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The Future of Electric Car Charging Noise Radiation

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Rob Lingenfelter
Gabriel Weger

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By Robert Lingenfelter, Acoustic Consultant, Burns & McDonnell, rlingenfelter@burnsmcd.com and Gabe Weger, Senior Acoustic Consultant, Burns & McDonnell, gweger@burnsmcd.com

As the transportation industry transitions into the electrification era, new sources of noise are introduced. Electric cars in operation are typically quieter than internal combustion engine vehicles and can be nearly inaudible at low speeds. However, there are new sources of noise associated with

electric vehicles that can have a more significant impact, specifically electric vehicle charging stations. As the demand for electrified equipment increases, the demand for electric energy harvesting, transmission, and storage also increases.

A single electric car will not generate a great deal of noise during normal driving operation. The vehicle batteries and motors are cooled as air passes over the components while the vehicle moves down the roadway. However, when the vehicle is charging, a significant amount of heat is introduced to the batteries and heat dissipation is required using cooling fans to maintain proper battery temperature and reduce degradation of the batteries. When a entire parking lot of electric cars are charging at the same time, a new source of noise is introduced.

In electric vehicle charging stations there are multiple sources of noise. There are the cooling fans on the vehicles themselves that will operate during charging, but there are also noise sources associated with the high-voltage electrical equipment required to get power to the vehicles. The electrical equipment includes transformers to connect the station to the power grid and the power conditioning systems (PCS) associated with the charging equipment. Both the transformer and the PCS can be significant noise sources. The combination of the various noise sources can produce audible noise in the areas surrounding the stations. This proposes a novel issue of electric car charging station noise, especially in residential or noise-sensitive areas.

When one thinks of a gas station, there is generally not a lot of noise associated with the operation of the gas station pumping gas. A new future of electric vehicle charging stations with PCS, transformers, and cooling fans presents new sources of noise not generally associated with transportation. So, how are these emerging noise sources of the electrical era managed?

Burns & McDonnell has been heavily involved with the management of noise associated with power generation, transmission, and storage systems throughout the United States. The recent emergence of lithium-ion battery storage systems and electric vehicle charging stations have introduced additional noise sources to communities that must be managed to reduce noise pollution. These forms of technology present similar issues of electrical and fan noise control. So, how are these forms of noise controlled?

The first step is to assess where a potential charging station may be located and if there are noise sensitive areas nearby. Once a potential site is identified, a determination of the noise generated by the station must be determined. This is determined based on vendor-provided and field-measured equipment noise levels. Once initial noise levels are calculated, the transmission to nearby receptors is predicted and potential mitigation strategies are identified. So, what are the options for noise mitigation of an electric vehicle charging station?

A general model of noise mitigation is the source-path-receiver approach. This method determines what is the most effective path of mitigation. Depending on the constraints of the potential project site, this method helps determine whether the source, path, or receiver is the most effective path of mitigation. Once the path of most effective mitigation is established, the types of mitigation available are determined.

Adding distance between the source and receiver is a simple way to reduce the noise impacts. There is typically a significant amount of distance loss attenuation in rural areas (e.g., approximately 65 dB (decibels) for 1-mile of distance based on a point source distance loss attenuation, not including ground surface attenuation, etc.). If distance between the source and

receiver is limited, for example in high-population density areas, the path or receiver mitigation should be reviewed. Depending on the location and the project site, path attenuation is the next approach to help maintain a balance between the effected community. Depending on the noise source type, attenuation to the source could be applied. The PCS noise can be mitigated the form of a sound attenuator, sound barrier, or similar. The last approach is providing mitigation at the receiver. This typically a last resort and generally not cost effective and can be intrusive to receiver.

As new sources of electrified noise become more prevalent in our day to day lives, management of their noise emissions will become more prevalent. As discussed in this article, there are different approaches to mitigate noise depending on the location of electrified noise emitting site.