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Analyzing transportation noise during the pandemic.

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ABSTRACT

The COVID-19 pandemic has introduced new challenges in the approach to many types of projects in the field of acoustical consulting. An important one being the impact on how transportation noise studies are conducted, in particular on-site noise measurements and subsequent computer modeling. The pandemic has affected roadway, railway, and aircraft travel, and consequently the noise generated by these transportation noise sources. This raises questions about the methods used to determine existing and future transportation noise impact upon residential sites. After a year into the pandemic, it appears that postponing an analysis is no longer feasible and the need for an adaptable method of analysis is required to meet jurisdictional transportation noise analysis requirements.

How should these studies be completed during this time in which it is highly likely that roadway, railway, and aircraft volumes are not what they were pre-pandemic? How or even should on-site noise measurements be taken? Will the local jurisdictions accept the studies completed during the pandemic? When will roadway, railway, and airport volumes be back to pre-pandemic levels, or will they ever be back to that volume? Will there be a significant impact on noise? This paper will follow the process used to complete transportation noise studies during the pandemic, which involved creatively adapting known methods to address these new questions while working closely with local jurisdictions, providing the education and guidance needed for them to comfortably review studies so that the transportation noise component of site approval does not slow down residential projects.

1. INTRODUCTION

Adapting to challenges is often one of the most common traits attributed to success. The COVID-19 pandemic has introduced many challenges to the world; specifically, allowing economies to operate while minimizing exposure between populations, which resulted in travel restrictions at a global, national, and local level. The impact of these restrictions was immediately noticed at the local level,

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especially as an acoustical consultant that analyzes transportation noise. A significant decrease in roadway volumes was apparent due to the need for employers and employees to implement tele-working.

Like every other industry trying to survive the pandemic, developers and builders still pushed forward with proposed land developments. In order for these projects to continue moving forward during the jurisdictional approval process, Phoenix Noise & Vibration saw it necessary to develop an effective method for providing accurate analyses of transportation noise for these projects. This required us to modify our current practices and inform our clients and government reviewers of the non-typical method. It was found that our local governments were open to discussing the topic and were happy to accept alternative methods to allow for projects to move forward.

Now that it has been over a year into the COVID-19 pandemic, it looks like transportation volumes are starting to normalize and that standard practices for transportation noise analysis can return. While it is relieving to know that things may return to "normal," it is also encouraging to know that our industry can still function with minor changes to standard practices.

2. TRANSPORTATION NOISE ANALYSIS PROCEDURES

While acoustical consultants likely differ in their practices for conducting analyses of transportation noise, there is usually some agreement in the procedures used to conduct these analyses. When applicable, these procedures typically consist of the following:

1. Noise measurements conducted on site.
2. Counting transportation volumes; roadway or railway.
3. Developing an existing computer model of the site.
4. Calibrating the computer model to the onsite noise measurements.
5. Modifying the existing computer model with the proposed site changes.
6. Analyzing future noise impact upon the site.

This process is generally an effective method for analyzing transportation noise impact upon a future development, but what do you do when current transportation volumes are no longer representative of typical conditions and noise generated by those transportation sources has decreased? This was the question that we had to ask ourselves due to conditions created by the COVID-19 pandemic. The other issue was that there were statewide travel restrictions which limited our ability to travel to the sites to conduct noise measurements.

2.1. On Site Noise Measurements

Understanding the purpose of onsite measurements when analyzing transportation noise is important when determining whether they are absolutely necessary to complete an evaluation of a site. Sometimes the intent is not to determine the noise level at the site from a specific source, but to determine how the noise propagates from that source to the site due to unique site conditions. Examples of these conditions may be significant topographic changes, obstructions, elevation of the noise source relative to the site, as well as other unique challenges. While these conditions can usually be computer modeled, the accuracy of the model's results can be significantly improved with validation from onsite noise measurements.

Our company typically uses DataKustik CadnaA to create computer models of proposed sites and have found that with accurate site data (i.e. topography, building footprints, roadway alignments, etc.) that the computer model is generally within 2-3 dBA of the noise measurements conducted at the site prior to any adjustments to input data. In the field of acoustics this level of accuracy is usually within an

acceptable tolerance. Therefore, we maintained a relatively high confidence level when we knew that we were not able to conduct noise measurements at a site.

Although we knew that our ability to computer model a site was fairly accurate, the model calculates noise based upon transportation data inputs, such as Average Annual Weekday Traffic Volume (AAWDT), truck percentage, percentage of volume occurring at night, etc. This can become an issue when the site is adjacent to a transportation source for which there is no published data. Prior to the COVID-19 pandemic, noise measurements at a site with these conditions were the primary way to determine the noise level generated by the adjacent transportation noise sources. This presented us with a challenge, as initially not only were we not allowed to travel but knew that noise levels measured of that transportation source were likely not representative of typical levels.

Given the challenges of conducting onsite noise measurements, we determined that we would approach our analyses using alternative methods. For sites which we knew we had published data for the transportation noise sources, we decided that we would computer model the site and use the results without onsite noise measurement validation. We would then later measure and recalibrate the model if necessary once travel restrictions were no longer in place. We found that our clients were generally receptive to this idea, as any attempt to keep the approval process moving forward using alternate means that were still accepted by the local jurisdictions was greatly appreciated.

We did not complete onsite noise measurements between mid-March and the end of June 2020, due to both the knowledge that most transportation was highly restricted and the lack of approval to move forward with noise analysis services on residential projects. During this time, any transportation noise study that was completed was done so with the "model-first-measure-later" approach (explained in Section 3).

2.2. Transportation Data & Modeling

Many onsite noise measurements were conducted between July and September, during a time at which roadway volumes appeared to be increasing compared to the beginning of the pandemic, yet also at a time where it was unclear if overall roadway activity and patterns had returned to "normal" (i.e. pre-pandemic) conditions. To account for any effect the changes to roadway activity may have had on the resulting noise output from the roadway, traffic counts conducted during the onsite noise measurements were compared to the most recent available data from the state departments of transportation (DOT).

To validate the computer model, automobiles and heavy trucks were manually counted at the site for a 30-minute period during the typical morning and evening peak hours, as well as at 10:00 PM to account for the nighttime traffic percentage. The higher of the 30-minute peak hour counts (the evening count for this site) was doubled for an hourly count, and then used to calculate an AAWDT using the K Factor and Equation 1 [1].

$$AAWDT = \frac{Peak\ Hour\ Volume}{K\ Factor} \tag{1}$$

The roadway noise output of the current model was calibrated according to the measured noise levels using the calculated AAWDT and then making adjustments to the nighttime volume percentage and roadway speed. To determine a nighttime percentage (which is not always provided by the DOT), in the current model the nighttime volume percentage was adjusted until the modeled difference between the daytime and nighttime average noise levels matched the measured difference. After doing this, if the

modeled day-night noise level (Ldn) output was still slightly low or high, the modeled roadway speed was adjusted above or below the posted speed limit. With the roadway speed adjustment, the modeled Ldn, daytime average, and nighttime average noise levels would then all match the measured values.

The calculated AAWDT during the onsite noise measurements was then compared to the most recent AAWDT available from the DOT, which was always (with varying degrees) lower, indicating that the roadway volume may still be affected by changes attributed to the pandemic. To account for the higher roadway volume, the DOT published AAWDT was used, along with the other parameters needed to calibrate the modeled output to the measured noise levels at the site. As such, the current model was calibrated according to the noise levels measured at the site and adjusted according to the higher DOT AAWDT reported for the previous year.

3. WORKING WITH JURISDICTIONS

In addition to the challenges created by the COVID-19 pandemic on our standard practices for conducting a transportation noise analysis, we also had to consider the impact on the ability for jurisdictional reviewers to understand what the changes represented and how they could be handled. This required us to reach out to the various jurisdictions and conduct open discussions of our newly proposed processes to adapt to the changes. In our discussions with these jurisdictions, we seemed to keep encountering some familiar themes, such as:

- Most reviewers do not understand noise beyond knowing to look for a noise contour on a site plan, and if a residence is one the wrong side of that noise contour there is the need for further analysis and potentially mitigation.

- Helping them understand concepts such as a 50% reduction in roadway volumes equates to a 3 dBA difference, or that school traffic does not make up a significant enough portion of the roadway volumes that it makes a difference in the Ldn. They did pick up quickly on the fact that travel restrictions result in less traffic and that any noise measured during that time would likely not represent typical conditions.

- Some jurisdictions looked to us for guidance on how to judge when roadway volumes would be representative of normal conditions, and, like us, questioned if they would ever be back to normal.

- We came up with 90% as the criterion for judging whether or not measurements could be equated to “normal” condition, as this equates to a difference in noise of less than 0.5 dBA, and explained that a 1 dBA difference is imperceptible and usually insignificant (until of course the noise at a site is at or 1 dBA above the respective jurisdictional limit).

- Some jurisdictions waited until their transportation departments confirmed that roadway traffic was back to 90%, while others were willing to accept the alternative approach.

3.1. Alternate Approaches

At the beginning of the summer in late June to early July, some restrictions in the area were eased, resulting in a substantial increase in roadway activity compared to the previous three months, yet not back to pre-pandemic levels. Around this time, the number of transportation noise study requests also seemed to increase back to what would have been normal for the summer months, leading us to consider whether there was a way to start conducting onsite noise measurements again for use in the studies rather

than continuing to delay them and pile up a huge backlog of onsite noise measurements that would at some point need to be completed.

For most jurisdictions in which we frequently complete noise studies, we were bringing this to the attention of the reviewers in mid-March before they had considered the impact of COVID-19 on noise and its impact on the overall site plan approval process. We had projects for which a noise study was a condition of approval in jurisdictions which require onsite noise measurements and clients who were still pushing forward so that their project would not be delayed.

Upon bringing up these concerns with onsite noise measurements to the reviewers' attention, they understood the challenges in completing the study at this time while also acknowledging that all projects could not be put on hold. We recommended for their consideration two alternate approaches to the traditional measure at the site and then model method:

1. Model first and provide a preliminary study based upon only a computer model and input data, and then once onsite measurements were again permitted, measure at the site and make any necessary adjustments to the calibration of the model and accompanying results.

2. For projects located near another project we had previously completed, use the measured data from that site.

Both approaches were accepted in the interest of keeping projects moving through the review process. It is interesting to note that we have had some difficulty in completing follow-up measurements for some of these projects, as the clients do not seem interested in having them completed once they receive that initial study, although they will be required to have them complete at some point. Although it is preferred that the measurements be conducted, as previously mentioned, there is some comfort in knowing the accuracy of the model-only results.

3.2. Schools

It was around this same time that one local county invited us to join a discussion on the effect of COVID-19 on roadway noise and how to conduct noise studies once the school year started. Historically this jurisdiction held a strong position that noise measurements during the summer months were prohibited due to the absence of school traffic in the measured results. In our meetings with them during the summer of the pandemic their concern was not that COVID-19 had affected all roadway traffic volumes, but instead that school volumes would be affected since the decision was made that all classes would be held virtually for 2020/2021 within the county. Their assumption was that without school traffic on the roadways, the noise level would be much quieter than it would normally be. It had not even occurred to them that overall roadway volumes had been severely compromised since mid-March and the resulting impact on roadway noise levels was highly questionable, only that there would less school traffic on roadways throughout the county.

For this jurisdiction, there were multiple meetings with us and other area consultants to help them feel comfortable with accepting the alternate methods explained above and moving forward with those projects in that fashion.

3.3. Open Discussion (Added Bonus)

An additional benefit that has resulted from increased communication with jurisdictional representatives is the ability to have open discussions regarding other matters that are related to the acoustical field. Some of these topics have included the analysis of airport noise impact upon residential developments and the methods used to determine if proper construction specifications have been

implemented. Similar to reviewers understanding of how transportation volumes impact noise, their understanding of construction techniques and methods to analyze the acoustical performance is limited. We have been able to help educate our government counter parts in the methodologies used in the acoustical field and help guide them in specifying requirements that can be effectively evaluated.

4. CONCLUSION

While the COVID-19 pandemic has brought on many new challenges, like many industries, developing alternative methods has allowed us to continue functioning through the constant changing climate. Though the changes that we implemented to our standard methods of analysis may not seem that significant and are likely already being used by other consultants within our industry, it was found that what may seem like a minor change required coordination on multiple levels. Additionally, it is important to know how to open up communication channels with the reviewers involved on your projects so that they and you have an understanding of the desired outcome.

The main benefit that has resulted from the challenges faced during the pandemic is knowing that our government reviewers are interested in having an open dialog about their jurisdictions' regulations and how they may or may not be applicable to a specific project. As representatives of our industry, it is our responsibility to help them make informed decisions about acoustic related issues.

5. REFERENCES

1. U.S. Department of Transportation Federal Highway Administration. Traffic Data Computation Method Pocket Guide. *Publication No. FHWA-PL-18-027* (2018).