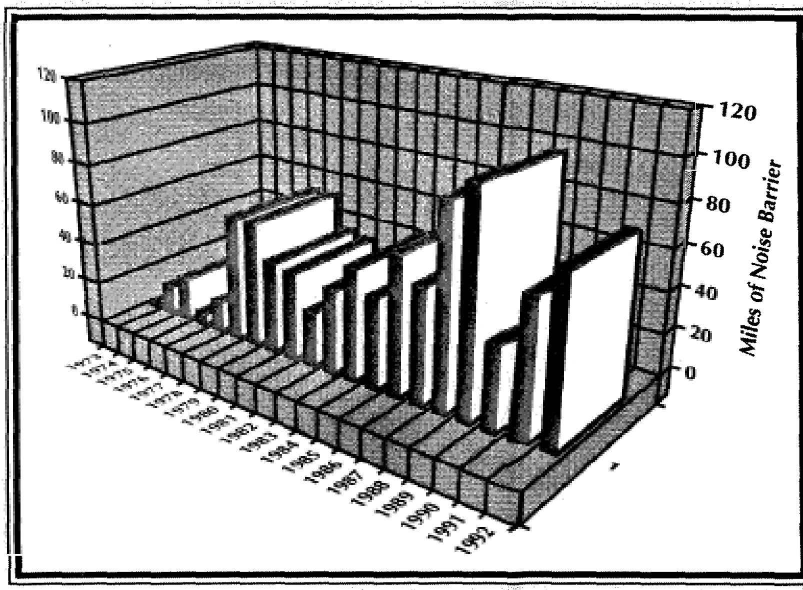
The Wall Journal™

The International Journal of Transportation-Related Environmental Issues

14

July/August 1994

In This Issue:

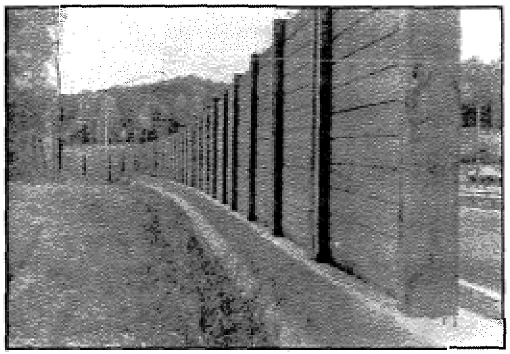


Also In This Issue:

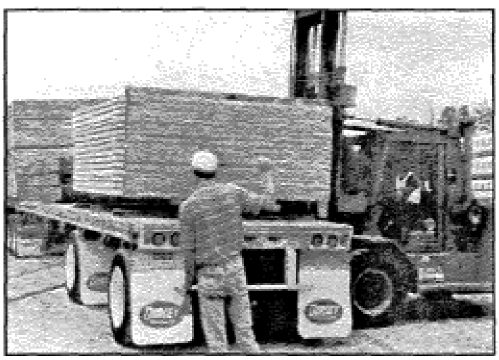
THE SOUND SOLUTION

PLYWALL *Post and Panel*

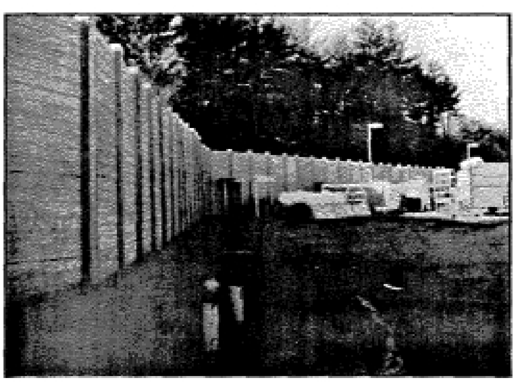
Permanent Engineered Wood Barrier Systems



PLYWALL can be mounted on traffic barriers and bridges. These 4"x10" posts were inserted into cast-in-place sockets which extended down into the footing of this traffic barrier.



Thousands of square feet of ready-to-install panels can be shipped economically by truck anywhere in the U.S. Panels are loaded with a large forklift equipped with 8-foot long forks. All posts, panels, cants, spikes and freight charges are included in the selling price.



This bottling plant had received noise complaints from nearby homes. The complaints stopped after installation of this 15-foot high PLYWALL barrier.

New Color Catalog Now Available

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The Wall Journal

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Editor's Corner

by El Angove

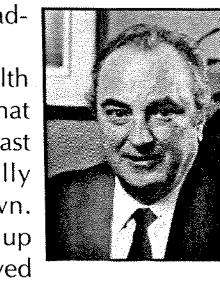
What can I tell you? Here I am in Florida, fat, dumb and happy, and nothing to do but roll around on the beach all day, sipping my mai tais, watching the world go by.

Yeah, tell me about it. Do you have any idea how much time and energy it takes for a hunt-and-peck typewriter artist to put out a 28-page journal every other month. On top of that, I'm not too computer literate, and I have some very incendiary diatribes with old Mac here.

You see that picture at the right? That was me, 45 years in a business suit and tie. Most of the time, I was in traffic getting to work; in Chicago, Boston and (horror of horrors) Washington, D.C. When I wasn't commuting, I was on a plane to some kind of a meeting or conference, sleeping in stuffy hotel and motel rooms, eating lots of chicken ala king, smoking too much, drinking too much. (Well, I do miss those last two a bit, but I digress). Back to the picture.

I don't look that way any more. I have given away all my suits (except the black one, for burial), ties, overcoats and any article of clothing that weighs over six ounces. I have now only short sleeve shirts which cannot be fastened at the collar. I do not have any pants that reach lower than my knees. It has now been over two years since I last wore a tie. I am going to get a new picture of the new me, as soon as the tan gets a bit darker so it will show up in the picture.

Well, I'm glad I got all that off my chest. It was only a segue into what I really wanted to say. If you're still with me, I am sorry that we are a couple of months behind our own announced schedule. You are receiving issues which have dates in the upper right hand corner of the first page, which have nothing to do with the current date at which you are reading it.



I hate to use health as an excuse, but that triple by-pass I had last Christmas really slowed me down. And then I packed up everything and moved to Florida, to soak up some of that sunshine that never goes away, and to avoid any more of that bone-chilling cold we had last winter on most of the eastern seaboard.

Those two adventures chopped about three months out of my life, and I have been struggling ever since to catch up. I think I am making progress now, and maybe by Christmas time, the Journal will be distributed on its announced schedule.

On other matters, I haven't had a great cover shot in a couple of months. I can't invent these things; you folks have to help. A good cover shot must, of course, be a good photograph (do not use your old Brownie). And, there has to be a good story to go with it. Look at issues number 8, 9, 11 and 12. Those are good photos, and I think the stories which accompanied them had a lot of interest for the readers.

In this issue, you will read about almost 1,000 miles of noise barriers which have been constructed from 1972 to 1992. Now, don't try to tell me that there are only four projects out of that 1,000 miles that we can run a feature story on. <u>Please</u> send me some project stories and photos. ■

In Coming Issues:

The Fundamentals of Sound — Part IV: The Receiver

More Noise Barrier Construction Forecasts

More Data on Noise Barrier Construction by the States

And More ...

ANNOUNCEMENTS

Boca Raton, Florida — September 12, 1994: Five Star Productions announced today that CARSONITE INTERNATIONAL (Ed. See adv. p. 15) is scheduled to appear on their highly acclaimed national television series, Today's Environment. The show, hosted by Ed Begley, Jr., provides a comprehensive look at new technology that affects our environment in a positive way. This series of weekly half hour programs is produced in a magazine-style format, which is the best method to distribute a variety of information pertaining to a specific industry, in a clear and concise way.

Carsonite International wages war on the blight of old tires filling our landfills, and actually turns this one form of pollution into a device to fight noise pollution. They shred the old tires and use them as fillers in highway noise barriers. With this new product, old tires may help reduce the noise on the highways they once traveled. This application will be the single largest consumer of discarded tires in the United States.

The program will air on CNBC, Saturday, October 15 at 12:30 pm Eastern, and on the Discovery Channel Wednesday, October 19th, at 7:00am Eastern and Pacific.

INTER-NOISE 85, the 1995 International Congress on Noise Control Engineering will be held at the Newport Beach (CA) Marriott Hotel from July 10-12, 1995. Abstracts of papers proposed for presentation at INTER-NOISE 95 must be received by the Technical Program Chairmen no later than November 29, 1994.

A major acoustical equipment, materials and instruments exhibition will be held in conjunction with INTER-NOISE 95. The Exhibition will include materials and devices for noise control as well as instruments such as sound level meters, noise monitoring equipment, sound intensity measurement systems, acoustical signal processing systems and equipment for active noise control.

A noise control seminar and an international symposium will be held at the Newport Beach Marriott immediately before INTER -NOISE 95. The seminar will be held on July 7-8, 1995. The 1995 International Symposium on Active Control of Noise and Vibration will be held on July 6-8.

For further information on these conferences, write to Noise Control Foundation, P.O. Box 2469 Arlington Branch, Poughkeepsie, NY 12603 USA.

Some Findings of Study on Reflective and Absorptive Noise Barrier Configurations for Railroad Retarders

By Martin Hirschorn, President, Industrial Acoustics Company, Inc.

There are still questions on the effects of sound absorption on the noise reduction performance of barriers for highways, railroads and airports; therefore the results of an eighteen year old specialized study on "Railroad Retarder Noise Reduction" might be of interest. The work was performed during 1975 to 1977 for the U.S. Department of Transportation, National Highway Traffic Safety Administration,Transportation Systems Center (TSC), Washington, D.C. under contract to the Burlington Northern Railroad, Inc. (BN) who subcontracted the work to the Industrial Acoustics Company, Inc. (IAC).

Cars and operational control were provided by BN under the direction of B.G. Anderson, Assistant Vice-President-Engineering. Field data were obtained and reduced by TSC under the direction of E.J.Rickley, Technical Monitor for this program. The existing ("normal") barriers and reconfigurations were designed and constructed by IAC. Data analysis was performed by Uno Ingard, consultant to IAC and Professor of Physics at Massachusetts Institute of Technology. (All individual positions and agency names are as they were in 1979).

The 80 page 1979 final report was written by Jim Morgan, the now retired Industrial Acoustics Company V.P. of R&D and Dr. Uno Ingard. The following includes extensive extracts from the report.

To alleviate a community noise problem, nine parallel Noishield Barriers 8 feet (2.4m) high, 143 feet (43.6m) long and 19'-3/4" (5.81m) apart, had been designed and installed by Industrial Acoustics Company at the Northtown railroad yard of the Burlington Northern Railroad in Minneapolis, Minnesota, an automatic classification facility with 63 tracks assembling freight trains for specific destinations.

The barriers consisted of 4 inch (102 mm) sound absorptive IAC Moduline Panels. For purposes of this study, 1/8 inch (3.12mm)-thick tempered Masonite covers were added to make barriers sound reflective. Acoustical measurements were taken at distances 25, 50 and 100 ft (7.62 - 15.24 and 30.48 meters) with the barriers absorptive and reflective when the absorptive panels were covered with masonite. Microphone heights were 5, 10 and 20 ft (1.52 - 3.54 and 6.1 meters) above ground level.

The noise problem was caused by railroad cars going down a "hump" when slowed down by retarders; the press on the wheels produced a squealing sound, with an intensity of about 114 dBA at 100 ft from the retarders with no barriers present. Most of the energy was in a frequency range between 2 KHz and 3 KHz resulting from friction generated vibration. The mechanism of noise generation presumably is not unlike the excitation of a violin string.

The results were summarized in the report as follows:

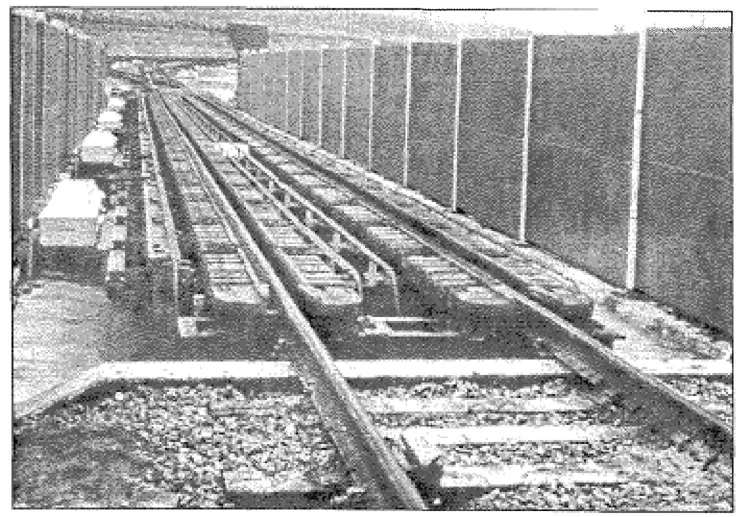
a. IL, (insertion loss), is markedly higher for an absorptive barrier than for a reflective barrier.

b. In a direction perpendicular to the barrier, typical values of IL are 16 to 22 dB for absorptive barriers between 8 and 12 feet high. Corresponding values for reflective barriers are 8 to 13 dB.

c. For a reflective barrier, the IL can be negative within a sector around the entrance and exit of the retarder, the angle of the sector being dependent on barrier height,

d. Barrier IL is dependent on direction to and elevation of the observation point as well as the barrier height.

e. Barrier extensions beyond the retarder improve IL within a sector around the entrance and exit of the retarder, but do not change IL in the direction perpendicular to the barrier.



f. Addition of an inward leaning "lip" along the upper edge of a barrier increases IL in the direction perpendicular to the barrier, but its effect decreases gradually to zero as the observation point is moved toward a direction parallel to the barrier.

g. The fact that substantially greater IL is achieved by an absorptive barrier may perhaps be explained by consideration of the effect of the "duct" which is formed between the barrier and the railroad car. The model of a single source shielded by a single barrier, which has been used in the development of standard prediction schemes, does not consider barrier absorption and is an oversimplification of the present problem.

h. Squeals generated by operation of the retarder in the manner chosen for this study typically lasted about five seconds with noise level reaching a maximum value usually when the car was close to the center of the retarder. The somewhat directional sound field, with highest levels in a direction perpendicular to the track, is offset by directional performance of the barriers; with barrier heights above ten feet, minimum levels occur in the perpendicular direction.

For the absorptive barriers, data were taken for five different heights, 4, 6, 8, 10 and 12 feet (1.22 - 1.83 - 2.44 - 2.29 - 3.66 meters). For the reflective barriers we have data for three different heights: 6, 8 and 12 feet. For the absorptive barrier the insertion loss increases with the barrier height and reaches a value of about 21 dB for a barrier height of 12 feet. The rate of increase of insertion loss per foot of barrier height varies from 3 dB per foot to about 1.5 to 2 dB per foot as barrier height increases. For the reflective barrier, the rate of increase is less and the value of insertion loss obtained with a 12 ft barrier is only about 12 to 13 dB.

A search of the literature should be undertaken to check whether similar barrier studies have been conducted for regular railroad low and high-speed train traffic. If the findings are negative we suggest that a noise control barrier study, similar to the one described above, be conducted for regular railroad transportation systems, as distinct from railroad retarder yards. ■

(For a copy of the complete report, contact Robert E. Schmitt at Industrial Acoustics, tel. 718 931-8000 or fax 718 863-1138)

Resurfacing for Noise Reduction: Results of an Experimental Overlay

By Bela Schmidt, Louis Berger & Associates, Inc., and Robert Fischer, New Jersey Highway Authority

The New Jersey Highway Authority operates the Garden State Parkway, a limited access toll road, which extends for 173 miles along the length of the state of New Jersey, from Cape May in the south to the New York State Line in the north.

In recent years the New Jersey Highway Authority has received an inordinate number of noise complaints from neighbors along the northbound roadway of the Garden State Parkway in the Toms River area. At one area of complaints the pavement surface consists of Portland cement concrete pavement slabs originally constructed with joints on 15 foot centers.

South of this area there is another section of the roadway where the pavement is bituminous concrete and traffic using this roadway section also generated high noise levels. At both locations the adjoining housing development is moderately dense with houses within 100 feet of the roadway. There is a wooded buffer zone between the roadway and the houses. These areas presently do not qualify for noise walls under the current New Jersey Highway Authority Policy for Construction of Sound Barriers.

In the summer of 1993, the New Jersey Highway Authority was approached by a Pennsylvania materials supplier offering to try out a new resurfacing material that was developed in France in 1988 called NOVACHIP. NOVACHIP has been used extensively in France, Belgium,Sweden, United Kingdom and Germany. To date in the US it has been used in the States of Alabama, Mississippi, Pennsylvania, New Jersey and Texas.

The New Jersey Department of Transportation is planning a NOVACHIP resurfacing project in 1994. NOVACHIP is used primarily for surface rehabilitation in place of chip seals, microsurfacing and thin overlays.

Some advantages of NOVACHIP include: no loose aggregate which is due to excellent adhesion, reduced noise levels, good skid resistance, no tire splash during rain of moderate intensity, simplified paving operation and quick reopening to traffic. The existing pavement to be overlaid must be structurally sound since NOVACHIP does not increase the structural capacity of the pavement. NOVACHIP is an ultra thin friction course approximately 1/2" to 5/8" thick. It is an open graded hot mix asphalt placed over a relatively heavy application of polymer modified emulsified tack coat. It is placed with specialized equipment that spreads both the tack and hot mix asphalt in a single pass, thereby simplifying the paving operation. The course aggregates are gap graded with a large portion of a single size crushed aggregate. The aggregates are coated with a mastic of sand, filler and asphalt cement. The asphalt cement content ranges from 4.7 to 5.3 percent depending on the actual gradation of the aggregates. The NOVACHIP asphalt is produced in a conventional drum mix plant and other than the gradation, the mix is essentially the same as conventional mixes.

The heart of the NOVACHIP process is the NOVACHIP paver,which consists of a receiving hopper for the hot mix asphalt, a screw type conveyor, the hot mix asphalt storage bin, a tack coat storage tank, the spray bar and finally the paving screed unit. All these components are mounted on a single chassis, which allows application at a rate of 20 to 25 meters per minute. The spray bar is mounted just ahead of the screed and applies the tack coat at a rate of 0.15 to 0.22 gallons per square yard, which compares to an average rate of 0.05 gallons per square yard for conventional mixes. Because the thickness of NOVACHIP overlays are approximately that of the size of the course aggregate, and therefore relatively thin compared to conventional dense graded overlays, NOVACHIP overlay requires less rolling and can be opened to traffic much sooner.

Resurfacing projects on the New Jersey Garden State Parkway typically consist of a 2" nominal thickness dense graded bituminous concrete overlay. This type of overlay is constructed at an average cost of approximately $6.00 per square yard, which includes items such as milling keyways at tie-in points, resetting inlet castings, placement of topsoil along the pavement edges and tack coat. Where NOVACHIP was used we substantially reduced or even eliminated items such as milling, resetting inlet castings and tack coat. With the reduction of these items the cost of NOVACHIP overlay was $3.18 per square yard, which is a 47 percent reduction in unit cost for resurfacing. There is a marked difference in surface drainage when driving on NOVACHIP in the rain.

Conventional bituminous concrete has a slick looking sheen when wet. NOVACHIP on the other hand has little surface water and in fact appears dry. Actual skid tests have shown a 13 percent increase in skid resistance compared to conventional mixes. Prior to applying the NOVACHIP overlay on two sections of the Garden State Parkway, our consultant Louis Berger & Associates measured the traffic noise levels on both bituminous concrete and Portland cement concrete pavements. The readings were taken at two locations simultaneously during morning and afternoon rush hours. The morning rush hours selected were on Fridays from 6:00 a.m. to 9:00 a.m.and the afternoon rush hours were on Mondays from 4:00 p.m. to 7:00 p.m. These measurements were made once before and once after the NOVACHIP resurfacing. The location of measurements, instruments and field personnel were kept the same. This was considered important because the task was to gather data that was comparable in every detail. Noise Levels Research into the sources of sideway noise levels generated by roadway vehicles identified several mechanisms that contribute to the overall noise levels impacting residential properties along roadways. These mechanisms, which may be called acoustic sources depend on the type of vehicle, its operating mode, type of power plant, level of maintenance, weather conditions, loading and road surface conditions.

The simple quantitative test conducted last fall at two sites along the Garden State Parkway was based on the assumption that free flowing peak traffic on weekdays is essentially the same from one week to the next and therefore wayside noise levels are also comparable when recorded over several weeks. Therefore it is reasonable to assume that if only one of the several noise sources, such as tire noise generated by altered road surface conditions changes, the change in measured wayside noise levels may be directly linked to the changed road surface conditions, thus establishing a cause and effect relationship. The emerging interest in roadway surface as one of the options for reducing free flowing highway noise is not new and may be explained by the relative contribution of the tire/surface interaction source to the overall wayside noise levels.

At both test sites, free flowing traffic, with Level of Service B to C, cruised by at steady speeds of approximately 55 to 65 mph. In this speed range and when travelling on a level and dry road surface at steady speed, engine and gear noise are no longer prominent and aerodynamic noise is not yet a major contributor to the overall total. Therefore, our attention was focused on the tire/surface interaction as a major noise source under these regularly occurring modes of highway use. While tire surface pattern and tire side wall construction does influence roll by noise levels, a much greater improvement (3 to 6 dBA) may be achieved by changing the roadway surface. For this reason, it is generally considered that there are greater opportunities in reducing the output from the tire/surface noise source by changing the road surface texture than by a redesign of the tire itself. Types of open textured road surfaces with high acoustic absorption are being used increasingly in Europe and North America with additional benefits beside noise reduction.

The tests described here were conducted on two days in September and two days in October of last year. A traffic count was made for each of the four days at the nearby Toms River Toll Plaza and from this data the traffic volume and mix were calculated for one of the test sites to ensure that no unobserved changes took place during data collection. The traffic data showed no change for the Friday AM peak traffic hours and a decrease of 4 1/2 percent in number of vehicles for the after paving test in case of the Monday PM peak traffic hours. This 4 1/2 percent decrease in traffic volume was offset by an 3 percent increase in commercial vehicles.

In the simplified test procedure reported here a stationary monitoring technique was employed to measure wayside traffic noise levels at two separate sites 2 1/2 miles apart. One microphone was used at each site, mounted on a tripod 5 ft. above grassy surface. Both locations were next to north bound travel lanes of the Garden State Parkway, at MP 80.69 and MP 83.18 test site. Microphone distances from the edges of the nearest travel lane were 37 ft. and 23 ft., respectively. An approximately 100 ft. wide wooded strip of land provided a buffer zone between residential properties and the traffic.

Data collection was accomplished using two B&K made Type 1 (precision grade) Noise Level Analyzers programmed to continuously monitor and sum up statistical data at 15 minute intervals. No frequency analysis was done on any of the data gathered. The statistical data collected were the L01, L10, L50, L90, L99, and Leq descriptors. The same instruments were used by the same operators at the same location for each of the tests and a log maintained to record all events pertinent to the measurements. A total of 12 data points were obtained during each of the 3 hour long tests conducted at each of the two sites.

The 15 minute Leq noise levels and the time of the day were plotted for each test site to show the difference between noise levels recorded before and after repaving. The test results presented here are site dependent because of the type of road surface before the resurfacing. At the bituminous concrete roadway segment tested at MP 80.69 the average noise level reduction achieved was 1.4 dB during the morning and 2.1 dB during the afternoon rush hours. Considering that for broadband noise, such as steady traffic heard at a distance, only a 3 dB or greater change is noticeable, the change achieved at this location may not be significant to residents living next to the roadway.

However, at the other site further north at MP 83.18, where a Portland cement concrete road surface was overlayed with NOVACHIP, the difference amounted to 3.2 dB in the morning and 4.1 dB in the afternoon. The improvement would have been greater were it not for the fact that of the 3 travel lanes only the middle and the left (fast) lane were concrete slab before repaving. The nearest lane already had a relatively smooth bituminous overlay similar to the one at the alternate test site before overlay. The test results reported here compare favorably with the NOVACHIP developer's data who reported a 2.6 dBA reduction at 56 mph and a 3.1 dBA reduction at 68 mph.

In summary, the test results show that a significant reduction in noise levels can be achieved on existing Portland cement pavement by using the NOVACHIP ultra©thin overlay. Noise reduction was less impressive with NOVACHIP on existing bituminous concrete. It is clear that NOVACHIP shows some promise in the reduction of noise levels; however, additional studies are required before this type of pavement can be recommended as an alternate noise abatement method with specific reduction in noise levels. The experimental work reported here focused on the influence of a specific road surface on the roll by noise levels of typical, free flowing highway traffic.

The test results indicate that for free flowing highway traffic at cruising speeds, the road surface can reduce the wayside noise levels and thus the need for additional mitigating measures. Sources in literature indicate that the higher the cruising speed within the permitted speed limits the greater the influence of the tire noise component on the overall noise levels. An evaluation of the variables of highway traffic suggests that the higher the percentage of light vehicles in a given traffic the greater the change in noise levels that may be achieved by altering the road surface. This is because commercial vehicles have a much stronger engine/gear noise generated component added to the total noise level at cruising speeds, which component is independent of the road surface the vehicles are travelling on.

It is worthwhile to note that future alternatives for highway noise abatement may well include quieter road surfaces with the potential to lower the height of noise barriers or, in borderline cases, eliminate the need for barriers altogether. And with the expected introduction of active noise control for commercial vehicles, a triad of highway noise mitigating measures will hopefully become available to officials responsible for traffic noise abatement.The change in measured wayside noise levels indicates that any computerized highway noise prediction model in the future should include data on the effect of road surface. Such refinement would present an expanded range of options in the search for finding the best combination of mitigating measures to reduce highway noise impacts. ■

(Ed. Note: There are a number of photos, graphs and tables in the complete paper, which space does not allow us to print. For information on the complete paper, contact Bela Schmidt at Louis Berger & Associates, telephone 201 678-1960, ext. 471.

HIGHWAY TRAFFIC NOISE BARRIER CONSTRUCTION TRENDS

Published July 1994 by United States Department of Transportation, Federal Highway Administration
Office of Environment and Planning, Noise and Air Quality Branch
Washington, D.C.

INTRODUCTION

The construction of highway traffic noise barriers is the most commonly used noise abatement measure found in highway programs. As of the end of 1992, 40 State highway agencies (SHAs) and the Commonwealth of Puerto Rico had constructed over 923 miles of noise barriers at a cost of over $816 million ($875 million in 1992 dollars). A detailed listing of noise barrier data may be found in "Summary of Noise Barriers Constructed by December 31, 1992" (see end of this article for availability). Following is a brief analysis of the data contained in the detailed barrier listing.

It should be noted that the data represent best estimates of SHAs on barrier construction. There may be nonuniformity and/or anomalies in the data due to differences in individual SHA definitions of barrier information and costs. However, some useful trends are evident. It should also be noted that data is not available for California for the years 1990, 1991 and 1992. This fact greatly affects trends shown for these years, since California constructs many noise barriers annually as shown by the following:

Year	Miles Constructed	Cost in 1992 $
1985	10.6	8.3 M
1986	27.3	29.4 M
1987	30.5	24.6 M
1988	33.6	27.2 M
1989	19.3	16.4 M
	121.3	105.9 M

NOISE BARRIER CONSTRUCTION

Some of the data contained in the detailed barrier listing has been converted to tabular form. Tables 1-8 provide data on barrier construction, height, materials and unit costs. The following points are drawn from the tables:

A. Expenditures in the last five years comprise almost 55% of the total for over 20 years of recordkeeping.

B. The overall average unit cost, combining all materials, is $13.75 per square foot. The average unit cost, combining all materials, for the last five years is $14.86 per square foot.

C. Approximately 30 miles of barriers have been built with highway program monies other than Federal-aid. Overall, approximately three-fourths of Federal-aid barriers have been Type I (a barrier built on a highway project for the construction of a highway on new location, or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment, or increases the number of through-traffic lanes). Type I barriers have comprised approximately 90% of Federal-aid barriers over the last five years. Type II (a barrier built along an existing highway) barrier construction has decreased, probably due to economic conditions.

D. Eighty percent (80%) of barriers that have been constructed range in height from 7 to 16 feet. Two percent (2%) of barriers are less than 7 feet tall, thirteen percent (13%) are 16 to 23 feet tall, and five percent (5%) are more than 23 feet tall. The overall average barrier height is 12 feet.

E. Barriers have been made from materials that include concrete, masonry block, wood, metal, earth berms, brick and combinations of all these materials. The large total for block in Table 5 is influenced by the the fact that California has built over one-fourth of all barriers and has used block almost exclusively until recently. The unavailability of California data for the years 1990-1992 is reflected in the low block totals for these years in Table 5.

F. Concrete has consistently been the most-used material for barriers since 1988. Concrete represents 36% of total material usage, block 22%, and wood 14%. Metal, berm and brick together account for less than 10% of the total. Seventeen percent (17%) of all barriers have been constructed with a combination of an earth berm and a wall.

G. Average unit costs for all years for all barrier materials range between $11.06 to $16.63 per square foot, except for earth berms which average only $3.53 per square foot. While concrete has been the most popular material, it has also been the most expensive at $16.63 per square foot. Overall average costs for wood, metal and combination barriers are approximately the same ($11.89, $11.05, and $11.80, respectively).

H. There are no block or brick barriers over 23 feet tall, or metal barriers over 26 feet tall. Wooden barriers have been constructed to heights of 24 feet and combination barriers to heights of 32 feet. Barriers more than 32 feet tall have been constructed both with concrete and with earth berms.

I. Unit costs for barriers do not always appear to increase as the barrier height increases (Note: This may be due to nonuniformity and/or anomalies in the data reported by SHAs).

SUMMARY

The most notable trend in highway traffic noise barrier construction is a dramatic increase in the amount of construction starting in 1988. SHAs have been spending approximately $100 million annually (remembering that the totals for 1990-1992 do not include California data estimated at $25-30 million annually). This increase has been attributable to Type I projects.

Most barriers have been made from concrete or masonry block, range from 10 to 16 feet in height, and average $13.94 to $16.72 per square foot in cost. ■

Editor's Note: We have taken a few editorial prerogatives with this material which was furnished us by the Federal Highway Administration. We hope they are not going to make a federal case out of this.

First, the material given contained only metric measurement data. Although we are well aware that the government wishes us to use metric measurements, I personally am a dinosaur and can conceptualize, ideate, and quantificate only in United States Customary Measurement terms.

Therefore, I have taken the liberty (and the hours and pain) to convert all metric measurement to United States measurements. The highway traffic noise barrier program is so vast that, to be understood, it must be represented in terms which are easily and quickly grasped by all of us.

The FHWA data shown here and in the tables, and in the Summary, are invaluable information to those in the industry.

For the "Summary of Noise Barriers" and further information, contact Bob Armstrong at FHWA, 202 366-2073.

YEAR	MILES	ACTUAL COST	1992 COST
?	5		
1970	1		
1971			
1972	1	500000	1,000,000
1973	2	5,00000	1,000,000
1974	14	5,000,000	10,000,000
1975	21	6,000,000	10,000,000
1976	6	1,000,000	2,000,000
1977	15	7,000,000	13,000,000
1978	60	28,000,000	42,000,000
1979	60	26,000,000	33,000,000
1980	44	23,000,000	25,000,000
1981	42	27,000,000	31,000,000
1982	26	19,000,000	23,000,000
1983	40	30,000,000	37,000,000
1984	53	42,000,000	49,000,000
1985	43	37,000,000	39,000,000
1986	65	70,000,000	72,000,000
1987	54	47,000,000	49,000,000
1988	93	106,000,000	104,000,000
1989	102	110,000,000	108,000,000
1990	39	58,000,000	56,000,000
1991	63	82,000,000	79,000,000
1992	76	91,000,000	91,000,000
TOTAL	**923**	**$816,000,000**	**$875,000,000**

TABLE 1
Noise Barrier Construction by Year

Note that 5 miles of noise barriers can neither be assigned a year of construction nor a cost. Also, 17 miles of barriers, while assigned a year for construction, cannot be assigned a cost. Note also that data is not available for California for the years 1990, 1991 and 1992.

YEAR	SQ. FT.	COST IN 1992 $	COST/SF
?	441,000		
1972	65,000	1,000,000	16.82
1973	108,000	1,000,000	12.54
1974	775,000	10,000,000	13.19
1975	1,249,000	10,000,000	8.18
1976	291,000	2,000,000	8.08
1977	1,044,000	13,000,000	12.26
1978	3,983,000	42,000,000	10.68
1979	3,757,000	33,000,000	8.64
1980	2,939,000	25,000,000	8.45
1981	2,379,000	31,000,000	13.01
1982	1,722,000	23,000,000	13.20
1983	2,648,000	37,000,000	14.03
1984	3,143,000	49,000,000	15.61
1985	2,713,000	39,000,000	14.21
1986	4,155,000	72,000,000	17.37
1987	3,584,000	49,000,000	13.56
1988	6,405,000	103,000,000	16.17
1989	7,190,000	108,000,000	14.96
1990	3,778,000	56,000,000	14.77
1991	5,382,000	80,000,000	12.82
1992	5,931,000	91,000,000	15.42
ALL	**63,680,000**	**$875,000,000**	**$13.75**

TABLE 2
Noise Barrier Construction Average Unit Cost by Year

Note that data is not available for California for the years 1990, 1991 and 1992.

(Continued next page)

(continued from page 9)

	TYPE I Miles	TYPE II Miles	TYPE I % of Total	TYPE II % of Total
?	6		100	
1970 -79	104	72	61	39
1980	37	7	83	17
1981	22	21	52	48
1982	18	6	74	26
1983	29	9	77	23
1984	39	14	73	27
1985	29	15	66	34
1986	41	24	63	37
1987	35	16	69	31
1988	83	8	91	9
1989	87	8	92	8
1990	35	4	88	12
1991	57	5	92	8
1992	58	6	90	10
ALL YEARS	**678**	**215**	**76**	**24**
TOTAL TYPES I & II		**893**		
ALL OTHER TYPES		**30**		
TOTAL ALL TYPES		**923**		

TABLE 3
Type I & II Construction by Year

HEIGHT	NO. of MILES	% of TOTAL
Under 7′	19	2%
7′ - 10′	132	14%
10′ - 13′	288	31%
13′ - 16′	321	35%
16′ - 19′	55	6%
19′ - 22′	63	7%
Over 22′	45	5%
ALL HTS.	**923 Miles**	**100%**

TABLE 4
Noise Barrier Construction by Height

NOTE to Table 3: A Type I barrier is one built on a highway project for the construction of a highway on new location or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes. A Type II barrier is one built to abate noise along an existing highway. This type of abatement, commonly referred to as retrofit abatement, is not mandatory and is constructed at the the option of the SHA. Seventeen (17) States have constructed Type II barriers. **It should also be noted that data is not available for California for the years 1990.1991 and 1992.**

(continued on next page)

(Noise Barrier Construction Trends, continued)

YEAR	CONCRETE SQ FT	BLOCK SQ FT	WOOD SQ FT	METAL SQ FT	MIXED SQ FT	BERM SQ FT	BRICK SQ FT
Unknown	226,000			140,000	75,000		
1970 - 1982	2,992,000	4,198,000	3,208,000	1,044,000	4,607,000	2,099,000	97,000
1983	452,000	840,000	291,000	183,000	463,000	355,000	65,000
1984	1,206,000	1,206,000	452,000	43,000	129,000	86,000	11,000
1985	452,000	990,000	441,000	11,000	700,000	86,000	11,000
1986	1,238,000	1,335,000	581,000	140,000	764,000	54,000	22,000
1987	893,000	1,798,000	280,000	43,000	538,000		32,000
1988	3,035,000	2,131,000	280,000	54,000	549,000	22,000	11,000
1989	2,874,000	1,281,000	1,485,000	226,000	1,023,000	140,000	108,000
1990	2,411,000	22,000	947,000		366,000	43,000	
1991	3,111,000	32,000	560,000	409,000	1,001,000	11,000	248,000
1992	4,252,000	97,000	635,000	151,000	614,000	32,000	43,000
TOTAL	**23,143,000**	**13,929,000**	**9,160,000**	**2,443,000**	**10,829,000**	**2,928,000**	**646,000**

TABLE 5
Noise Barrier Construction by Year by Material Type

Note that there are 600.000 square feet of noise barriers constructed with other materials.
Note 2: No breakout has been done for sound-absorptive barriers, which are included in the above.

YEAR	CONCRETE PER SQ FT	BLOCK PER SQ FT	WOOD PER SQ FT	METAL PER SQ FT	COMB. PER SQ FT	BERM PER SQ FT	BRICK PER SQ FT
1983	21.74	17.37	11.61	8.73	12.82	2.14	17.28
1984	16.54	17.28	9.20	20.25	22.95	1.86	18.86
1985	21.00	10.68	10.78	26.29	17.37	2.97	14.96
1986	18,67	18.86	17.84	11.33	13.29	6.97	22.20
1987	16.26	12.54	10.87	16.07	13.48		27.31
1988	19.79	11.71	9.75	11.61	14.96	5.76	22.02
1989	18.02	12.45	13.66	10.50	13.66	2.79	20.53
1990	17.37	10.59	12.91		7.99	0.19	
1991	16.44	11.33	17.00	10.50	10.41		13.19
1992	15.98	16.82	13.94	15.70	13.94	10.03	16.16
ALL YEARS	**$16.63**	**$13.84**	**$11.89**	**$11.06**	**$11.80**	**$3.53**	**$16.44**

TABLE 6
Noise Barrier Construction Material Average Unit Cost by Year

Note that there are 600.000 square feet of noise barriers constructed with other materials, costing approximately $22.76 per square foot.
Note 2: No breakout has been done for sound-absorptive barriers, which are included in the above.

(continued on page 16)

Summaries of Professional Papers

Presented at the TRB A1F04 Committee1994 Summer Meeting in Philadelphia, Pennsylvania July 10-13, 1994
Hosted By: McCormick, Taylor & Associates, Inc. and the Pennsylvania Department of Transportation

NOISE REDUCTION BY A BARRIER WITH ROUND ABSORPTIVE MATERIAL ALONG THE EDGE

This paper presents one of the ways to get larger excess attenuation by a lower noise barrier. It is well known that the edge potential of the barrier acts like a second noise source specifically for the shadow region. Following this fact, a large excess attenuation will be expected by reducing the edge potential. The sound diffraction behind the barrier with the absorptive round edge was analyzed theoretically using the geometrical theory of diffraction, and the excess attenuation caused by the absorbing edge was numerically calculated. This value amounted to about 7 to 8 dB in the practical shadow region. Experimentally, this effect was checked using a scale model in the anechoic room and the same result was also obtained.

From this result, an absorbing cylinder for practical use was developed. The effect of this practical cylinder was measured when it was installed at the top of the existing noise barrier along the expressway. The effect was found to be about 2 to 3 dBA in the field experiment.This effect corresponds to the excess attenuation obtained by the use of a thin noise barrier, which is 2m higher, but without absorbing cylinder.

To answer the aesthetic demands a new absorptive element was developed. This element was named "ROUTE SILENT", which has the shape of a mushroom in cross-section and the same perimeter as that of the prototype. The effect of this type of absorbing edge was also measured in the field and a little larger excess attenuation was obtained.

Author: K. Fujiwara, Department of Acoustic Design, Kyushu Institute of Design, Shiobaru 4-9-1, Minami, Fukuoka, Japan

THE NOISE ABATEMENT PROGRAM OF THE MTA — NEW YORK CITY TRANSIT

Authors: Tom Carmody and William Jehle New York City Transit Authority
(Paper summary and address of authors not given).

SOUND INSULATION OF HOMES TO MITIGATE 24-HOUR CONSTRUCTION NOISE

As part of Westside LRT Project in Portland, Oregon Eq-Met has been granted a noise variance by the City of Portland to construct during the nighttime hours of 10 p.m. to 7 a.m. One of the conditions of the noise variance is a program to retrofit impacted homes in the Goose Hollow community at the East Portal of the Tunnel with additional sound insulation. This program, known as the Sound Insulation Program, is based on treating those homes that are expected to be exposed to nighttime construction noise of L_{eq} = 50 dBA or more.

The Sound Insulation Program consists of the following key elements:

- Improve the noise reduction provided by the existing exterior building elements of each home with the windows and doors closed for sleeping and living quarters directly exposed to the construction noise.
- To provide (1) a noise reduction of 25 dB between outside and inside and (2) to reduce the nighttime interior noise levels to 35 dBA or lower.
- Allow the homeowner to establish a priority list of the spaces to be treated within the budgeted monies allocated per home.

Author: Steven Wolf, Parsons Brinckerhoff, 505 South Main St., Orange, CA 92669 Tel. 714 973-4800

CHALLENGES AND OPPORTUNITIES IN DEVELOPING RESIDENTIAL/COMMERCIAL PROJECTS IN A NOISE NEIGHBORHOOD

A dyeing factory in a mixed industrial and residential part of Tsuen Wan, Hong Kong, is planned for redevelopment into a residential-cum-commercial complex. Besides being surrounded by district distribution roads and containing a proposed elevated trunk road and a nullah, the site is adjoined by a number of multi-story industrial buildings and shunting area of the Mass Transit Railway.

This paper describes the planning objectives and the various noise mitigation measures including innovative building design and the integration of road construction into the building structure for noise amelioration. The redevelopment proposal presents a challenging job for both noise specialists and architects in making a noise sensitive development viable in an established urban area.

Authors: James Wong, Noise Policy Group, Environmental Protection Department, Hong Kong Government, and Stephen Wong, Axis Environmental Consultants, Ltd., Hong Kong
(Addresses not available)

RESURFACING FOR NOISE REDUCTION: RESULTS OF AN EXPERIMENTAL OVERLAY

The New Jersey Highway Authority resurfaced two sections of the Garden State Parkway pavement using an ultra thin, open graded, bituminous resurfacing material developed in France called "Novachip".The material was used over both existing bituminous concrete and Portland cement concrete pavements. "novachip" reduces noise, improves skid resistance and improves surface drainage. This presentation will focus on the methodology employed and the measured noise level reductions obtained by roadside monitoring of actual traffic. Data to be presented include the results of 24 hours of measurements, traffic volumes and vehicle speeds. The presentation will be illustrated with 35mm slides and viewgraphs.

Authors: Bela Schmidt, Louis Berger & Associates, Inc., 100 Halsted St., East Orange, NJ 07019, tel. 201 678-1960x471, and Robert J. Fischer, New Jersey Highway Authority, Woodbridge, NJ.

(Note: An expanded summary is printed elsewhere in this issue; see paper title on the first page)

CONSIDERATIONS FOR CORRECTING SOUND LEVEL MEASUREMENTS WITH BACKGROUND NOISE

In many sound measurement situations, the need arises to determine the magnitude of a specific sound source while persistent — although fluctuating — background noise exists. Measurements can be obtained of the "total" (i.e., source and background noise together) and the background alone. Correction procedures are widely used for adjusting such measurements, but these procedures are not recommended if the background noise is within 4 dB of the total. This paper examines the uncertainty associated with these corrections and their viability for high-background noise measurements.

A correction scheme is proposed which consists of repetitive measurements of the source-signal-with-background and background noise alone, then the computation of a signal estimate and prediction interval. The procedure assumes that both the source of interest and background noise are: uncorrelated, normally distributed, random processes which are stationary over the duration of the measurements. The procedure was tested using both random numbers and experimental measurements. The test yielded mean errors of about 0.5 dB with 30 measurements and -10 dB signal/noise ratios.

For useful results, the numbers of measurements must be selected to provide for a calculated confidence interval which acceptably contains the prediction errors. These requirements are strongly influenced by the variability of the measure parameters. For relatively low background noise situations, the technique is useful primarily for quantifying expected measurement confidence bounds.

Author: Michael A. Staiano, Staiano Engineering, Inc., 1923 Stanley Avenue, Rockville, MD 20851-2225, tel. 301 468-1074

ACOUSTIC LIGHTWEIGHT BARRIERS TO ABATE AIRCRAFT AND HIGHWAY NOISE

The major difficulty in noise control is to achieve a high level of noise reduction at low frequencies such as in the range up to 500 Hz. However, the low frequency content in aircraft and highway noise is the most significant. According to the Mass Law, the construction of the barriers needs to be massive in order to reduce noise in [the] low frequency range. Brick or concrete walls are usually heavy enough to be good sound reflectors, though the cost of manufacturing and installation of such heavy barriers is relatively high. We propose lightweight, inexpensive barriers which have the same or even higher transmission loss as ten-to-twenty times heavier concrete barriers. We will also present a novel design of windows to obtain higher noise transmission loss in the low frequency range.

Author: Dimitri M. Donskoy, Stevens Institute of Technology
(address not readily available)

GIS APPLICATIONS IN THE MARYLAND STATEWIDE HIGHWAY NOISE ABATEMENT PROGRAM

Summary not available.

Author: Ken Polcak, Office of Environmental Design, Maryland State Highway Administration, 707 N. Calvert St. Rm 312, Baltimore, MD 21202, tel. 410 333/8072

COMMUNITY PARTICIPATION AND AESTHETIC CONSIDERATIONS IN TYPE II HIGHWAY NOISE ASSESSMENTS

A Type II noise study has been performed for the 16-mile corridor of Route I-287 in New Jersey between the New Jersey Turnpike and Route 22. Since several residential communities would be affected by the construction of noise barriers along this corridor, public participation in the barrier design process was encouraged by the New Jersey Department of Transportation and its consultants. Key issues involved in educating the public on noise issues and fostering best relations for public acceptance of barrier installations will be discussed. A 3-dimensional GIS model used for topographical and building shielding modeling was used in this analysis which provides instructive graphic displays for public presentations.

Author: James Cowan, McCormick, Taylor & Associates, Inc., 701 Market St., Suite 6000,Philadelphia, PA 19106, tel. 215 592-4200

DNL DEMOGRAPHICS: AN ALTERNATIVE TO "DEMOCRATIC" ANALYSIS OF AIRPORT NOISE COMPLAINTS

Airport noise abatement programs might include tabulation of community complaints on the assumed basis that number or frequency from a given source indicates a need for operational or air traffic control remedy in a particular part of the airport environs. A summary of recorded complaints at Pittsburgh International Airport from 1989-1993 suggests that this democratic method, tacitly equating complaints with votes, should be qualified by analysis of sociological and other non-operational, human factors, such as age and character of neighborhood, social circumstances of callers, dates, times and seasonal variations of complaints, and publicity of airport matters, like construction, Part 150 studies and litigation. The paper will recommend strategies for making this analysis and addressing presumed noise problems, by reference to particular neighborhood and individual situations, through noise abatement and litigation structures, and for coordinating these structures.

Author : Maria Zulick Nucci, Esquire, Allegheny Department of Aviation, Pittsburgh International Airport, Landside Terminal, Suite 4000, P.O. Box 12370, Pittsburgh, PA 15231-0370, tel. 412 472-3542

NOISE IMPACT AND ABATEMENT FOR NORTHEAST CORRIDOR OPERATIONS

Noise and operating conditions are reported and assessed for Amtrak inter-city and MBTA commuter trains providing service along a 6-mile section of the Northeast Corridor main line passing through residential areas near Boston. The feasibility and costs associated with alternate noise abatement methods are reported. Eight noise abatement methods, including noise barriers, are discussed.

Author: David E. Coate, Acentech Incorporated, 125 Cambridge Park Drive, Cambridge, MA 02140, tel. 617 499-8019

THE 89TH AIRLIFT WING'S AIRPORT RELATIONS PROGRAM — DEALING WITH STAGE I AIRCRAFT IN THE EASTERN REGION...AND THE WORLD

This presentation will describe the 89th Airlift Wing's Airport Relations Program. This program has been initiated to deal with the issues of using civilian airports in the Eastern Region for training by Stage I and II aircraft. The 89th has a fleet of civilian aircraft including unmodified B-707's, DC-9's, G-111 's, and associated B-727's. Due to the nature of the wing's mission, these aircraft must train at airports in the region in maneuvers which increase the noise levels of these already noisy aircraft. This program comprises both operations, communications and administrative improvements.

While actual noise reduction ability is small, operational improvements include noise abatement training and management of of noise sensitive airport usage. Communications efforts include surveying airports for noise abatement and operations information and participating at airport meetings and regional conferences. Administrative efforts to improve response to noise complaints and utilize more airports in the region are also being pursued. The 89th Airlift Wing Airport Relations Program sets a precedent for improving interaction

(continued next page)

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between the military and civilian airports which may become increasingly important as the military concentrates more aircraft at fewer bases.

Author: Matthew W. Kundrot, Captain, 1st Helicopter Squadron/89th Airlift Wing, Andrews Air Force Base, Maryland

STAMINA 2.0 AND ORNAMENT GROUND ATTENUATION ALGORITHM EVALUATION FOR SITES WITH BARRIERS

STAMINA 2.0 was evaluated with the ground attenuation algorithm used in the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) to determine its potential to improve predictions for noise levels at receiver locations near traffic roadways in which barriers are present in the propagation path. For the study of 41 sites, it was found that STAMINA 2.0 with the ORNAMENT ground attenuation algorithm reduced the mean over prediction of noise levels from 2.6 dB, for STAMINA 2.0 alone, to 0.5 dB. The mean errors for the two predictions were found to be statistically different from each other, and the mean error for the prediction with the ORNAMENT ground attenuation algorithm was not found to be statistically different from zero. The STAMINA 2.0 program predicted little, if any, ground attenuation for receivers at typical first-row distances from the highway where noise barriers were used. The ORNAMENT ground attenuation algorithm, which recognizes and better compensates for the presence of a barrier in the propagation of a sound wave, predicted significant amounts of ground attenuation for most sites.

Author: Lloyd A. Herman, Civil Engineering Department, Ohio University, 141 Stocker Center, Athens, OH 45701 ■

Ed. Note: These summaries have been printed in the order in which they were presented at the meeting. Please contact the authors directly if you wish more information on their papers. If you have any difficulty in reaching an author, drop us a line and will try to locate for you.

The TRB Committee A1F04 Summer Meeting 1994 —

By Domenick Billera, Chairman,TRB Committee A1F04, Transportation Related Noise and Vibration

If you read a magazine from front cover to back, I can assume that you have read all of the "Summaries of Professional Papers" (on pages 12, 13 and 14) which were presented at this year's annual summer meeting.

If you have done so, then you have a general awareness of the scope and type of activity which occupied three full morning sessions to accomplish. And this does not take into account the work of the authors to write the papers and prepare the presentations to include appropriate slides, charts, graphs, etc.

That's the hardest part of these meetings, and perhaps the best part. These papers are all prepared by working professionals in the field. Professionals who have a wealth of experience in their particular discipline, and have the willingness to share it with their fellow professionals.

At the end of each presentation, there is a spirited question-and-answer time, which usually has to be cut short to stay on schedule. Our knowledgable audiences always have something to say or questions to ask. When the presenter is through, he or she is rewarded with a warm round of applause.

That's _participation_ and _involvement_. Our summer meetings are now going into their 13th year. And they keep receiving larger attendance every year. The reason for this is that, for the summer meetings, we meet exclusively within our membership and friends and associates. This allows us to expand our participation, involvement and learning experiences. One method is through:

TECHNICAL TOURS

These tours were conducted during the afternoon hours of the meetings. This year, attendees had their choice of two out of three Technical Tours. The three:

A. Air Traffic Noise: Boeing Helicopters Tour includes a presentation on the V-22 Osprey Tiltrotor and the new RAH-66 Comanche helicopter; a discussion of rotorcraft noise; a tour of the largest wind tunnel in the U.S.; and a tour of Boeing's flight simulation laboratory, which has been used to research the effect of flight control management to community noise.

B. Rail Noise: Southeastern Pennsylvania Transportation Authority. Tours of Fern Rock loop track for a discussion of the associated rail noise problem and solution, with a following tour of the subway.

C. Highway Traffic Noise. A bus tour of metropolitan Philadelphia noise barriers, guided by Harvey Knauer, PennDOT's I-95 Project Coordinator, Peter Dodds of KCI Technologies, and David Still of Gannett Fleming. The tour visited two award-winning newer projects, including some of the Blue Route's (I-476) 22 miles of sound barriers; a revisit of I-95, last seen by this committee in 1980, to view new retrofitted barriers; and visit to some of the most innovative sound wall treatments in the country on the Vine Street Expressway. On the Blue Route, we saw other interesting design features, including a walkway/bikeway system in the Swarthmore College area.

As you can see, these Technical Tours are representative of the three principal areas of the A1F04 Committee's research and investigation activities: Air, Rail and Highway traffic noise. There were two very full afternoons of hands-on examination and learning experience of some outstanding noise abatement projects. That is why we included two restful evening social gatherings:

SPECIAL EVENTS

The first was a visit to a restaurant on Philadelphia's beautiful waterfront. In this convivial atmosphere of wining and dining, the attendees freely intermingled to further share their experience and ideas for new research in their fields. The second was the:

CHAIRMAN'S BARBECUE

As a grand finale to the activities, all of the attendees were invited to "Quadrifoglio", my home in the rolling hills of Northampton county in Pennsylvania, for an outdoor barbecue and an evening of entertainment.

ACKNOWLEDGMENTS

A large number of people contributed to the success of this year's annual meeting, too many in fact to list by name. The presenters of the papers were, of course, the prime contributors. The audience contributed with insightful questions for the authors. The exhibitors, who have become an integral part of the meetings, contributed to the wealth of information available to the attendees. The organizers, McCormick, Taylor and Associates, Inc., and the Pennsylvania Department of Transportation contributed untold hours in the planning and implementation of the entire meeting. All of these groups were the winners in the process.

For those of you who have not yet attended a TRB Committee A1F04 meeting, we strongly urge you to join us in Boston, Massachusetts, July 16-19, 1995 for our next annual summer meeting. You will come away a winner, too.

Sprinkled throughout this issue, you will find some assorted photos of the summer's activities. We'd like to see you in the picture. We need representation from many more state highway agencies. Please call me at the New Jersey Department of Transportation to discuss your joining and participating in A1F04 activities. My telephone number is 609 530-2834, my fax number is 609 530-3767. ■

Conference coordinators Deborah Fries and Tamar Arslanian of McCormick, Taylor & Associates also greeted the arriving attendees and performed the requisite Summer Meeting registration rites.

(more photos on page 17,18,20 and 21)

(*Noise Barrier Construction Trends*, continued from page 11)

HT.	CONCRETE SQ FT	BLOCK SQ FT	WOOD SQ FT	METAL SQ FT	COMB. SQ FT	BERM SQ FT	BRICK SQ FT	ALL SQ FT
> 32′	75,000					43,000		118,000
32′	312,000				172,000	43,000		527,000
29′	269,000		43,000		129,000			441,000
26′	2,067,000		937,000	75,000	484,000	280,000		3,843,000
23′	2,443,000	313,000	1,442,000	301,000	2,423,000	129,000		7,050,000
19′	3,294,000	32,000	958,000	65,000	667,000	43,000	172,000	5,253,000
16′	9,462,000	6,232,000	3,003,000	1,227,000	3,638,000	538,000	194,000	24,736,000
13′	3,638,000	5,845,000	1,851,000	657,000	2,379,000	1,367,000	151,000	15,985,000
10′	1,474,000	1,442,000	753,000	108,000	926,000	388,000	129,000	5,264,000
7′	108,000	65,000	172,000	11,000	11,000	97000		463,000
ALL	**23,143,000**	**13,929,000**	**9,160,000**	**2,443,000**	**10,829,000**	**2,928,000**	**646,000**	**63,680,000**

TABLE 7
Noise Barrier Construction Material by Height

Note that there are 600,000 square feet of noise barriers constructed with other materials

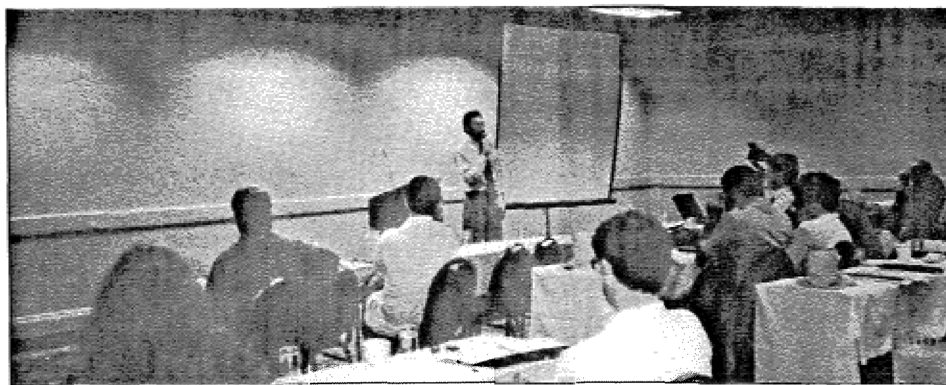
HT.	CONCRETE PER SQ FT	BLOCK PER SQ FT	WOOD PER SQ FT	METAL PER SQ FT	COMB. PER SQ FT	BERM PER SQ FT	BRICK PER SQ FT	ALL PER SQ FT
> 32′	29.77							20.07
32′	18.86				4.83	1.39		12.91
29′	11.24		6.69		9.94			10.41
26′	19.88		17.09	14.40	8.73	2.42		16.35
23′	17.84	13.84	8.64	7.53	9.57	1.58		12.17
19′	18.12	14.96	16.54	14.96	12.17		14.49	17.00
16′	16.26	11.15	12,91	9.94	14.03	4.55	14.68	13.75
13′	14.68	16.91	8.55	12.91	11.43	3.16	17.09	13.29
10′	14.03	13.94	10.78	9.66	12.63	4.27	21.00	12.63
7′	16.16	3.53	11.71	131.27	5.57	7.99		12.54
ALL	**$16.63**	**$13.84**	**$11.89**	**$11.06**	**$11.80**	**$3.53**	**$16.44**	**$13.75**

TABLE 8
Noise Barrier Construction Material Average Unit Cost by Height

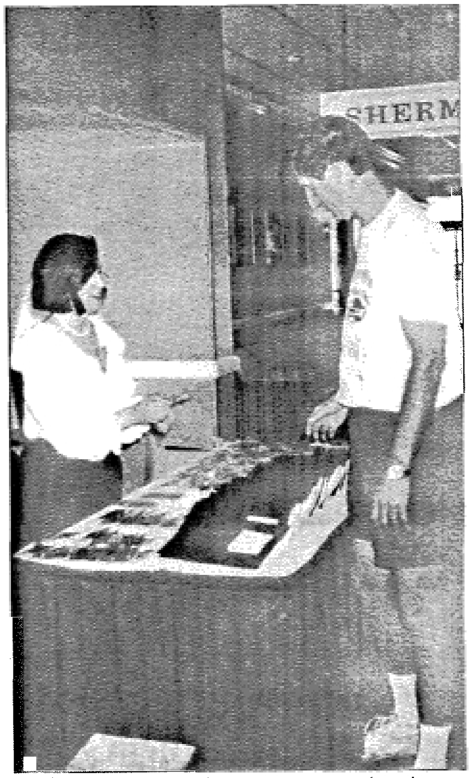
Note that there are 600,000 square feet of noise barriers constructed with other materials

■

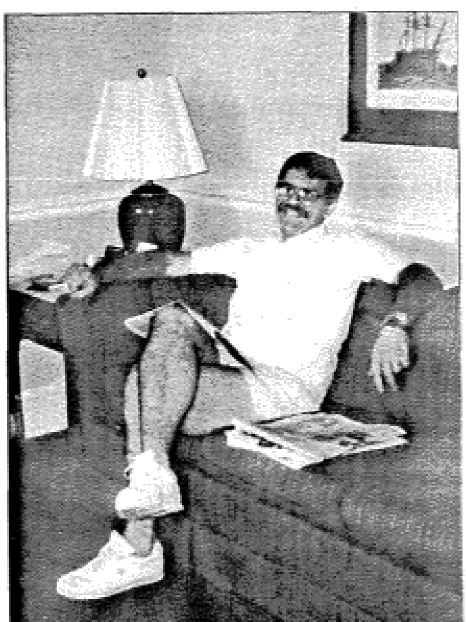
*(**photos from the A1F04 Meeting,** continued from page 15. More photos on pages 18, 20 and 21)*



James Cowan of McCormick, Taylor during a question and answer interval in his presentation

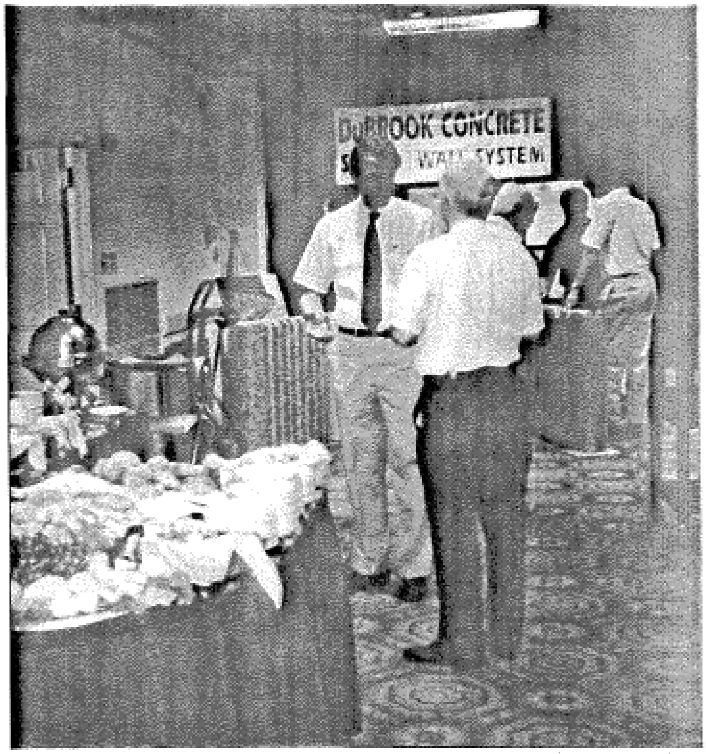


As you can see, dress is very casual at the summer meetings. But not quite as casual as the vacationers in the hotel and on the street.

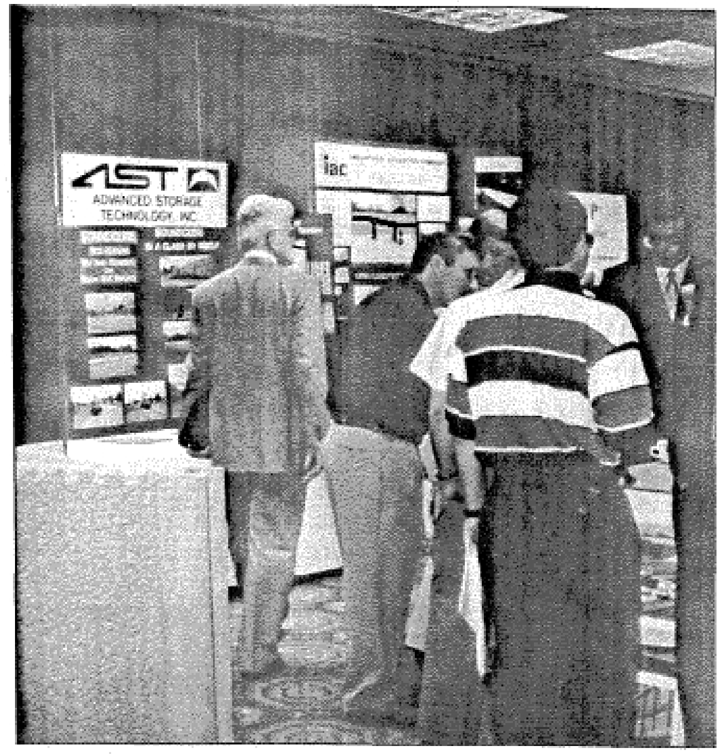


Jim Byers of PennDOT, taking a brief respite from his exertions as a coordinator of the Summer Meeting, seems to enjoy his work.

(*Photos from A1F04 Meeting*, continued from page 17. More photos on pages 20 and 21)



Attendees were greeted in the Exhibition Hall before the morning sessions began with fresh fruits and pastry and beverages. This generated many 'breakfast meetings' among the exhibitors and the attendees



The exhibitors were kept busy during the exhibition hours, discussing their products and services with the attendees. The "exhibition hall" has been a regular feature of the Summer Meetings for a number of years.

TRB Committee A1F04

By Domenick Billera, Chairman

BETWEEN a ROCK and a HARD PLACE, or TRYING to PLEASE ALL the PEOPLE ALL the TIME

As a government employee in the 90's, I find myself on the receiving end of a constant barrage of calls to: Reinvent Government; Work Smarter; Reduce Overhead: Eliminate Procedures and Processes; and Increase Output. Simultaneously, noise barriers, one of the environmental disciplines which I manage, is the number one (by a country mile) topic of irate letters to our Commissioner. Many of the letters eventually filter down to my office for development of a response. So, what's the connection?

Pressed by the current "trim the fat" ethic of today's managers, we have lost the luxury of having time to really think about the ramifications of the noise barriers we propose. Our landscape and design staffs reply with "No time!" when asked to look in greater detail at the site specific options and consequences of our barrier building. As a result, we spend more and more of our precious time responding to complaints from the citizenry that our barriers are far from an aesthetic optimum leaving even less time to design them!

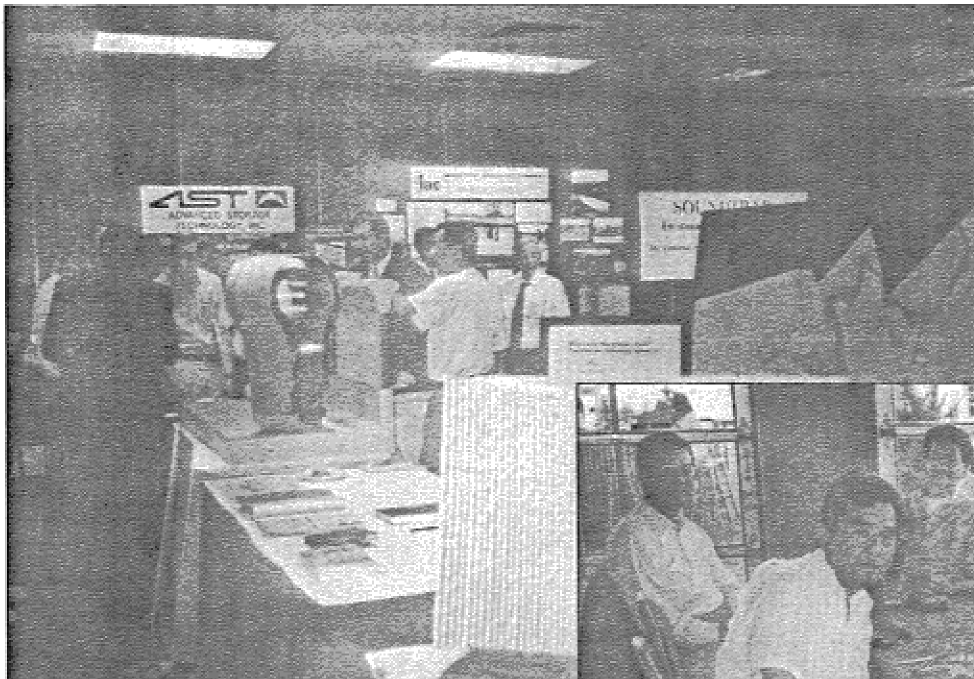
How do we escape from this "Catch 22" situation? Good question. Technology may help us with 3-D visuals of barriers so we can easily and quickly view the barrier designs seen previously only in our mind's eye. Perhaps you readers can suggest some other ways to break out of this vicious circle. Please send your ideas to my attention at The Wall Journal. We thank you for taking the time to share with us your opinion on this controversial public issue.

— The Management

About The Career Connection

On page 4 of this issue, you will find a new department, which we call "The Career Connection". We have had some success for our readers in previous notices about careers, and decided that we should now formalize that service, since it seems to be catching on and will begin to require significant space. Since printing space is a leading factor in the cost and profitability (or lack of it) of The Journal, it is appropriate that we affix a cost to this future service. Accordingly, hence forward your cost of a one-time insertion of an advertisement the size of the ones on page 4 will be $95.00, payable in advance of publication. That is reasonable to our cost of publication, and extremely reasonable compared to an employment counselor. The Wall Journal is read by approximately 2,000 persons with an immediate interest in the same field you are in. Our reader database has been carefully culled and certified to contain only the kind of people you wish to reach.

***(Photos from A1F04 Meeting,** continued from page 18. More photos on page 21)*



A corner of the Exhibition Hall where attendees inspected the exhibits and questioned the exhibitors about their products and services before and after the sessions and during morning and afternoon intermissions.

A contingent of attendees from foreign lands (including an exhibitor) congregate before dinner at the Philadelphia waterfront restaurant

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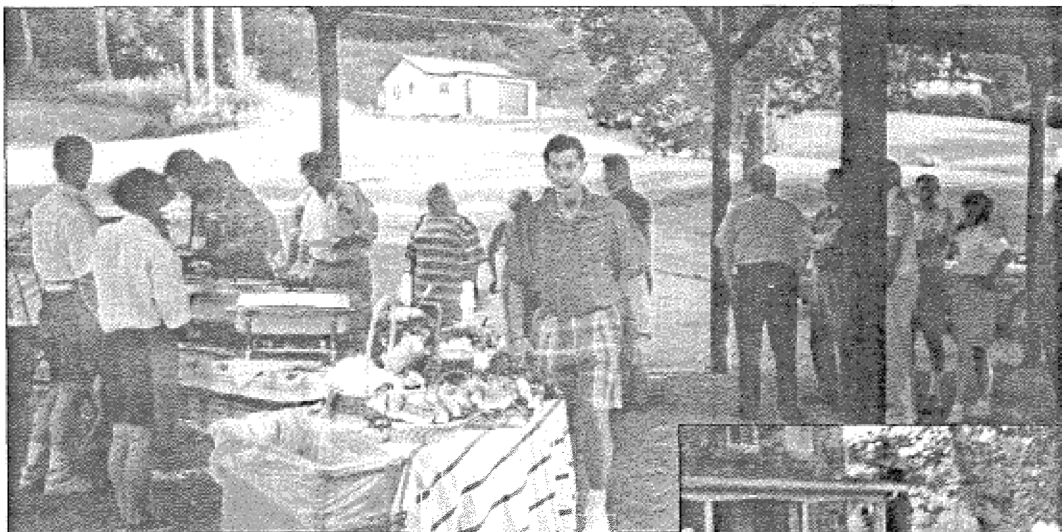
***(Photos from A1F04 Meeting,** continued from page 20)*



(Above) At the Chairman's home for a farewell barbecue, attendess line up for barbecued ribs and steaks, with corn-on-the cob, potato salad and all the extras that go with an old-fashioned picnic in the country.

(At right) Tables and chairs spread out on the lawn provide a place where old friends and new may gather to enjoy the food and discuss (what else?) all of their common interests in the field of transportation related noise and vibration. What a great way to get involved. ■

PRESS RELEASE

Date: August, 1994
By: The Scott System

Five thousand years ago, the Egyptians molded concrete in clay molds that told the story of their dreams of the future: hieroglyphics — a story in stone. Today, public art is becoming increasingly popular as a method to add interest and culture to massive urban structures and miles of concrete sound and retaining walls.

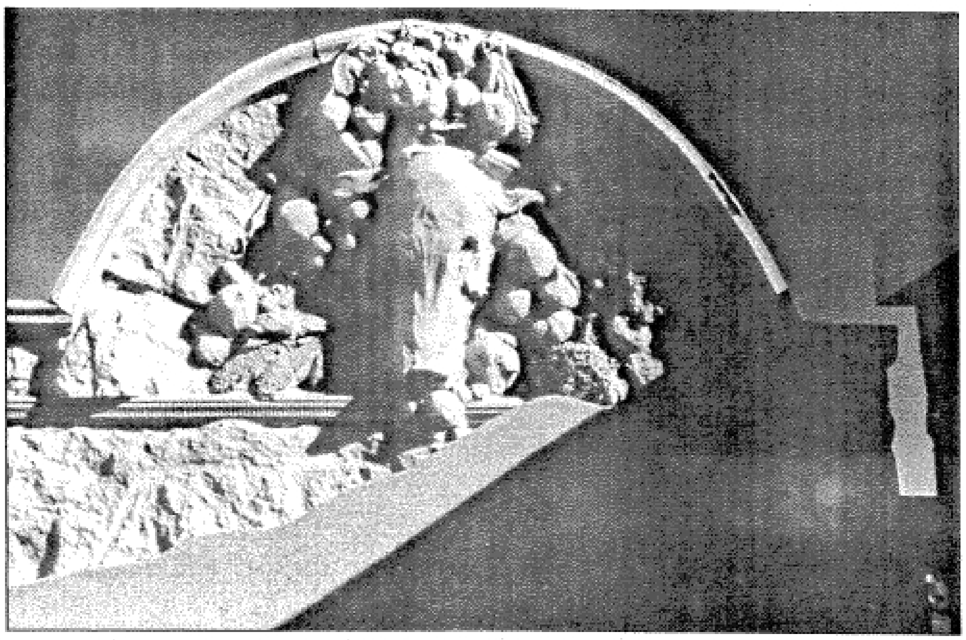
Communities usually express great concern over the aesthetics of construction projects, especially when large concrete walls for noise or flood control; are on the drawing boards. Designers now have the tools to change cold, grey, imposing concrete into a work of art. Scott System, Inc. in Denver, Colorado manufactures elastomeric form liners for concrete construction. These rubber-like mats are used to create an infinite number of textures in concrete, including one-of-a-kind artists' creations. No matter how intricate the design, Scott System is able to easily produce a mold of the artist's work and the image is reproduced in the concrete structure.

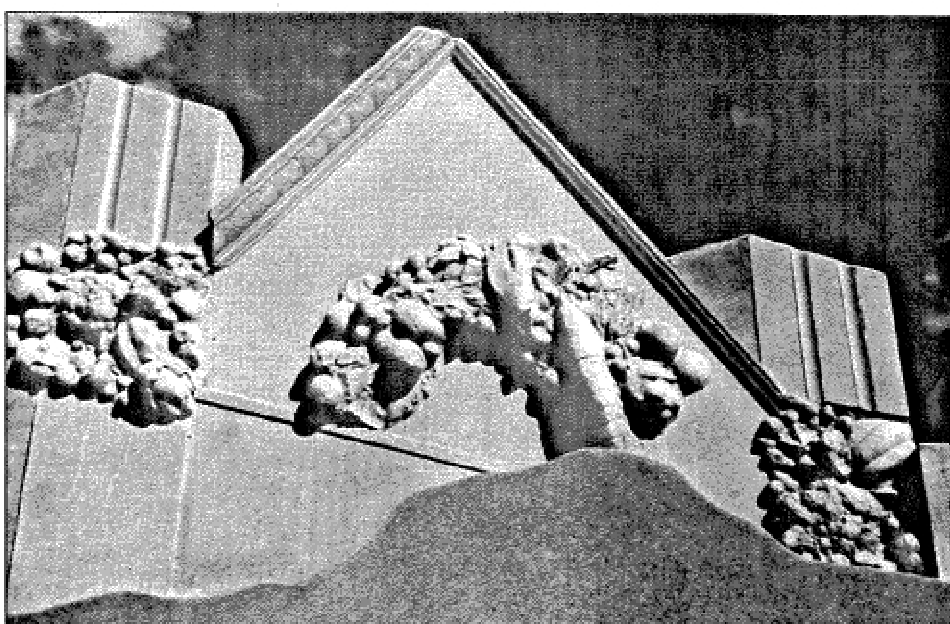
Architectural artist Carolyn Braaksma, who has been commissioned to do numerous projects nationwide, recently completed a concrete panel project for the new Broadway Marketplace shopping plaza in South Denver. The goal was to connect freestanding super-stores and acres of parking to give the feeling of a quaint old public market place where butchers and farmers sold fresh meats, fruits and vegetables. Her panels, which serve as surround and entrance walls, show the detail of rooftops of older homes with pigs' heads, lobsters, mushrooms and a cornucopia of edibles. Inscriptions from childrens nursery rhymes accompany the panels with such as "To market, to market, to buy a fat pig" and "cauliflower, big tomato, cherry pie, who am I"? And lyrics from a 1967 Frank Zappa song, "Call Any Vegetable," also adorn some of the panels.

In Morgan City, Louisiana a 25' tall crawfish adorns the massive flood walls and in Phoenix, Arizona a southwestern pattern enhances miles of sound barriers. This application is also being used in Williamson, West Virginia, Seattle, Washington and is currently being considered along highways in New Jersey, Pennsylvania and other states as well.

Buck Scott, president of Scott System, thinks that "the use of expressive textures and concrete graphics is the perfect marriage between designers and neighborhood communities." He states, " It is proven that art in concrete reduces the visual scale of the massive concrete walls and since virtually any image can be created in concrete, the design possibilities are limitless!"

The Scott System is located in Denver, Colorado and may be reached by calling 303 371-958. *(ED. Note: see advertisement on page 21).*





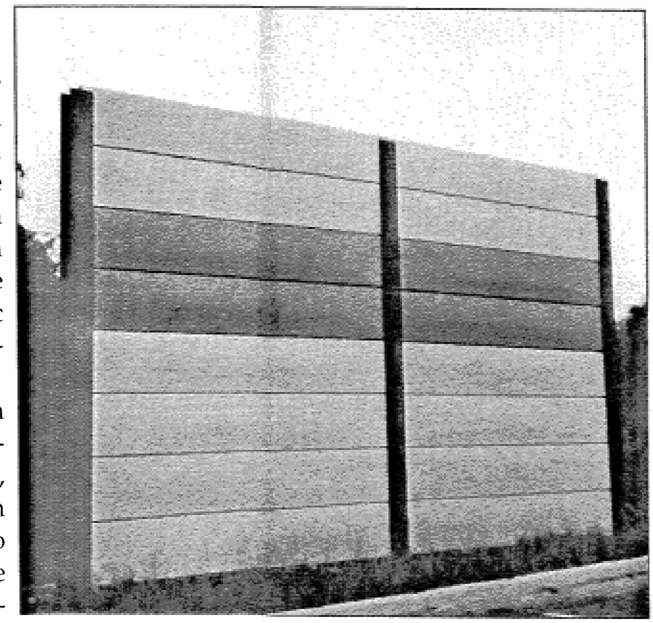
PRESS RELEASE

Date: September 15, 1994
By: Industrial Acoustics Company, Inc.

Industrial Acoustics Company recently installed a two-bay Noishield Transportation Sound Barrier at the Maryland State Highway (SHA) Administration Demonstration and Display Facility near the Baltimore/Washington International Airport. The Sound Barrier panels were quickly installed by an inexperienced three man crew in one hour from begining to end, or about four minutes per panel.

Present at the installation were three representatives from Maryland State Highway Administration: Paul Stout, Assistant Chief, Traffic Operations; Rodney Winn, New Product Review Board; John Saikas, Division of Bridge Design.

The IAC Noishield Type FS/S exhibit very high sound absorption coefficients, especially in the low frequencies, (e.g. 1.31 at 125 Hz) and an STC of 38. The finish is a polyester powder coating which has been salt spray tested to 7,000 hours. The base color is light tan with an attractive pastel green horizontal stripe on the upper portion. Graphic appliques are also available.



In accordance with Maryland SHA's procedures for demonstration, the panels remained in place for several weeks to allow inspection by state officials and other interested parties.

A videotape of the installation and final result is available from:

Richard C. Roth
Director, Transportation
Sound Barrier Programs
Industrial Acoustics Company, Inc.
1160 Commerce Avenue
Bronx, NY 10462
Tel. 718 430-4515

■

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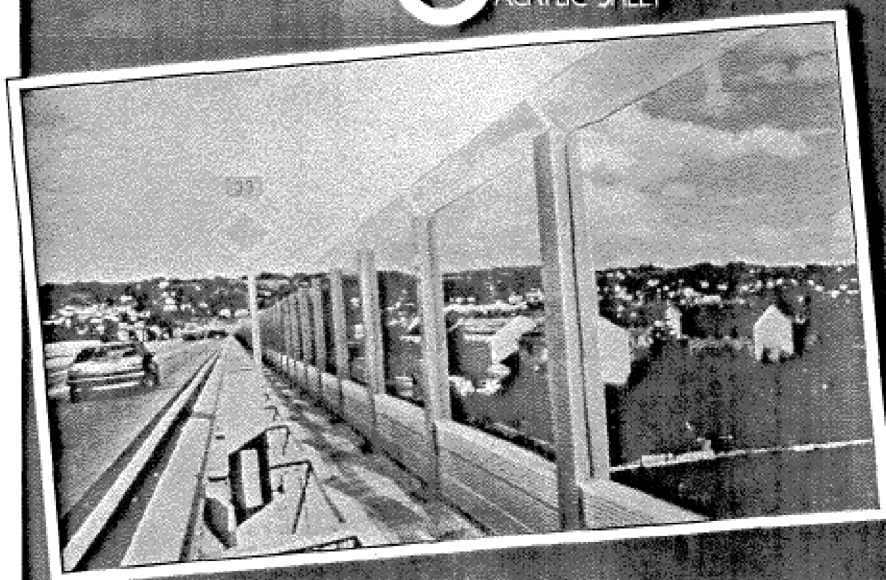

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