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***The Importance of Community Involvement
in a Successful Construction Noise Control Program***

by Erich Thalheimer, INCE

**Parsons Brinckerhoff, Inc.
Noise Control Manager
Central Artery / Tunnel Project
185 Kneeland Street, Boston, MA 02111
Phone: (617) 556-2466 Email: exthalhe@bigdig.com**

Introduction:

The Central Artery / Tunnel (CA/T) Project in Boston Massachusetts is generally recognized as the largest and most ambitious urban reconstruction project ever undertaken in the United States. Otherwise known as the Big Dig, the CA/T Project is scoped to rebuild Boston's highway system infrastructure from the ground down, with active construction in very close proximity to thousands of residences and businesses expected to last 12 years and cost some \$13.6 billion. Indeed the CA/T Project can be considered as well as the largest construction laboratory in the country, affording the opportunity to develop new construction techniques and associated mitigation strategies. The most politically-charged of these required mitigation programs is to successfully control construction noise to avoid posing a noise hardship to the abutting communities [1]. Towards this end, the importance of a project's active interaction and relationship-building with the affected communities can not be overstated.

Times and the political climate have changed since the original Central Artery was built in Boston back in the 1950's. Back then, hundreds of homes were taken by Eminent Domain and leveled. Very little fair compensation, and even less sympathy, were extended to affected communities. But the old excuse of viewing construction noise to be only a temporary and necessary short-term impact to the communities is no longer acceptable to ever more organized and politically-connected community members. Today, for a large-scale public works project to move forward, the topic of construction noise must be adequately acknowledged and successfully managed or else face the very real threat that disgruntled community members can bring the project's progress to an expensive and embarrassing halt.

The good news is that through the lessons learned and precedents set by the CA/T Project's construction noise control program [1], large-scale urban construction projects can be advanced and noise can be successfully mitigated to the extent necessary to satisfy the affected communities.

CA/T Noise Control Program:

The CA/T Project's construction noise control program [1] is tasked with ensuring that noise associated with construction operations does not adversely affect abutting communities along the eight mile corridor in which active construction work occurs around-the-clock. The program makes use of all reasonable and feasible forms of construction noise mitigation, starting by controlling noise at the source where noise control measures are most effective by restricting the loudness of equipment and placing restrictions on the times of day that particularly loud operations can take place. Where needed, pathway noise control measures are routinely used as well such as noise barriers, curtain systems, or even the provision of acoustical window treatments [2]. However, this paper will focus on perhaps the most important receiver noise control option; that being active community involvement.

The CA/T Project's strategy in dealing with the affected communities is to be as proactive as possible, but with the ability to react if needed with additional noise mitigation resources and solutions. This willingness to actively interact with the affected community and to ensure their ability to maintain a given acoustic quality of life must begin at the top of the project with the project directors and managers. At the CA/T Project, the noise control program enjoys a very high level of "command support" from upper management. By successfully implementing committed noise control policies [3] through deeds and actions, the community eventually comes to trust the word of project managers. In turn, the community is much more tolerant of occasional high noise events and more understanding of unusual work schedule requirements. A partnership mentality results that yields benefits to both the Project and the communities.

Community Involvement Process:

The Project considers community involvement to be a key aspect of its noise control program which directly influences and benefits the affected community. Indeed experience has demonstrated that the community's tolerance in general is elevated when the community feels they have been informed and included in the design and mitigation process. People have a need to be heard, and to have their opinions taken seriously.

The CA/T Project has built, and continues to foster, a good working relationship with the affected communities. Even though relevant information related to project designs and work schedules are fully disclosed through the State's rigorous environmental notification process [4], the Project has learned that it is best to continue to have open dialogue with the communities throughout the duration of the project. The Project has established an internal Community Liaison Group whose duties include scheduling and moderating regular community meetings. These meetings take place typically on a monthly basis in an easily accessed public building in each affected neighborhood. Special community meetings can also be arranged if unusual project work carries with it some concern for noise consequences or unusual mitigation plans.

Each of the Project's community liaisons arranges for and publicly promotes the community meetings. Notices are posted in the local newspapers and flyers are circulated throughout the affected neighborhoods. In addition, several recognized community groups, defacto community advocates, regulatory oversight agencies, and local political representatives are formally notified by the Project in hopes that their respective members will attend and be encouraged to contribute at the Project's community meetings. Finally, for those abutters with access to the Internet, the Project maintains a comprehensive web-site (www.BIGDIG.com) at which visitors can access all types of information about the CA/T Project.

At these community meetings, Project representatives present plans for upcoming work operations and explain any mitigation measures intended to minimize the impact of the construction to the community. The Project uses large-scale site maps and graphics, and hands out pertinent information for community members to keep. Open dialogue is encouraged, and often times community members do suggest good ideas for the Project to consider further. Most often times, these community meetings are attended by senior Project officials, thus giving community members direct access to decision makers at the Project.

The material and information at these community meetings are presented in a format to make sense to the lay-person. To the Project's surprise and delight, it has been found that reducing matters to their simplest form is not always necessary; instead the community in general has educated itself about these matters and can digest more advanced technical presentations. However, to ensure that the community understands the technical significance of relevant matters, the Project has arranged through the Massachusetts State Legislature to provide funding for the community to select its own preferred technical consultant. As an example, the firm of Beta Engineering was selected by the North End community to assist them in understanding the Project's presentations and to provide some technical review of the Project's positions. This relationship has benefited both parties - the community has increased confidence that the Project is being fair and honest, and the Project can explain technical matters in more detail to other knowledgeable professionals and build its credibility.

Through these community meetings, and through the use of Noise Control Plans [1] and Noise Technicians patrolling the work sites empowered to shut down otherwise unmitigably noisy work (at night), the Project attempts to be as proactive as possible at avoiding noise complaints. However, should neighbors or business owners feel disturbed by construction noise, then they can call the Project directly at CAT-HELP (228-4357) anytime 24-hours per day, 7-days per week, and register their complaints with live operators at the Project's Interim Operations Center (IOC). The ability for abutters to immediately contact the Project is another example of beneficial community involvement.

Noise Complaints:

One measure, but by no means the only one, of the success or lack thereof for the CA/T construction noise control program is found in the numbers of noise complaints called in to the IOC by distressed neighbors. The IOC receives complaints on a very wide array of topics; everything from traffic congestions to slurry that splashes on pedestrians shoes. However the largest percentage of complaints the Project receives is due to noise (once as high as 50% of the total complaints), the vast majority of which resulting from night work.

A statistical evaluation of the noise complaints received by the Project was performed over the time period ranging from May 1994 through November 1999. Figure 1 shows the numbers of monthly noise complaints received by the IOC. Over these 67 months, some 2282 noise complaints were logged. On average, the IOC typically receives about 34 noise complaints per month from abutters, but has received as many as 88 noise complaints during a particularly noisy month in which work operations were not adequately mitigated. The fewest number of noise complaints in a given month was three.

Interestingly, the months of January and November produced the fewest number of complaints on average (approx. 6% relative to the other months), and the months of April, May, and September produced the highest average number of complaints (approx. 10% relative to the other months). This trend may be partially explainable as a seasonal effect in which abutters are more inclined to open their windows in the spring and fall, and thus hear more noise than with their windows otherwise closed.

However, the simple number of monthly noise complaints as shown in Figure 1 does not adequately account for the fact that over these 67 months work activities and areas of operations were accelerating at an ever-increasing pace. To account for the increasing amount of work (i.e. potential construction noise), Figure 1 also shows the dollars invoiced to the Project on a monthly basis by all the various construction contractors. Today, with the Project running at peak construction, contractors are invoicing the Project at a rate of \$120 million per month (or \$4 million per day). Thus it can be seen that even though the amount of work has increased dramatically (4-fold) over the 67 months, the number of noise complaints did not grow appreciably and in fact remains at about 20-30 complaints per month.

To emphasize this important factor, Figure 2 shows the trend for monthly noise complaints normalized to account for the amount of work ongoing Project-wide. An index was devised which calculates the number of noise complaints/\$million invoiced/month. As can be seen in Figure 2, except for a year or so of high noise complaints in 1996, the noise complaint index shows a relatively stable rate of complaints, supporting the fact that the Project has and continues to take noise control very seriously.

In fact it was in reaction to the growth of noise complaints in 1996 that the Project reevaluated and reaffirmed its commitment to successfully control construction noise. The Project hired additional in-house acoustical staff and established a Noise Panel that continues to this day to meet bi-weekly to coordinate the noise-related actions of construction, environmental, management, community liaisons, and legal staff. Outside interests are also invited to the Noise Panel meetings, including representatives from the City of Boston Environmental Department (BED), the Massachusetts Department of Environmental Protection (DEP), and the Federal Highway Administration (FHWA). The Project also tightened the restrictions contained in its Construction Noise Control Specification 721.560 [5] which is a part of every contractor's contractual obligations.

Figure 1. Noise Complaints at the CA/T Project

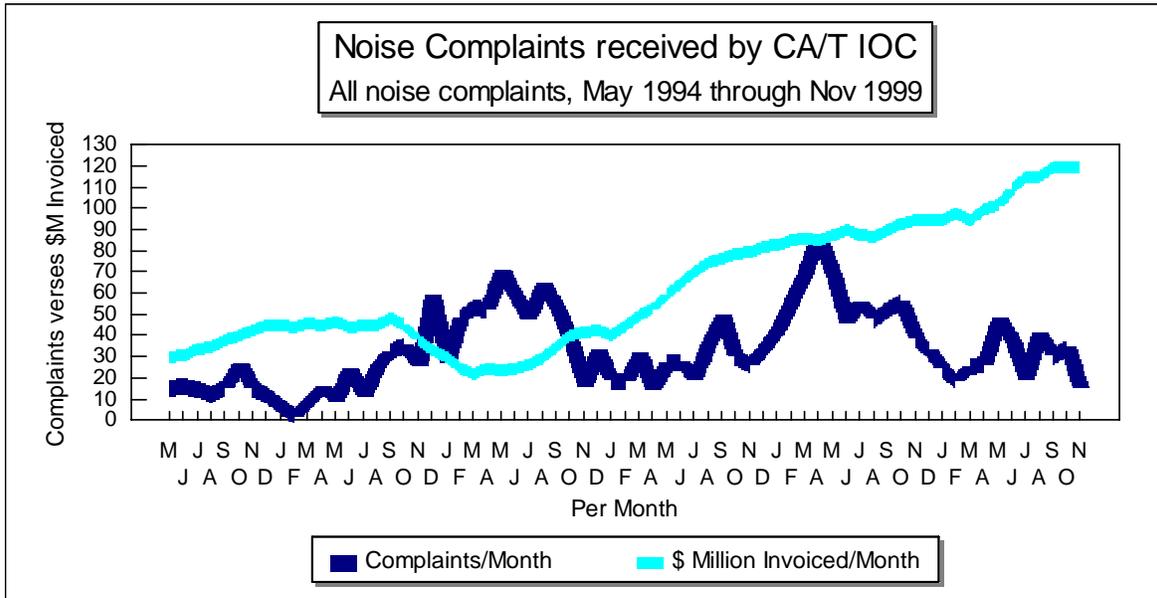
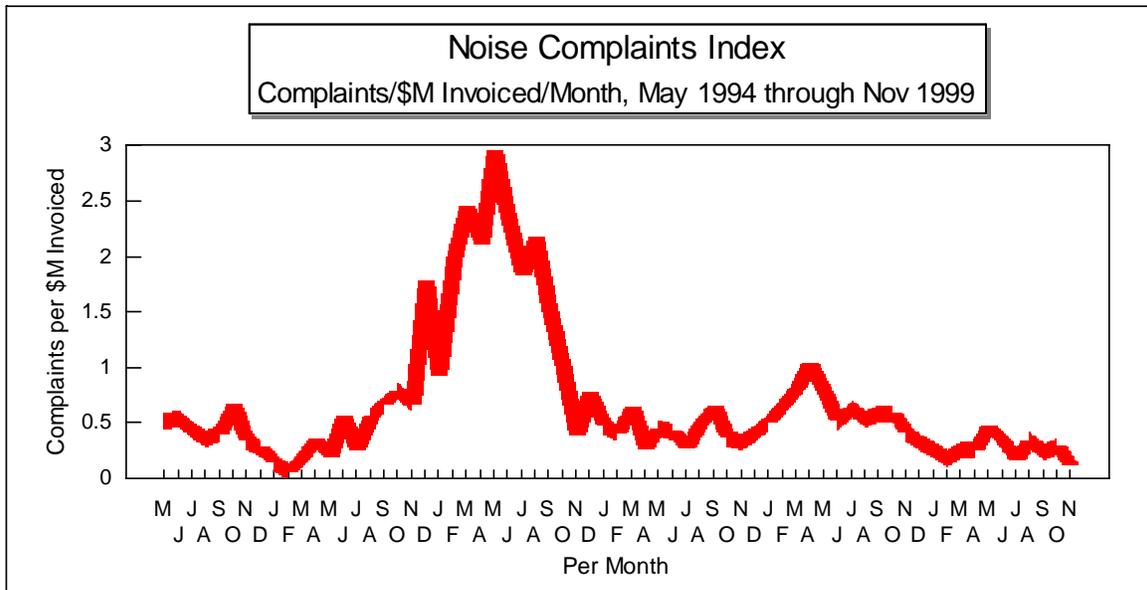


Figure 2. Noise Complaint Index at the CA/T Project



Examples of Community Involvement:

Three case examples are provided to illustrate the significant role that the community has played in developing new construction noise control programs and policies at the CA/T Project.

- 1.) Back in early 1996, the Project performed a comparative backup alarm demonstration study [6] in order to find an acceptable solution to the numerous backup alarm noise complaints received from the community at night. During the study, outspoken community members and repetitive complainants were invited to witness the tests. Several backup alarm manufacturers were contacted and sample backup alarms were provided. Samples included radar-activated alarms and strobe-light alarms, however the preferred alarms resulted to be the manually-adjustable (high/low) or ambient-sensitive (automatic) types of alarms. Consequently, all the vehicles used at night on the Project were subsequently required in the Noise Control Spec [5] to be equipped with these quieter-type backup alarms; which in comparison are some 20 dBA quieter than (or 1/4 as loud as) a standard backup alarm.

In reaction to even further objections from abutters in very close proximity to night work areas, the Project has gone so far as to prohibit the use of audible backup alarms from midnight to 6:00 AM in certain high sensitivity residential areas. This option, though not encouraged, is acceptable to OSHA providing that vehicle rearward movements are directed by an observer [7].

- 2.) In response to the need for more noise mitigation than accomplished with only source and pathway controls, the Project in 1997 elected to implement an acoustical window treatment program [2]. The program was initially intended to reactively address continuing nighttime noise complaints for which the Project developed an Off-Site Noise Mitigation Policy [2,8] establishing eligibility criteria for abutters to receive window treatments.

In 1998 however, as a direct result of community suggestions, the Project expanded the acoustical window treatment program to proactively treat bedroom windows in residences that were likely to be adversely affected by nighttime construction noise. Noise models were used to predict which residences would be eligible based on anticipated work schedules and established criteria policies [2,5,8]. As a result, some 300-400 bedroom windows were proactively approved and treated, at a cost of about \$400,000. This window treatment program continues to this day under the contract name C30A1, and is expected to treat another 200 windows in anticipation of future work [9] at an additional cost of \$100,000.

- 3.) Perhaps the best example of the extent to which the CA/T Project is willing to involve the community is illustrated in the development process of the C17A6 contract; which will eventually demolish the existing elevated Expressway (I-93), complete construction of various tunnels and boat-section roof tops, and refinish the surface streets. Even though the work was not scheduled to start until 2002, the affected community had great concern for the potential nighttime noise implications and insisted that the Project address their noise concerns as early as 1998. Towards that end, the Project embarked on an extensive two-year-long effort to work with the affected community to assure them that construction noise would be adequately mitigated.

The Project established an in-house Task Force comprised of community liaisons, construction schedulers, traffic engineers, and environmental staff. The Task Force listened to the community's concerns and with these concerns in mind prepared a comprehensive construction noise impact study [9] assessing all aspects of C17A6-related work. Noise models were used to predict construction and demolition noise consequences, and predicted noise levels were assessed against applicable noise limits contained in the Noise Control Spec [5]. Where significant unmitigated noise impacts were anticipated throughout the community, mitigation measures were warranted. Candidate noise mitigation measures were developed for senior management's consideration, and the relative cost-benefits of each mitigation measure were estimated.

Eventually the preferred noise mitigation measures were presented foremost to the affected community and their technical consultants, as well as to City of Boston and local political representatives. The presentation of proposed noise mitigation measures was an iterative process. The community was encouraged to comment on the proposed measures, and the measures were reconsidered and refined accordingly. In the end, the Project had committed to (1) restricting certain noisy equipment from night work, (2) the provision of extensive noise barriers and noise curtain systems, (3) an expansion of the successful bedroom window acoustical treatment program, (4) a prohibition of backup alarms at night, and (5) an option to perform some work on Sundays (at a cost premium) that would otherwise need to be done at night due to traffic restrictions. In all, these noise mitigation measures will cost the Project an estimated \$2-3 million [9].

Conclusion:

It must be remembered by project officials and construction contractors that noise associated with large-scale construction projects can directly affect the quality of life for the abutting communities. And that if not adequately managed, excessive construction noise can motivate distressed communities to threaten a project's progress. Indeed a failure to control a project's "physical noise" can lead to generating more "political noise" than project managers may be able to handle [1].

Fortunately with the valuable experiences gained on the CA/T Project, and by keeping in mind the importance of good community interaction and relationship-building, a project can progress its work and associated construction noise can be successfully controlled both physically and politically.

References

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