Appendix D: Noise Technical Memorandum

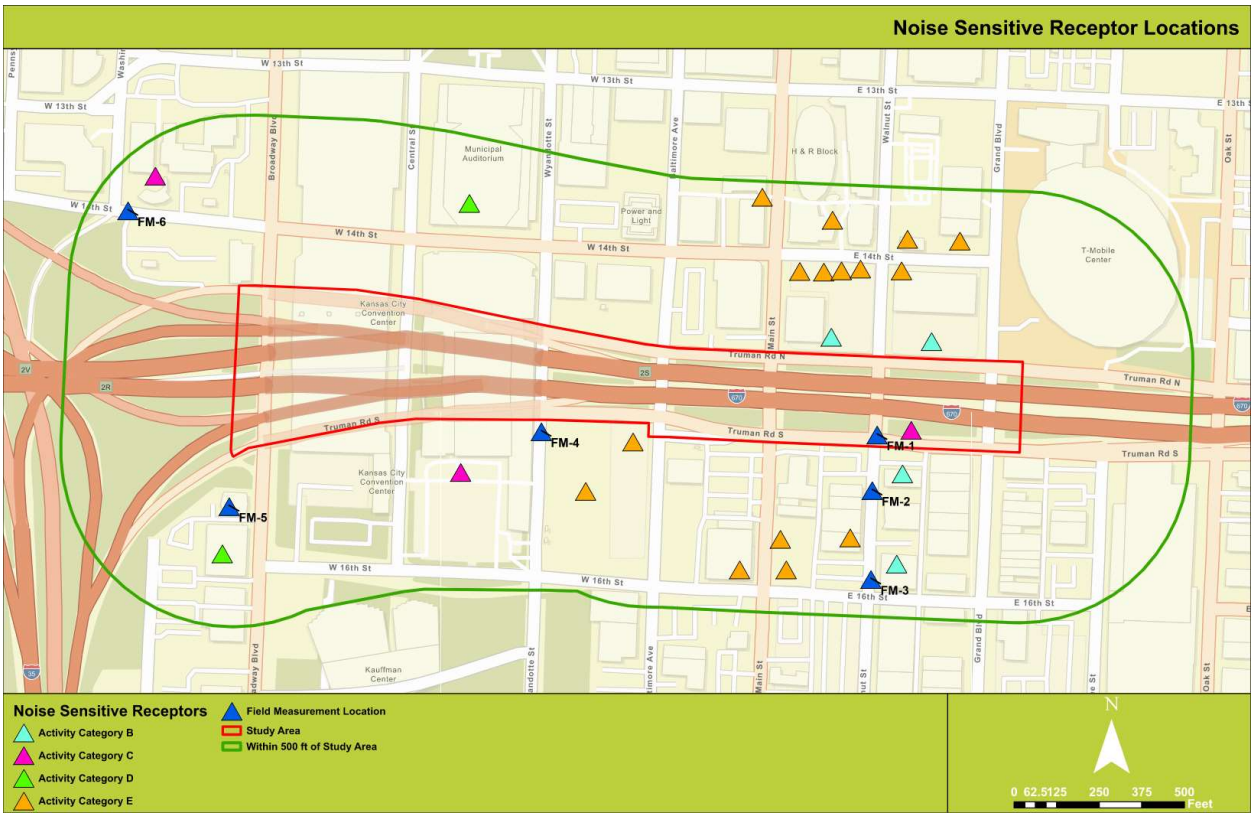
The South Loop Link project is a Type III project as defined in 23 CFR 772. Although noise analysis is not required for Type III projects under the regulation, a noise screening analysis was completed to examine any potential impacts.

Noise is essentially defined as unwanted sound. It is emitted from many natural and man-made sources. Highway traffic noise is usually a composite of noises from engine exhaust, drive train, and tire-roadway interaction. Traffic noise is most commonly measured in "A-weighted" decibels (dBA). A dBA corresponds to the manner in which the human ear perceives noise at different frequencies. Since traffic noise is generated by passing vehicles and traffic volumes generally fluctuate, an hourly equivalent sound level, or $L_{eq(h)}$, is used to measure traffic noise. The $L_{eq(h)}$ is the constant, average sound level that contains the same amount of sound energy over the time period as does the varying levels of actual traffic noise.

FHWA has developed a Noise Abatement Criteria (NAC) to identify noise sensitive land use and a corresponding $L_{eq(h)}$ where noise levels that approach or exceed certain thresholds are defined as a traffic noise impact. A summary of noise sensitive receptors within approximately 500' of the study area are listed below and shown in Figure 1.

- NAC Activity Category B: Four multi-family, multi-story residential structures with balconies
- NAC Activity Category C: A dog park, a convention center outdoor area, and a church
- NAC Activity Category D (Interior): An auditorium and a nonprofit institution
- NAC Activity Category E: Numerous restaurants with outdoor seating and several hotels with balconies

Figure 1 – Noise Sensitive Receptor Locations



To understand the existing noise environment, six field noise measurements were taken in the field for 10 minutes each (locations identified in Figure 1). Measurements were taken between 6:00 am and 7:00 am to represent the loudest hour of the day, when traffic volumes are high, but congestion has not yet led to significantly reduced speeds.

- A measurement was taken directly adjacent to I-670 at an existing dog park. Traffic noise from I-670 is significant and constant. The $L_{eq(h)}$ during this measurement was greater than 78 dBA. MoDOT defines 66 dBA as a traffic noise impact. This 12-decibel increase would sound more than twice as loud and require a 900% increase in acoustic energy over the impact threshold.
- The further away from I-670, the common sounds of a downtown urban environment become distinguishable and add to noise levels, but the ambient noise levels from I-670 traffic noise remain noticeable.
    - A measurement 180' south of I-670 on Walnut Street had an $L_{eq(h)}$ of over 67 dBA with I-670 being the dominant noise source. Noise levels rarely dropped below 66 dBA over the duration of the measurement.
    - A measurement 500' south of I-670 on Walnut Street had an $L_{eq(h)}$ of over 64 dBA, though with the absence of other noise, noise levels from I-670 traffic alone averaged around 61 dBA.
- West of Broadway Boulevard where I-670 emerges from underneath the Kansas City Convention Center, traffic noise is still dominant. However, it is difficult to discern noise coming from I-670 versus other roadways, particularly I-35. A measurement approximately 350' south of I-670 had an an $L_{eq(h)}$ of over 62 dBA, and a measurement approximately 400' north of I-670 had an an $L_{eq(h)}$ of over 59 dBA.

The South Loop Link project will significantly reduce traffic noise levels from I-670 in areas between Wyandotte Street and Grand Boulevard. Today, traffic noise levels significantly exceed impact thresholds adjacent to the highway and remain audible for several blocks. By placing a deck over these areas, I-670 traffic noise will be completely shielded from the adjacent land use. On the other hand, tunnel openings can produce localized increases in traffic noise levels in relatively close proximity to the openings. As seen in Figure 1, no noise sensitive locations are in proximity of the proposed east tunnel opening. Only two noise sensitive locations are in proximity of the proposed west tunnel opening: a church with an outdoor common area and a non-profit institution, which would be considered for interior noise impacts. The increases in noise levels can depend on a variety of factors, but Table 1 below shows an estimate for increases in noise levels outside a tunnel opening due to the "tunnel effect" at various distances.

Table 1 – Tunnel Effect (dBA) Added to Noise Levels based on Distance from Roadways and Tunnel Openings

Distance from Road Centerline (feet[1])	Distance from Tunnel Opening (feet[1])	dBA Added to Noise Levels (2+ Lane Long Tunnel)
330	30	0
330	165	1
330	330	1
330	985	0

Source: National Academies of Sciences, Engineering, and Medicine 2014. Supplemental Guidance on the Application of FHWA's Traffic Noise Model (TNM). Washington, DC: The National Academies Press. https://doi.org/10.17226/22284.
[1]Distances in NCHRP report adjusted from meters to feet.

As shown in the table, a maximum increase of 1 dBA would be expected for noise sensitive receptors 330’ beyond the roadway centerline. Both noise sensitive receptors outside the project area are beyond 330’ from the I-670 centerline and are also subject to traffic noise from I-35. A 3 dBA change in noise levels is considered barely perceptible by the human ear. Also, one of these two receptors is Activity Category D, meaning it is only considered noise sensitive for interior levels, and a building reduction factor would need to be applied. Therefore, the project and the “tunnel effect” will not cause a noticeable increase in traffic noise levels for any noise sensitive receptors, and noise sensitive receptors directly adjacent to the project should experience a significant reduction in traffic noise levels.