Construction Noise: I-78 Through the Watchung Reservation

DENNIS A. DIEHL

The objective of the work described in this paper was to formulate a quantitative assessment of the noise environment adjacent to a segment of I-78 before, during, and after construction of the roadway. Existing noise levels were taken at 10 sites to establish a baseline for comparison with construction noise levels and traffic noise levels. These ambient noise levels ranged into the low 50s for all sites. During construction, four sites experienced no noise impacts, one site was severely affected, and the remaining five sites were intermittently affected by noise during various construction activities. When traffic noise was measured with noise barriers in place, seven sites were not affected, one site was moderately affected, and noise levels at two of the sites increased significantly in comparison to the preconstruction noise levels. At 9 of the 10 sites, the highest single L_{eq} measured was generated during the initial phases of construction. Clearing, cut and fill, and rough grading operations were the major sources of noise at all sites. Drainage installation, bridge work, construction of retaining walls, and rock drilling were secondary sources of noise. The only activity that caused a sustained increase over the existing noise levels was hauling. The noise from this operation dominated other construction noises for the duration of the project.

An assessment was made of the noise environment along the I-78 corridor in the borough of Mountainside, townships of Berkeley Heights and Springfield, and city of Summit in Union County, New Jersey (Figure 1). The evaluation included measurements taken before, during, and after the construction of I-78.

Ambient (existing) equivalent noise levels (L_{eq}) were taken at 10 sites to determine the existing noise environment before the I-78 construction began. Construction noise levels were then monitored at the same 10 locations during all phases of the I-78 project. Noise levels were also monitored with traffic flowing along the completed roadway. The objective was to formulate a quantitative assessment of the noise environment at the areas adjacent to I-78 before, during, and after construction.

Because of the dissimilarities of each site (topography, offset distance from the roadway, shielding effects, etc.), a comparison among sites would be of little use. A site-specific analysis, on the other hand, accomplished the research objective. All the noise levels mentioned in this paper are the L_{eq} for a 15-min period. An impact is defined as either an increase of 10 dBA above the ambient level or an L_{eq} greater than 64 dBA. To save space in publication, bar graphs for the sites show only half of the measurements taken. A full listing of the measurements, with the dates that the measurements were taken and the construction activities that caused the noise levels, is available on request.

Environmental Activity, Bureau of Materials, New Jersey Department of Transportation, 951 Parkway Ave., Trenton, N.J. 08625.

PROJECT SITE DESCRIPTION

This segment of I-78 borders the Watchung Reservation, Hidden Valley Park, and several adjacent communities. Within the project limits, 10 sites were selected as representative noise-sensitive areas: a hospital, a school, and eight private homes. The existing terrain was wooded and mountainous. This segment of I-78 segment was constructed along the face of a mountain range that borders the Watchung Reservation.

NOISE MEASUREMENT INSTRUMENTATION

A Bruel & Kjaer Precision Integrating Sound Level Meter Type 2218 was used to take conventional sound level values, expressed as L_{eq}. All of the measurements reflect the A-weighted L_{eq} value for 15-min periods.

MEASUREMENTS

Summary

Of the 10 sites monitored, 4 experienced no impacts (as defined previously) from construction noise. One site was severely affected, and the remaining five sites were intermittently affected during various construction operations. When traffic noise was measured with noise barriers in place, seven sites experienced no impacts, one site experienced moderate impacts, and the noise levels at the remaining two sites increased significantly in comparison to the preconstruction ambient levels.

At 9 of the 10 sites, the highest single L_{eq} that was measured occurred during the initial phases of construction. Clearing the site, cutting and filling, and rough grading activities all generated noise impacts at all sites for varying periods of time. Drainage installation, bridge work, construction of retaining walls, and rock drilling were secondary sources of construction noise.

The single activity that generated a sustained impact at most sites was hauling. The size and condition of the trucks that were used, in combination with the speed and duration of the operations, created a source of noise that dominated the noise from other construction activities throughout the length and

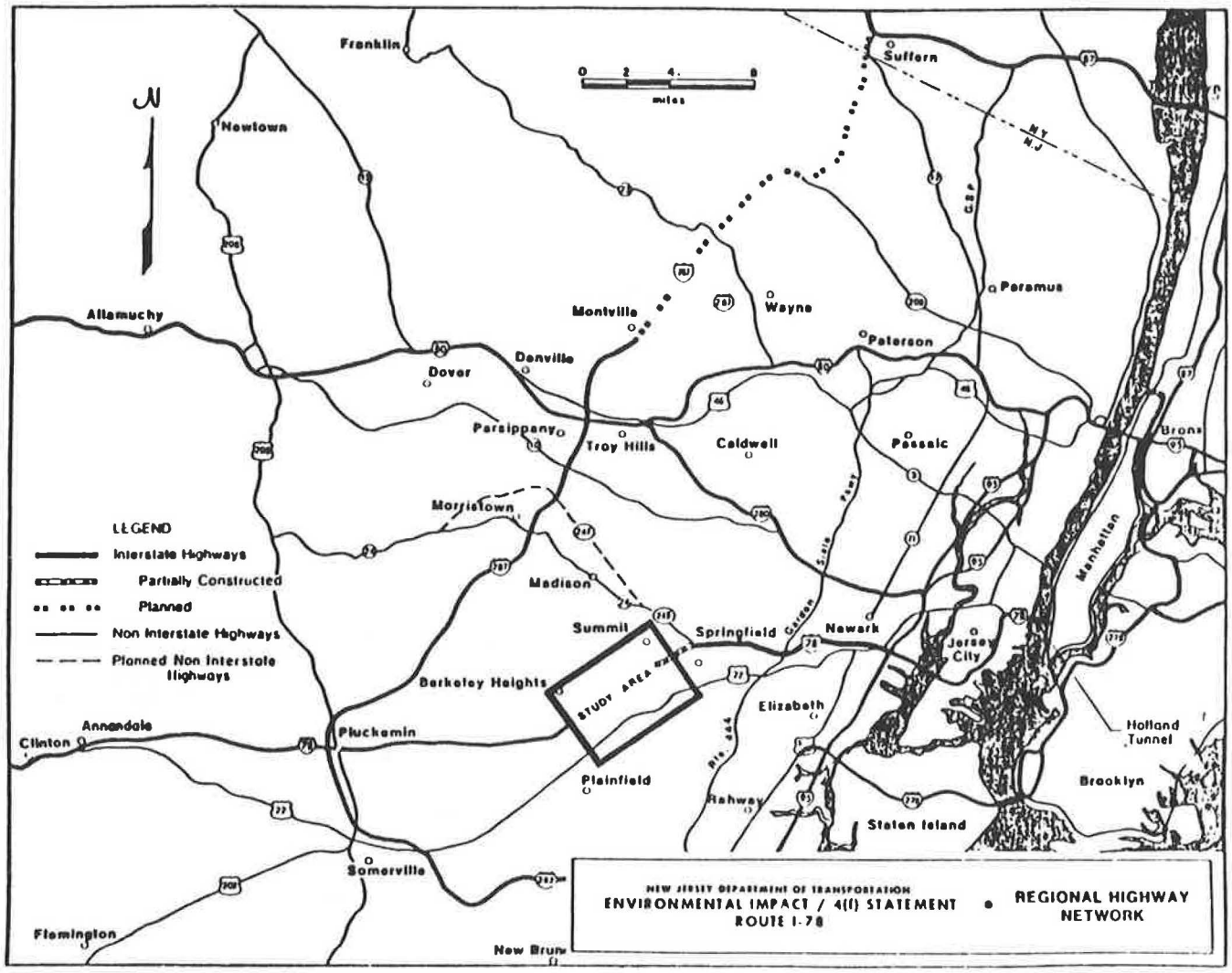

FIGURE 1 Study area.

duration of the I-78 project. Although noise levels for pile driving were the highest of those recorded, the length of time during which pile driving was performed was short enough that this activity did not draw any complaints from the community.

During the time that paving operations were under way, the installation of noise barriers was nearing completion. The noise measurements at the corresponding location varied accordingly. No noise impacts from paving operations were recorded. The noise measurements for the entire project are summarized in Table 1.

Site 1: Sayre House

Although peak L_{eq} construction noise levels were measured at 82 dBA during pile driving along Sayre Pond, this activity was quickly completed. Thus these measurements do not accurately reflect the overall noise levels for all activities at this site. During the first 8 months of construction, noise levels were found to range from the middle to upper 60s (Figure 2).

When the cut and fill operations and the construction of the retaining wall at Sayre Pond were completed, the noise levels generated by subsequent activities (mostly construction vehicles passing by) tapered off somewhat and were found to be less than 60 dBA. Near the final stages of the project, with the noise barriers in place, construction noise levels (exclusively generated by passing vehicles at this point) were consistently in the low 50s. The traffic noise levels at this site generate an L_{eq} of ~60 dBA. It is evident that there was a slight noise impact here from both construction and traffic.

Site 2: Guttman Home

The construction noise at this site was reduced by the shielding effect of the elevated Baltusrol bypass (Figure 3). During the initial phases of construction, noise levels were higher than the overall average at this site. After the cut and fill operations were completed, the noise levels (mainly caused by earthmovers hauling materials along the I-78 main line) caused no impacts.

TABLE 1 L_{eq} NOISE LEVELS

Site	Location	Existing	During Construction		Traffic	Noise Barrier
			Peak	Average		
1	Sayre House	50–52	82	58	59–60	Yes
2	Guttman home, 38 Ascot Way	49–52	75	56	54–55	Yes
3	Engelhardt home, 31 Skylark Drive	53–56	80	63	59–60	Yes
4	Gural home	48–50	82	69	60–61	Yes
5	Swalin home, 264 Oakridge Drive	55–56	62	54	51–53	No
6	Governor Livingston High School	48–52	70	54	56–58	No
7	Chin home, 54 Roland Road	46–50	80	55	55–58	No
8	Schmiedeke home, 69 Ridge Drive	47–50	72	61	65–69	No
9	Cowap home, 47 Twin Falls Road	46–50	64	61	53–56	Yes
10	Runnells Hospital	45–49	53	53	55	Yes

NOTE: All measurements in dBA.

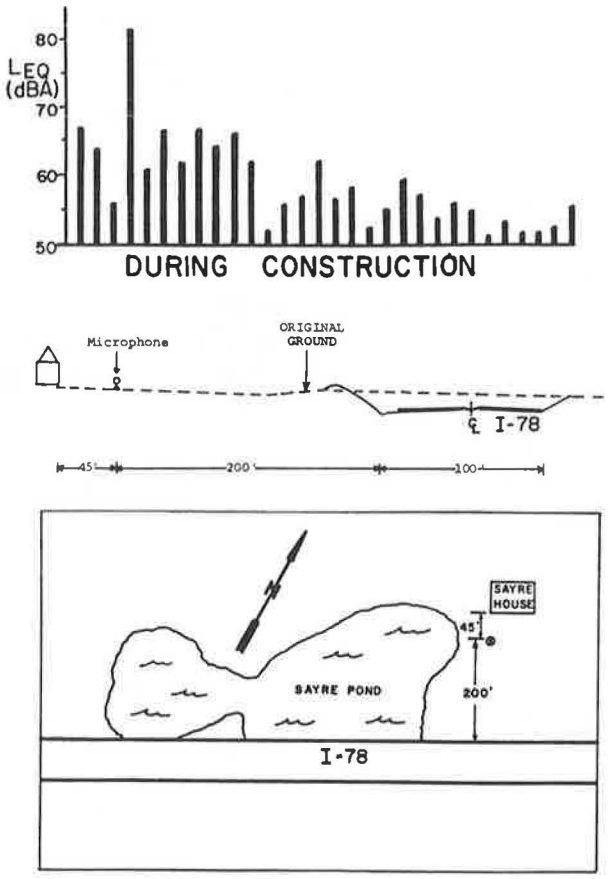

FIGURE 2 Site 1: Sayre House.

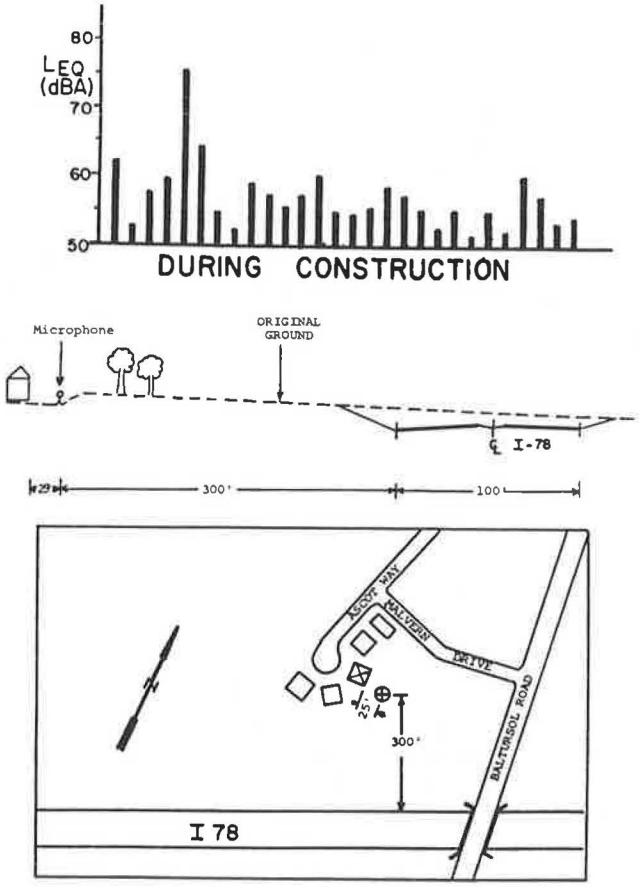

FIGURE 3 Site 2: Guttman home, 38 Ascot Way.

The inclined noise barrier that was used in this area was difficult to install. Currently, the effectiveness of the barrier is being compromised by the gaps that occur where the sections abut. Some differences were apparent when existing levels were compared to construction and traffic noise levels; however, no noise impacts resulted.

Site 3: Engelhardt Home

This site, which was located close to the I-78 main line, was often exposed to noise levels well above 70 dBA. After the cut and fill operations were complete, the noise levels (generated primarily by vehicles passing by) tapered off to the upper 50s (Figure 4).

The postconstruction L_{eq} traffic noise levels, which were in the range 58–60 dBA, verify the effectiveness of the noise barrier at this site. Substantial impacts would have occurred if a noise barrier had not been constructed. Noise during construction did cause slight impacts, but traffic noise did not cause any.

Site 4: Gural Home

The Gural home, located immediately adjacent to the I-78 right-of-way (Figure 5), experienced the most severe impacts

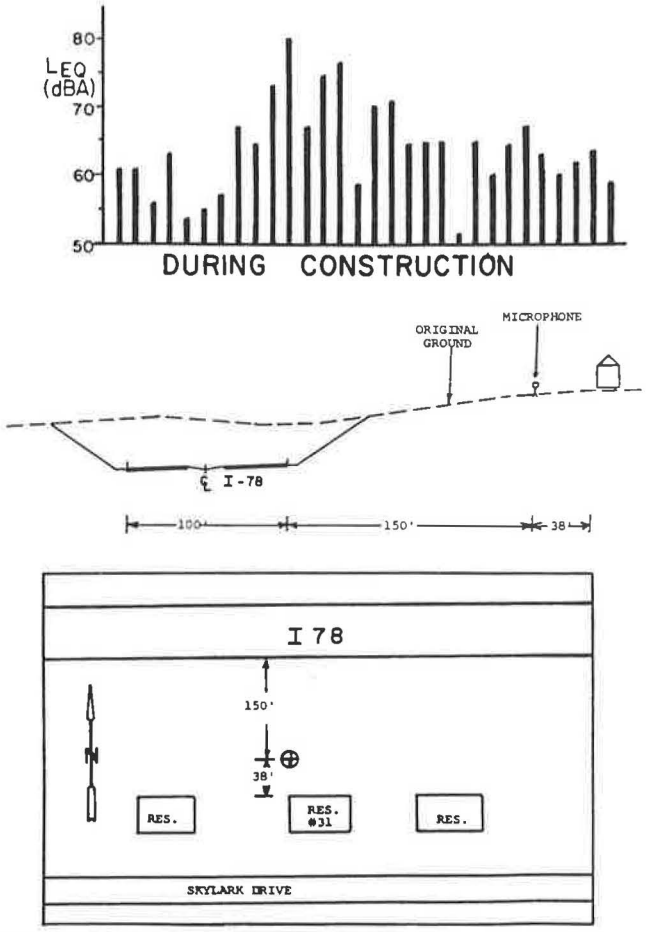

FIGURE 4 Site 3: Engelhardt home, 31 Skylark Drive.

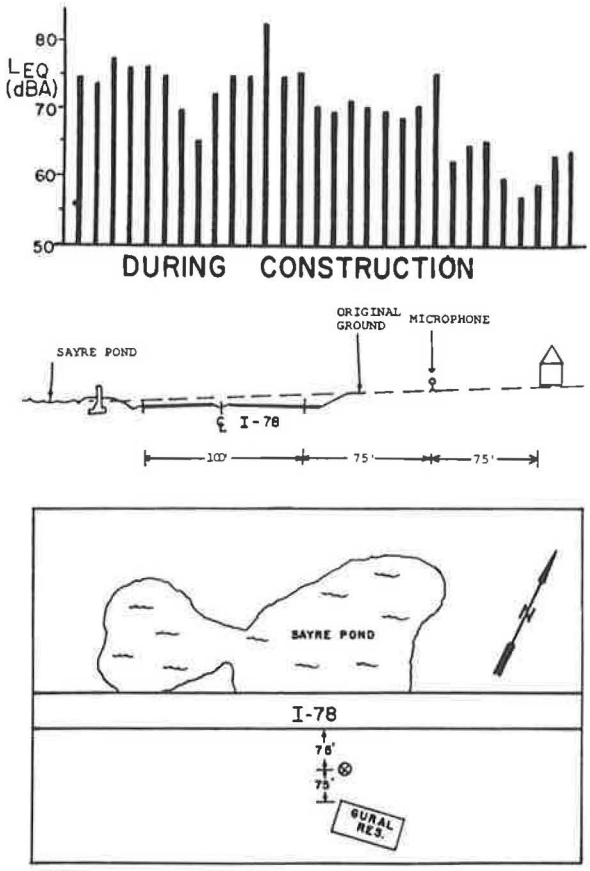

FIGURE 5 Site 4: Gural home.

of any site monitored during the project. L_{eq} levels in excess of 75 dBA were common, and the occupant filed numerous complaints throughout the construction period.

Several changes of plans in the vicinity (the Sayre Pond area) made it necessary to rework many completed parts of the project. The site was near the beginning of the haul road, and accelerating and decelerating trucks generated impacts almost continually during construction.

The noise reduction capabilities of the noise barrier are evident at this site: the traffic noise L_{eq} is only 60–61 dBA. Although there is an obvious noise impact (a 10-dBA increase), traffic noise levels remain well within federal guidelines.

Site 5: Swalin Home

This site, located atop the mountain ridge at a substantial setback from the face of the cut, was exposed to impacts only during activities that occurred immediately near the top of the slope (e.g., clearing, installation of the right-of-way fence). The traffic noise levels are barely audible, with no impacts (Figure 6).

Site 6: Governor Livingston High School

The school is located at a site that has topography similar to that of Site 5 (Figure 7). Noise levels exceeded 70 dBA during only one measurement period, when a bulldozer operation was proceeding along the top of the ridge at the right-of-way. For the most part, construction noise levels were found to be in the low to middle 50s.

Traffic noise levels are slightly greater than both the ambient and construction noise levels. At 56–57 dBA, however, the traffic noise is not an impact and is well within the federal design limits.

Site 7: Chin Home

This home is also located along the ridge, slightly set back and somewhat shielded by trees and heavy vegetation (Figure 8). It was seldom exposed to noise levels in excess of 60 dBA. In addition, this site is located at the western end of the project, at the end of the haul road. Therefore the noise caused by vehicles passing by on the haul road, which affected many of the other sites, was not a factor here. Rock drilling activities, however, did generate an impact for a limited time. Traffic noise levels are greater than the ambient levels, but they are well within design criteria.

Site 8: Schmiedeke Home

The Schmiedeke home is situated directly on the ridge, with no setback (Figure 9). It has an unobstructed view of the roadway and is now subject to major impacts from traffic noise (~20 dBA greater than the ambient noise levels). Construction

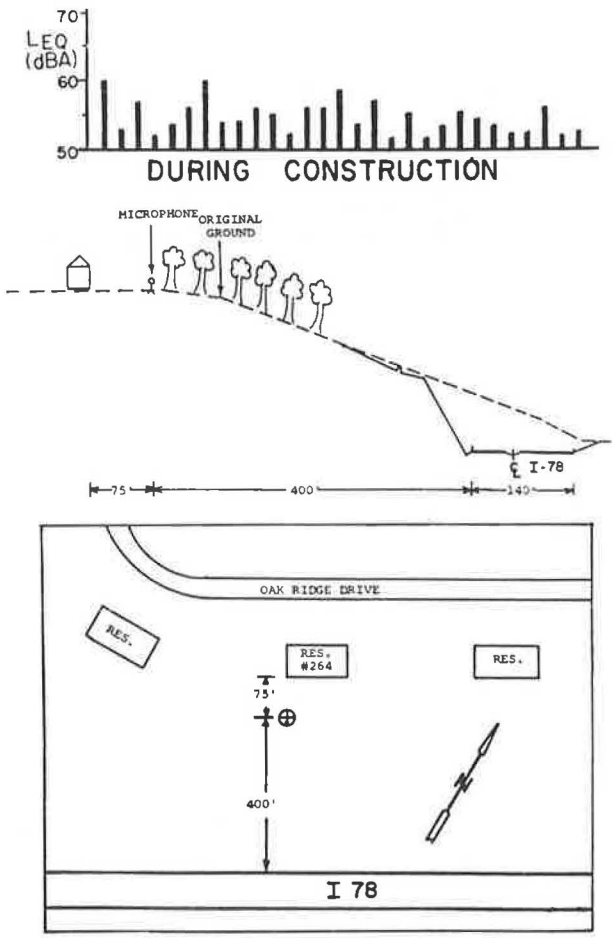

FIGURE 6 Site 5: Swalin home, 264 Oakridge Drive.

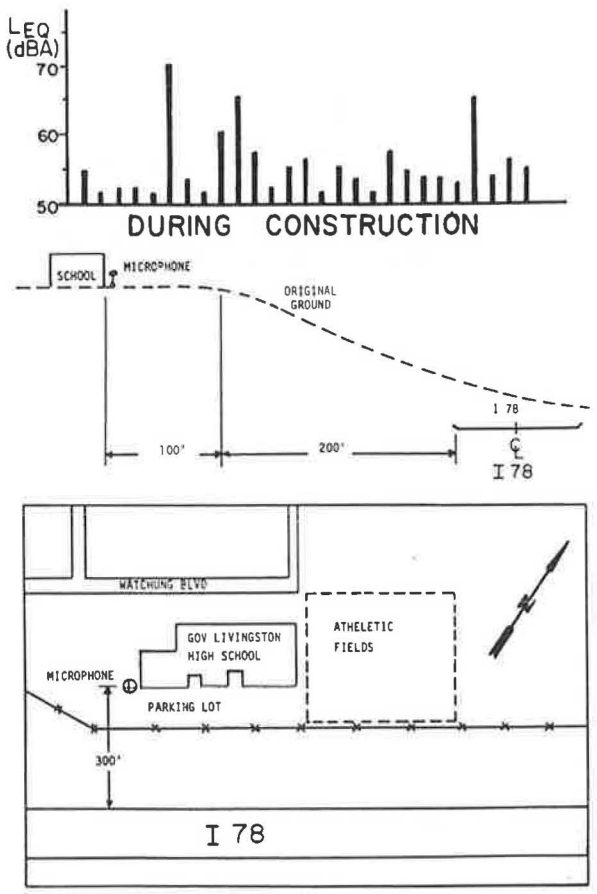

FIGURE 7 Site 6: Governor Livingston High School.

noise impacts, on the other hand, were moderate because this site is also located west of the section of the haul road that carried most of the passing construction vehicles. Some short-term construction noise levels of 65–70 dBA were counteracted in the average by the absence of construction activity during most of the project.

The owner recently complained about traffic noise and inquired about mitigation. Because the home is located directly atop the ridge, noise abatement procedures (namely noise barriers) are not feasible, so the occupant has placed the home on the market.

Site 9: Cowap Home

Construction noise levels generated a slight impact for a short time at this site. After the noise barriers were installed, however, neither the construction noise nor the traffic noise levels generated any impacts (Figure 10). All of these levels were only slightly greater than the ambient and were well within design criteria.

Site 10: Runnels Hospital

Most of the project's construction activities occurred some distance from the hospital (Figure 11). The segment of I-78 that was immediately adjacent to the hospital area had been completed, except for paving, under previous contracts. Because the hospital is considered very sensitive to noise impacts, noise barriers were constructed promptly in this area. The combination of the placement of noise barriers and the distance of the hospital grounds from most of the project's construction activities resulted in no noise impacts at this site. The distant construction activities were barely audible, and their noise levels seldom exceeded 50 dBA.

CONCLUSIONS

It is inevitable that noise impacts will occur during construction. The duration of the impacts is brief, however, in comparison to the overall time frame of an Interstate project of the magnitude of the I-78 construction. Construction noise levels tend to be higher during the initial phases (e.g., clearing, cutting and filling) and then taper off as the project nears completion.

Long-term impacts are generated along haul roads. When there are large amounts of materials to be moved or when the truck speed limits are high, activities on haul roads can generate levels of noise that exceed all guidelines for extended periods. This project required the removal of 3×10^6 yd^3 of material, so the haul road was used continually throughout most phases of construction for about 2 yr.

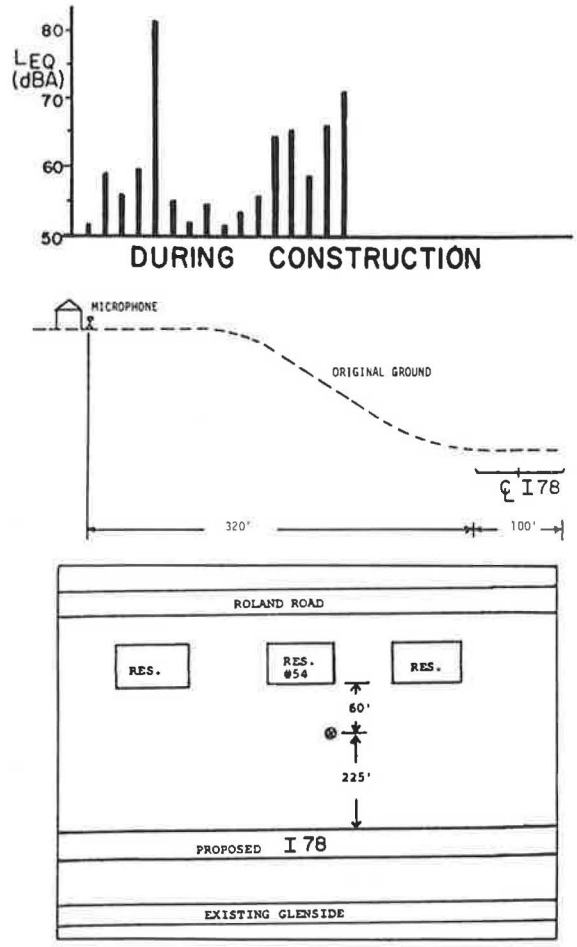

FIGURE 8 Site 7: Chin home, 54 Roland Road.

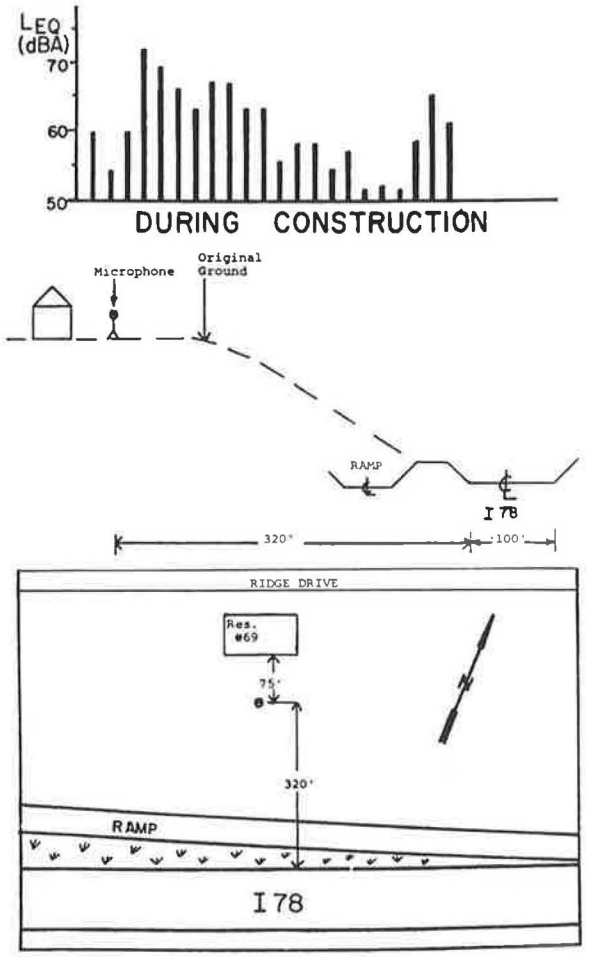

FIGURE 9 Site 8: Schmiedeke home, 69 Ridge Drive.

Involvement in noise impact issues is divided among several parties. The three that are always present during construction are as follows.

Department of Transportation

The responsibilities of this department, or more specifically, its resident engineer, go far beyond the planning stages of the project. Even though numerous commitments are placed in the contract plans and specifications, the resident engineer must ensure that these paper commitments become a reality during construction. For example, working hours (7:00 a.m. to 7:00 p.m.) were incorporated into the I-78 specifications. Contract personnel, however, would routinely start their equipment early to allow warm-up time before 7:00 a.m. Because the equipment was not "operating" (engaging in construction), the contractor did not feel that he was in noncompliance with the working hours.

A compromise was made. The contractor used an area adjacent to the quarry for overnight equipment storage. Because the quarry was far removed from any noise-sensitive areas, the operators could warm up and service the engines and be ready to start work at 7:00 a.m.

Contractor

The contractor is the key to minimizing construction noise impacts. The contractor's willingness to modify certain activities in consideration of noise-sensitive areas supersedes all the recommendations and guidelines that can be established. Prudent location of equipment and materials away from noise-sensitive sites, for example, will lessen the impact of construction.

Another step that the contractor can take to ensure tolerable noise levels is identifying those pieces of equipment that are particularly loud and then providing timely maintenance or replacing the offending equipment to reduce overall noise levels. During the early phases of the I-78 monitoring program, for example, one earth-mover in particular was found to generate noise levels well in excess of 90 dBA. Stack emission was identified as the dominant noise source. The contractor, when advised of the situation, ordered the earth-mover to be removed from operations. This action demonstrated the contractor's good faith in making efforts to address the concerns of this noise-sensitive community.

A final measure that, in particular, can reduce overall noise levels is to limit the speed at which earth-movers and dump trucks can travel the haul roads. This action will lower both peak noise levels and L_{eq}. It will also curtail those overzealous

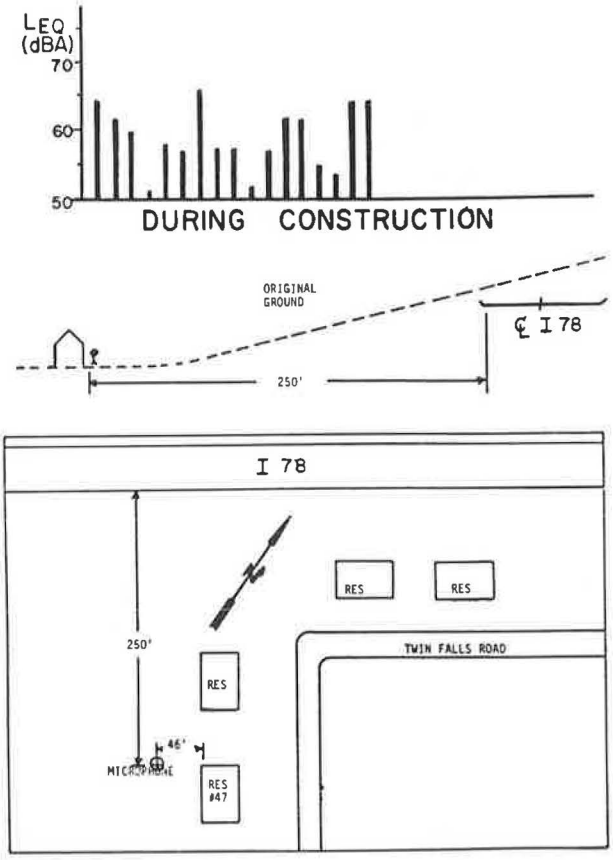

FIGURE 10 Site 9: Cowap home, 47 Twin Falls Road.

drivers who have been observed to operate their vehicles at speeds far exceeding the main flow of traffic.

Community

Community involvement is an integral part of environmental impact statement development. Public meetings, however, are

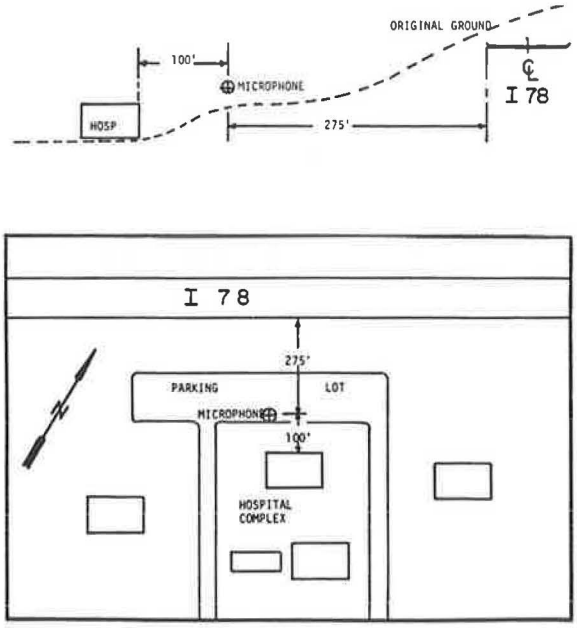

FIGURE 11 Site 10: Runnells Hospital.

conducted a long time before construction actually begins. The efforts of the department of transportation become obscured with time because years may pass between the public meetings and actual construction. A simple letter from the department to those home owners whose property is adjacent to the project site, outlining the anticipated construction schedule and acknowledging that the community will be somewhat inconvenienced, works wonders in maintaining a good working relationship. When this technique was employed on another project, no complaints from the community were received.

Publication of this paper sponsored by Committee on Transportation-Related Noise and Vibration.