LACKEY DAM LOGISTICS FACILITY

ACOUSTIC PEER REVIEW

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PREPARED FOR:
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We reviewed Sound Analysis report regarding the Proposed Lackey Dam Logistics Center (dated May 17, 2022 and September 6, 2022), along with the CadnaA models of the project site and a calculation spreadsheets used alongside the CadnaA model (for each report), all provided by Cavanaugh Tocci (the project acoustical consultant). Our review was focused on evaluating the methods used by Cavanaugh Tocci in developing and evaluating their model, as well as the appropriateness of the methods used to address any noise concerns.

The proposed Lackey Dam Logistics Center is located on Lackey Dam Road, southwest of the intersection of Lackey Dam Road and Oakhurst Road, in Sutton, Massachusetts. The major noise sources associated with the facility are vehicular traffic (trucks), material handling equipment within the building, building mechanical equipment, loading and unloading activities (e.g., forklifts, backup beepers, and trailer cooling equipment), and an emergency generator (daytime testing only). The result of the Cavanaugh Tocci study was a site plan that includes various noise reduction measures (i.e., sound barriers) to reduce sound levels to both code and recommended levels. Based on our review of the information, we generally agree with the approach and conclusions of the Cavanaugh Tocci study, with a few exceptions related to the mobile sound source goals.

The following are our specific comments regarding the study.

1.0 Criteria

1.1 Codes and Regulations

Cavanaugh Tocci quotes the relevant sections of Massachusetts regulations regarding noise (310 CMR 7.10), Massachusetts Department of Environmental Protection (MassDEP) regulation 310 CMR 7.10 U and Noise Policy 90-001, the Town of Sutton Zoning Bylaw Section 6, and the Town of Uxbridge Zoning Bylaw (Chapter 400, Article VI, Section 400-20(E)(2), 400-20(F)(3a), and 400-42(F)(b)(2i).

Based on our review, these are the appropriate applicable sections of the various codes and regulations.

1.2 Recommended Limits

Cavanaugh Tocci notes that not all of the sound sources of the project have specific limits established in the applicable codes and regulations. As such, they have established recommended goals for mobile equipment sound based on the type of sound produced (i.e., impulsive, tonal, or continuous). Cavanaugh Tocci establishes limits for each category of sound with regard to ambient sound levels (+15 dB for impulse, +10 dB for continuous, and +5 dB for tonal) which are consistent with best practices and how codes are applied in other jurisdictions.

1.3 (Existing) Ambient Sound Levels

Because the criteria is relative to ambient sound conditions, Cavanaugh Tocci needed to establish the baseline ambient used for comparison in their study. They deployed sound level meters (SLMs) to measure levels over a seven-day period in September 2021. They collected data at two locations, SM1 was located near the project site toward Oakhurst Road and represented ambient sound levels for residential property lines closest to the project site located along Oakhurst Road and SM2 which was located along Lackey Dam Road and represented property line sound levels of residences located across Lackey Dam Road. Meters were set to collect data on an hourly bases with fast time-weighting.

The sound level meters deployed conform with applicable acoustical standards for conducting these types of measurements and the locations chosen are appropriate to represent the various property line conditions needed to complete the study. Typically, background sound levels and traffic are measured with a slow time-weighting; however, the fast time-weighting will result in higher maximums and lower minimums and will result in a more conservative result of the study based on using the minimums as the ambient sound level (see discussion below on 90th percentile). We note that Cavanaugh Tocci reviewed data related to changes in traffic due to COVID-19 and found that any impacts would not affect the results of this study.

In reviewing the presented measurement data, we noted that rain occurred on Thursday September 16. Rain and wet roads can alter the measured sound levels, specifically the spectral content due to wet roads. While we would typically remove this data from the data set, we note that it does not affect this study because the 90th percentile (essentially minimum) values are being used as the background sound level.

1.4 Final Criteria

The final criteria are presented in two tables in the Draft 2 report, Tables 1 and 2. Both tables are presented below.

Measurement Location	**Background Sound Levels** (Lowest Measured Hourly 90th Percentile A-weighted Sound Level) **($L_{AF90,1\text{-}hr}$)**		**MDEP Limits for Stationary Equipment (dBA)**	
	Day	Night	Day	Night
SM1 (R1-R9)	28	25	38	35
SM2 (R10-R19)	31	29	41	39

Day 7:00 AM to 10:00 PM
Night 10:00 PM to 7:00 AM

Table 1. Lowest measured day and night A-weighted background sound levels ($L_{AF90,1\text{-}hr}$) and MassDEP Noise Policy limits on stationary equipment sound Proposed Lackey Dam Logistics Center, Sutton, MA

Measurement Location (Applicable Receptors)	**Average of the Lowest 90th Percentile Sound Levels Measured Each Day ($L_{AF90,1\text{-}hr}$)**		**Recommended Design Goals for Mobile Equipment Impact/Continuous/Tonal (dBA)**	
	Day	Night	Day	Night
SM1 (R1-R8)	33	29	48/43/38	44/39/34
SM2 (R9-R18)	36	31	51/46/41	46/41/36

Day 7:00 AM to 10:00 PM
Night 10:00 PM to 7:00 AM

Table 2. Recommended voluntary design goals for mobile equipment sound Proposed Lackey Dam Logistics Center, Sutton, MA

We note that there is a discrepancy between the ambient sound levels used in each table and that the difference is that Table 1 uses the lowest 90th percentile measured, while Table 2 uses the average lowest 90th percentile measured over the entire seven-day period. We understand that the average lowest 90th percentile was used because it is expected to repeat the typical (repeatable) sound level and that the lowest measured 90th percentile may be an outlier. We disagree with this approach, because the various noise sources could coincide with the lowest sound levels measured at the site, resulting in a exceedance of background beyond criteria.

Comparing the mobile sources against an average of the lowest 90th percentiles would result in the mobile sources exceeding the lowest measured ambient levels by up to 20 decibels; this is based on the daytime ambient difference between lowest and average of the lowest of 5 decibels and the allowance of impulsive noises to exceed ambient by 15 decibles. In our opinion, the ambient for Table 2 should match the ambient used in Table 1 and be represented by the lowest measured (or worst case) level. If the equipment would not be operating at the time the lowest level was measured (e.g., 10pm at night), then we would agree with using another measured lowest 90th percentile during the times the sound source would operate.

2.0 Computer Modeling and Calculations

2.1 Model Setup

We were provided with the current CadnaA model of the project site on August 11, 2022 via email. Upon receipt, we opened the model and reviewed the configuration and layout. While the model varied from what the images contained in the Draft 2 Report, it is consistent with the project site and changes to the layout that have been explained by the design team during conference calls with us. The model was created with the latest available version of CadnaA (2022 MR1, build 191.5229), which conforms to applicable standards for calculation of sound propagation.

The model has been constructed to represent the final site layout (at that time), all of the applicable noise sources, and the noise sensitive receivers being considered. Sound sources have been established based on sound power levels (PWL) and include spectral content where available. While we have not reviewed specific sound data for the equipment, levels are generally consistent with what we would expect based on the type of equipment. We note that some sound sources are based on previous measurements conducted by Cavanaugh Tocci at similar facilities and agree that these are likely representative of the anticipated sound at this facility.

The site includes all improvements (grading, paving, buildings, etc.) that are expected as part of the project and the evaluation area of the model includes all GIS (contour) information. Ground absorption has been established based on the type of surface (paved areas are reflective and foliage/soil areas are absorptive); we agree with the ground absorption settings and approach used in the model.

The CandnaA software can calculate up to 20 orders of reflections. The more orders of reflection, the more complicated the calculation/model, sometimes with diminishing returns. While there is no industry standard for the order of reflections to use, our procedure is to use 3. Cavanaugh Tocci reports that they used 2. We evaluated the model and reviewed several receive locations with both 2 and 3 orders of reflections on and found no difference in the results.

The model uses receptor heights of 7 and 17 feet for one- and two-story buildings. Receptors are generally located at the façade of the receive building of interest, while some (e.g, R15) appear to be located at the property line. While 7 feet and 17 feet are appropriate for building evaluation, we typically use 5 feet above grade for evaluation of noise at property lines to represent an average human standing ear height; with that said, the difference between 7 feet and 5 feet will be minimal and the 7- or 17-foot elevation will be more conservative when evaluating barrier effectiveness.

As noted above, the model is constructed with receiver locations generally at the building facades and not at the property line (MassDEP code states "The criteria are measured both at the property line and at the nearest inhabited residence."). In most cases, this is not expected to result in a significant difference in the receive sound level and all sound levels are being compared to appropriate ambient sound levels. We anticipate that in most cases the difference between the sound level at the property line and the sound level at the building façade will be within one decibel.

In general, we agree with the approach and settings used in the CadnaA model.

2.2 Calculations

We were provided with a calculation (Excel) spreadsheet that Cavanaugh Tocci used in conjunction with the CadnaA model results to evaluate the impacts of the various sound sources. After a review of the spreadsheet, we attended a conference call with Cavanaugh Tocci to walk through the calculation process and understand the methodology used.

As we understand it, the "partial level" results are exported from the CadnaA model and input into the calculation spreadsheet. The "partial level" results from CadnaA represent the contribution of each individual noise source at a given receive location (e.g., R9). By using the "partial level" results, Cavanaugh Tocci was able to evaluate the impact of each specific equipment and focus noise reduction measures based on the noise sources that were exceeding or contributing to exceedances of the established criteria. This approach is consistent with how we would evaluate the model results. We note that there may be instances where multiple

The calculation spreadsheet has several references to the criteria, some of which appeared to be inconsistent with the criteria established in the report (and noted above). After discussion with Cavanaugh Tocci, we understand the methodology used in the spreadsheet and that some items noted as "criteria" were only used for intermediate evaluation steps and that the final summary information is utilizing the correct criteria (and is also what is presented in the report). We do note that the criteria used for data evaluation of mobile sound sources, as presented in the report (Tables 4 and 5), do not align with the criteria established in Table 2 of the report; for receive location 1 through 9 the criteria are listed 1 point high and for receive location 10 through 19 the criteria are listed 4 points high. Please also refer to our previous discussion on mobile source criteria in Section 1.4, above.

Based on our review and conversations with Cavanaugh Tocci, the calculations are appropriate and consistent with best practices.

3.0 Noise Reduction Measures

3.1 Barrier Design and Location

The report and model include several barrier segments oriented between the noise sources (both fixed and mobile) to reduce the impact of the sound and align with project requirements. Each barrier segment is design with a minimum top elevation (with the exception of segment 6 that is indicated at 15 feet above the pavement) and a length, for a total of 1992 feet of barrier.

The report also recommends that barrier sections 3a, 3b, 4a, 4b, 4c, and 6 be acoustically absorptive to reduce reflections.

Based on our review of the model, the barrier locations and heights appear to be optimized based on the noise source locations in the model. The only additional consideration that we would offer is to add a barrier connecting segments 2 and 3a. Furthermore, the model noise source locations represent what we would consider typical/worst case locations; while the noise source locations may not represent all possible locations of noise, they should represent the worst case locations relative to the barriers and sensitive receivers.

4.0 Conclusions

Based on our understanding of the project and review of the work completed by CavanaughTocci, we believe that the study was completed in general accordance with best practices. The measurements, model, and calculations are all consistent with best practices and how we would conduct/develop them.

The criteria have been established based on appropriate jurisdictions and where objective limits are not defined, the team has established sensible goals that are consistent with other jurisdiction codes and regulations; however, we feel that the use of the average 90th percentile is establishing a goal higher than it should be and recommend using the lowest measured 90th percentile during the time period the sound source would be active. The result of using the average 90th percentile as compared to the lowest is that sound levels will exceed the ambient by more than presented when the ambient is quieter than the average and in some cases conditions presented as meeting goal may exceed goal. The criteria and results tables should be reviewed for consistency and updated should the criteria be modified as suggested.

In general, the barrier design appears to be optimized both in location and in height. We reviewed a few possible adjustments to height and determined that the difference in performance was not significant and would not result in meaningfully different results. We do offer that a barrier connecting segments 2 and 3a could be beneficial to some receive locations.

The report doesn’t indicate any materials or minimum requirements for the barriers; we assume that the project will utilize commercially available barrier systems.

Based on our review, the project is meeting the intent of the various noise codes even though some receive locations are projected to experience sound levels beyond goal. We note that from the data presented in the report, many of the receive locations are exposed to sound levels comparable to those projected from the project due to other noise sources (likely traffic along local roadways).

This concludes our current comments. We are available to discuss our review at your convenience.

Thank you,

Christopher A. Peltier, PE

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