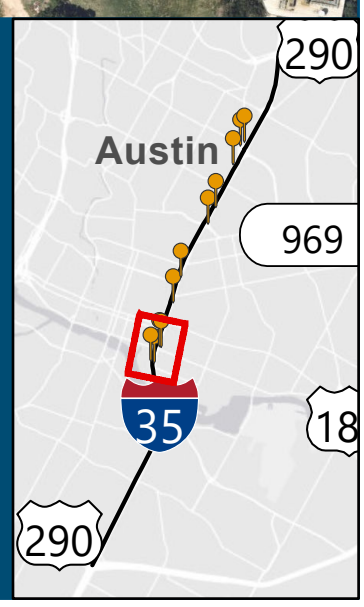


Temporary Noise Barriers

I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association



Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

Temporary Noise Barriers

I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

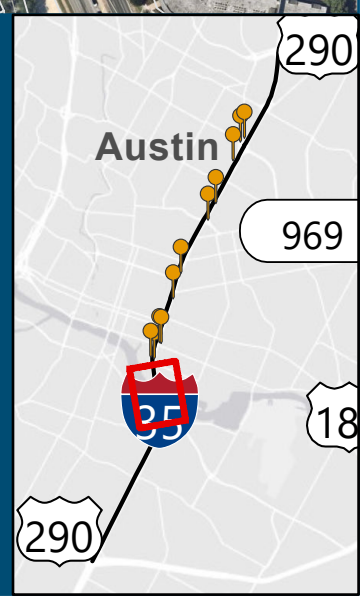
Project Area

Location of Temporary Noise Barriers

Parcel Boundary

Neighborhoods

Neighborhood Association



Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

Friends of Riverside ATX Neighborhood Association

RIVERSIDE

SOUTH RIVER CITY

Temporary Noise Barriers

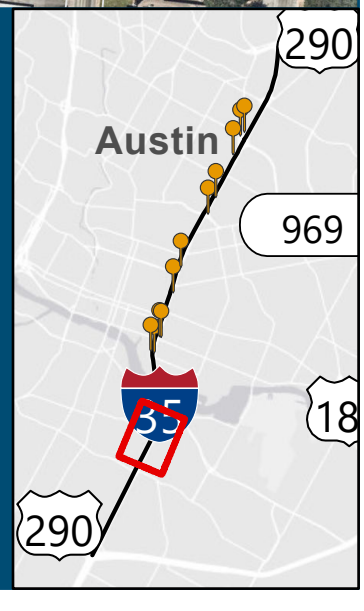
I-35 Capital Express Central Project

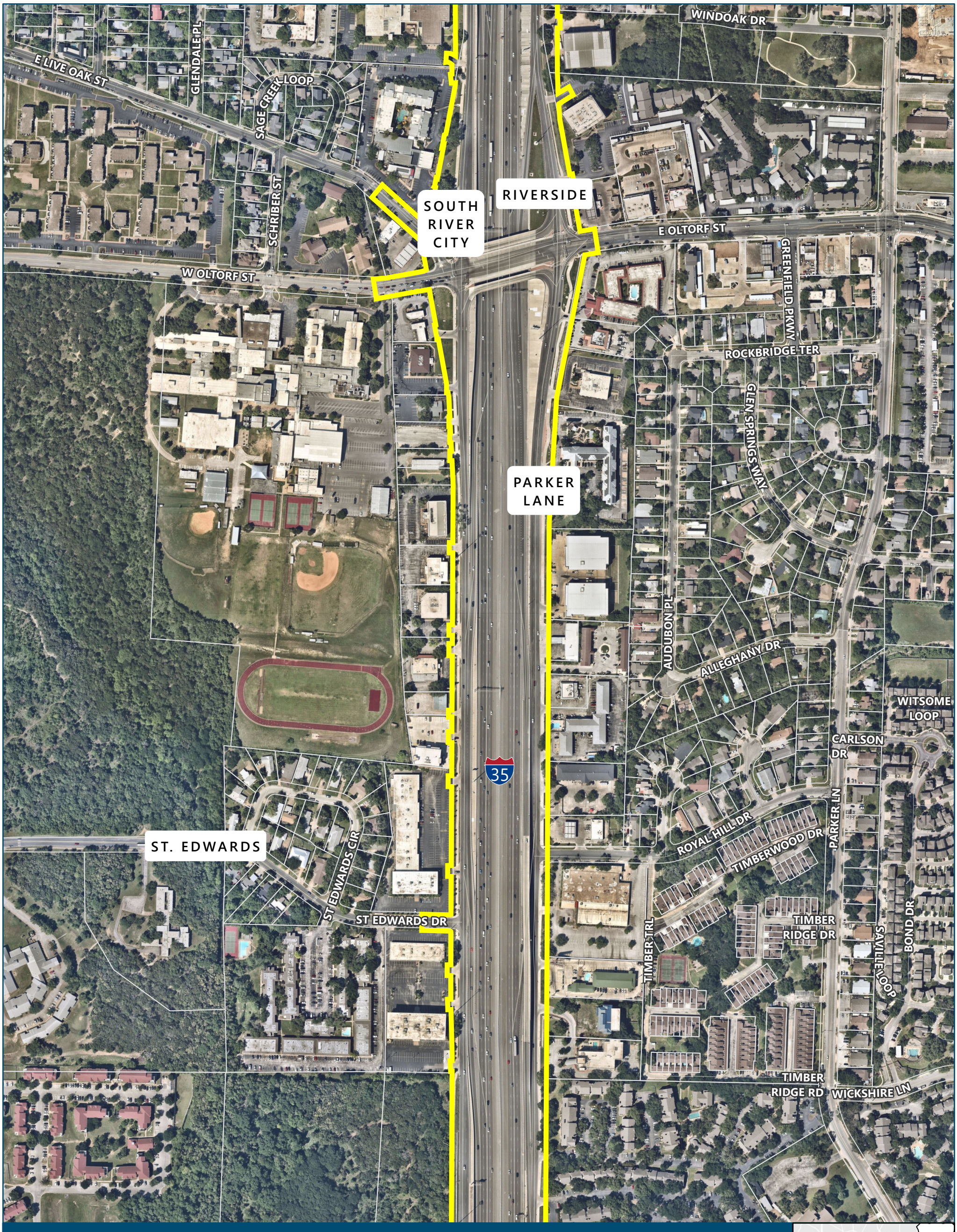
From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association





Temporary Noise Barriers

I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

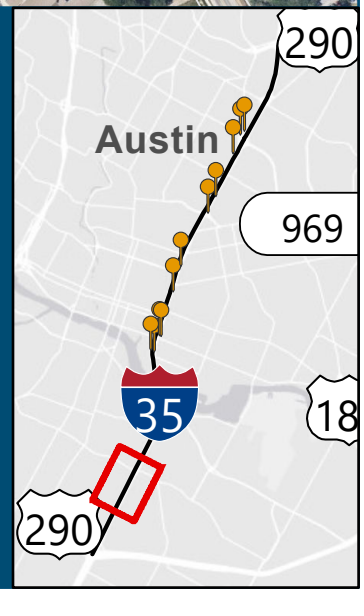
Project Area

Location of Temporary Noise Barriers

Parcel Boundary

Neighborhoods

Neighborhood Association



Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

TIMBER RIDGE RD
WICKSHIRE LN
PARKER LN
SAN MARINO DR
WOODWARD ST
35
71
MCKINNEY
PARKER LANE
Project Limit
290
ST. EDWARDS
GOVERNORS ROW
71
EAST CONGRESS

Temporary Noise Barriers

I-35 Capital Express Central Project

From US 290 East to
SH 71/Ben White Boulevard
Travis County, TX
CSJ: 0015-13-388

Feet
0 150 300

Basemap: Nearmap, TNRIS, 2022

- Project Area
- Location of Temporary Noise Barriers
- Parcel Boundary
- Neighborhoods
- Neighborhood Association