Noise Barrier Inquiries from Lafayette Village I-495 HOT Lanes Project

Date: June 25, 2008

Pursuant to the Design Public Hearings held on May 20th and 21st, 2008, several written comments/inquiries were received regarding the proposed noise barrier for the Lafayette Village area of Annandale, Virginia. Because of the iterative nature of the questions, it was decided that using a comprehensive approach would allow for greater detail in the response and would allow for the community to see that its concerns were being addressed holistically and fairly.

Detailed and thoughtful inquiries were received from the Lafayette Village Community Association in addition to individual homeowners on Yorktown Village Pass and Brunswick Forest Pass. The I-495 HOT Lanes Project proposes to construct 7,300 feet of noise barrier in the vicinity of Lafayette Village. The barrier will start approximately 300-feet from the Little River Turnpike/Hummer Road intersection and extent, adjacent to I-495 to the intersection to Gallows Road. This barrier is identified as Barrier 7B. It will be constructed of absorptive materials. It was approved by the FHWA/VDOT Noise Abatement Committee Noise on May 6th, 2008 with the caveat that a step down provision be investigated at the northern (Gallows Road) termini. The height of the barrier varies between 5 and 24 feet. The wall is estimated to cost at least 1.8 million dollars. Approximately 170 properties are expected to receive between 5 and 10 decibels of reduction in the highway noise they will experience during the 2030 peak noise hour. The barrier is composed of two sections. The gap between the sections is filled by a hilltop. The hilltop is located approximately between the ends of Trammel Court/Thor Drive and Payton Forest Trail. The gap in the barrier is possible due to the elevation of the existing ground, which permits the barrier to merge into the hill, without losing its effectiveness. As will be discussed, it is the top of barrier elevation that will be important in determining barrier effectiveness.

This Technical memo will attempt to address the following aspects of the inquiries to VDOT regarding noise barrier 7B:

- The misconception regarding the insufficiency of using existing topography as a substitute for a barrier
- A request for a uniform 30-foot tall noise barrier
- A request to calculate impacts at internal third-floor levels
- The affect of project-related tree removal on traffic noise
- A request for additional (third-floor) noise monitoring
- A request for barriers that maximize noise reductions

Sufficiency of Using Existing Topography as a Substitute for a Barrier

Noise barriers work by breaking the line of sight between the noise source and the noise receptor. For noise barrier 7B, the existing topography, provides a natural barrier. This

allows for cost savings without compromising the barrier's effectiveness. The hilltop is located between station 729+00 and 737+00, a distance of approximately 800 feet. The detailed survey done for the construction plans depict that the top of the hill is at elevation 309 feet. It is the ground-level of the hill and top of barrier elevations that are important when considering if the line of sight is broken. With a maximum elevation of 309 feet, the hilltop allows for the line of sight to be broken by the hill, rather than a constructed barrier. **Table 1** summarizes the top of barrier elevations associated with the area between to two portions of noise barrier 7B.

Table 1: Summary of Important Top of Barrier 7B Elevations

Location	Material	Ground Elevation	Top of Barrier	Wall Height/Comments
Sta 728+00	Barrier	264 feet	277 feet	13 feet
Sta 729+00	Barrier	268 feet	284 feet	16 feet
Approximate Sta 731	Hillside	288 feet	288 feet	The ground elevation of the hilltop is generally higher than the adjacent section of barrier
Approximate Sta.734	Hillside	309 feet	309 feet	
Approximate Sta 736	Hillside	300 feet	300 feet	
Sta 737+00	Barrier	290 feet	303 feet	13 feet
Sta 738+00	Barrier	282 feet	302 feet	20 feet

Noise Impacts at Internal Third-Floor Levels

When determining highway noise impacts, Federal regulations and Virginia's Noise Abatement Policy utilize exterior areas of frequent human use. This is typically outdoor areas at ground level. Outdoor areas are those that noise walls can most effectively benefit. Indoor environments are very complicated and are best mitigated by insulation and other internal modifications. Because of the intrusiveness associated with insulating private structures interior modifications are limited to public use or nonprofit institutional structures. For these uses, individual inspections are required and noise insulating solutions proposed. This is conducted, necessarily, on a case-by-case basis. An additional consideration is the wide-spread use of common noise insulating techniques in northern Virginia, such as air conditioning, double glazed windows and other window treatments.

In addition to ground level calculations, the I-495 HOT Lanes Project included second floor balconies (in multi-family housing units only) as an exterior area of frequent human use. This had the effect of increasing the number of dwelling units and leading to noise barriers designs of maximum heights. Noise barrier designs are conducted by balancing the cost (as represented by the barrier's length and height) with the number of protected and/or benefited units. Capturing the second floor dwellings allowed the cost/benefit ratio to be maximized.

In the same vein, utilizing a standardized wall height would be wasteful from a public expenditure prospective. Building more wall than is necessary raises construction cost and lengthens the construction period, without proportionate benefits. Virginia's Noise Abatement Policy limits noise barriers to a cost of $30,000 per protected and/or benefited unit. Without a process to "optimize" the barrier, VDOT would be able to approve fewer

noise barriers. The same would be true if higher floors were considered. Barriers of sufficient height couldn't be cost effectively built. Additionally, there are engineering limits pertaining to the heights that free-standing walls can safely attain.

The Affect of Project-Related Tree Removal on Traffic Noise

The Federal Highway Administration's frequently asked questions addresses vegetation as follows:

Will Vegetation Reduce Noise Levels?

Vegetation is not considered as noise abatement, especially when involving Federal-funded projects. Vegetation must be a minimum of 100 feet thick, a minimum of 20 feet high, and so dense that it cannot be seen through in order to provide a 5-dBA noise reduction. Anything less than that thickness will not help much for the noise. Of course, the psychological effect (out of sight out of mind) can be beneficial...

Nevertheless, one of the guiding principles that led to the current preferred alternative is to minimize right-of-way acquisition. This will not eliminate disruptions to existing vegetation, but it will minimize it.

The Need for Additional Monitoring

One of the most misunderstood aspects of the traffic noise modeling process is the use of on-the-ground monitoring of current noise levels. By and large, the primary use of monitoring is to validate the computer models constructed to predict the noise levels that will exist during the peak noise hour in the future (2030 in this case). Model validation is accomplished by comparing the monitored noise levels with noise levels generated by the computer model, using the traffic volumes and speeds that were encountered during the monitoring process. This comparison ensures that reported changes in noise levels between existing and future conditions are due to changes in traffic and design conditions and not to discrepancies between monitoring and modeling techniques. If the constructed models predict the noise levels similar to the monitored noise levels (± 3 dBA), the model is considered validated. The I-495 HOT Lanes Project conducted a large scale monitoring program. In Lafayette Village, noise measurements were taken at Pence Court (site #9) and Esterbrook Drive (site # 37). With a properly validated model, additional monitoring, especially at the higher floors of study area structures, is not considered necessary.

Barriers that Maximize Noise Reductions

A foundation of good public policy, including Virginia's Noise Abatement Policy, is to treat all affected property owners fairly and to manage public resources wisely. This results in the rigid data collection and analysis process used during this project to determine traffic noise impacts. Many of the concepts developed to balance property owner impacts and public expenditures have already been discussed (for example, "areas of frequent human use", validation and the use of vegetation). Additionally, the previous discussion about costs and benefits is relevant. Maximizing noise reductions will almost always occur with barriers of maximum height. This, of course, raises costs. Consequently, a process of optimizing occurs in order to achieve the goal of a substantial noise reduction. This balances the ability to provide noise barriers with the limitations associated with the $30,000 per protected and/or benefited unit criteria.