The Wall Journal™
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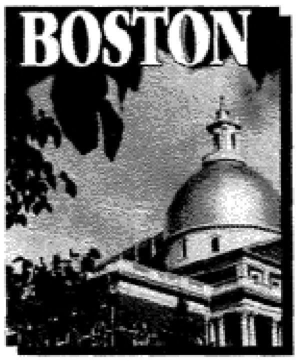
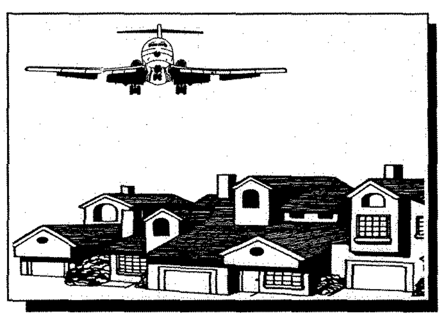
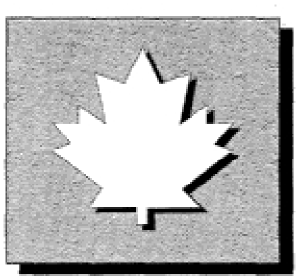
THE INTERNATIONAL JOURNAL OF TRANSPORTATION-RELATED ENVIRONMENTAL ISSUES

In This Issue:







The Wall Journal

The International Journal of Transportation-Related Environmental Issues

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EDITOR'S CORNER

by El Angove

THE LIGHTER SIDE

The other day, one of our readers called me to inquire if I was ever going to change my picture in this column. He intimated that he was growing sick and tired of looking at it. He also suggested that I was somehow trying to emulate the portrait of Dorian Gray.

I was somewhat appalled by this barefaced effrontery, but I refrained from making a cheeky rejoinder, considering that he was a paid-up subscriber.

After imbibing in a temper-calming bone dry martini, I chilled out enough to contemplate whether or not the good reader may have had some good pith in his blather. After all, I am not the epitome of the human male, and I certainly am not photogenic.

I decided to give the good reader his due, since there may be others of his persuasion out there. Henceforth, I shall dredge up other esoteric picturizations of myself in the pursuit of editorial erudition, scientific patois, and the nonpareil martini (gelid Absolut vodka, a mere breath of dry vermouth, no fruit, deep-frozen ice, once stirred, not shaken).

In this issue, I present the first of the new look of your editor. This portrayal was captured shortly after the founding of The Wall Journal, as I strode the Commons of Fredericksburg in the Commonwealth of Virginia. It was an auspicious moment, despite the howling of a pack of stray dogs who took not well to the tolling of the bell, and the ragged street urchins who took great delight in pelting me with cobblestones they were able to dig up from the street.

In coming issues, I shall select random portrayals of my visage as I encounter the trials and tribulations of various aspects of the publishing business. I trust this will quiet those who have grown weary, if not disgusted and revolted, at seeing my same picture in every issue.

I must warn you, however — this has been the *lighter side*. You may be forcing me to the ***darker side.***

Be very afraid.

Ye Olde Editore

With that nasty business out of the way, I turn to the immediate affairs of the Wall Journal. I have tried my best to maintain a neutral position in the composition of this journal, considering it to be simply a communications medium for the professionals in the transportation noise and vibration control industry.

However, it has been like pulling teeth to get good material to publish. And, most of the time, the material arrives at the eleventh hour and I have to spend two weeks of 12-hour days to put this journal together. And, that always means that I am behind schedule.

Now, you all know that I do not publish full professional papers. I leave that to the real professionals like INCE, with their Noise Control Engineering Journal. I am not in that business. My journal is dedicated to providing a little information about a lot of things, with details on how readers can reach the authors for the complete paper.

In the event you do not know, I have been in the transportation noise abatement business since 1974, as a salesman of noise barriers. I have sold many, many miles of highway noise barriers, airport noise barriers and mass transit noise barriers.

I *know* this industry, even though I am not an acoustics engineer. I have a *feel* for this industry — I know the basics of the acoustics, the structural requirements, the soils, the meteorology, the building materials, the construction.

What I am missing in this journal are the experts' *opinions*. There are questions to be answered. Examples:

1. Is there an implicit advantage for sound-absorptive surfaces on ***any*** wall?
2. Is there any ***real*** significance in a very high NRC rating?
3. Should there be an aesthetic height limitation on roadside noise barriers?
4. What is government's position on use of recycled materials in noise barriers?
5. Who will lead them? ■

ANNOUNCEMENT

AIRPORTS 95 *"Airport Engineering: Innovation, Best Practice and the Environment"*

A Conference in Sydney, Australia <u>October 9-11, 1995</u>

Airports 95 is being organized and promoted by The Institute of Engineers, Australia, the Federal Airports Corporation and Civil Aviation Authority with the assistance of senior members of the engineering profession, universities and aviation consultants.

OBJECTIVES

To provide a forum for learned discussion on trends, innovations and experiences in the planning, design, development and operation of major international airports. The Conference will draw on the expertise of speakers eminent in the various fields of airport-related activity, and will have particular reference to the needs of the air transport industry in the Pacific Region. It will also present an overview of the development of Sydney Airport as a major hub for airlines serving the region.

SCOPE

The general theme of the Conference will address innovation and best practice, including technical and financial aspects in the planning, design, construction, operation and environmental context of world airport systems. Several specific topics are seen by the Organizing Committee as being particularly relevant at this time:

- Demand Forecasting
- Decision criteria for multiple airport systems
- Siting strategies for future airports
- Airspace constraints and management
- Related urban infrastructure
- Trends in airport ownership
- Influence of new-generation aircraft
- The trend to "Build, Own, Operate and Transfer" airports
- Developments for efficient terminal design
- Runway, taxiway and apron design
- Techniques for independent parallel approach and landing
- Management of airport-generated noise
- Environment as an integral part of of air port planning
- Evolving airport management structures
- Airspace management of multiple-airport systems
- Development in airport electronic and electrical engineering

WHO SHOULD ATTEND & BENEFITS

The Conference should have particular appeal to airport planners and decision makers who are currently considering development or expansion of airport facilities to serve air transport requirements over the next decade. Delegates will participate in a plenary session discussing current aspects and future trends in multiple airport systems, airline perspectives on infrastructure requirements and directions for environmental impact assessment. The Conference will then be structured into three parallel streams: Airport Planning, Airport Design and Construction, and Airport Operations.

Technical papers will be presented on the best international airport practices. Delegates will be involved in discussion with international colleagues in areas of professional interest, and may participate in technical tours of significant features of Sydney Airport.

For further information, contact::

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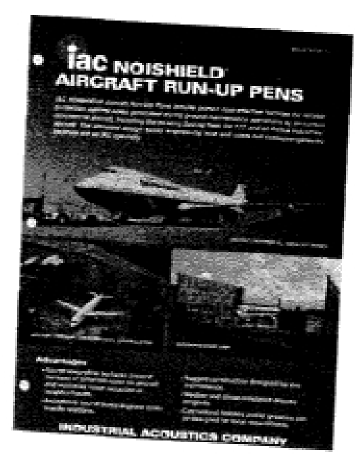
PRESS RELEASE

FOR IMMEDIATE RELEASE
Thursday, June 29, 1995

New Four Page Color Brochure on Aircraft Run-Up Pens

Industrial Acoustics Company has released its new brochure describing its run-up pens for aircraft noise reduction during maintenance and test. The 4-page color brochure shows photos of several facilities for both military and civilian aircraft. Case histories and test data are described for locations in the United States and abroad.

Also described are the Hush-House, used when aircraft testing needs to be done during harsh weather conditions, with security in mind, or when severe acoustical criteria in the neighborhood must be met. The Hush-Houses do not affect the performance characteristics of the engines.



CONTACT:
Richard J. Peppin
INDUSTRIAL ACOUSTICS COMPANY
1160 Commerce Avenue
Bronx, NY 10462
Tel 718 931-8000, fax 718 863-1138

Letters to the Editor

Dear Sir:

Please find enclosed check for renewal of my subscription to The Wall Journal. I would like to mention that I think your publication is excellent and has been of great use to me during the year that I have been receiving it.

Allen R. Muhic
Senior Environmental Planner
URS Consultants
Cleveland, Ohio

Dear Sir:

Enclosed is our check to renew our subscription to The Wall Journal. We find your journal to be very useful. Keep up the good work.

James C. Novak
Environmental Manager
Dames & Moore/MCE
Rolling Meadows, Illinois

Dear Sir:

I've just learned about The Wall Journal from a gentleman at Caltrans by the name of Allen Wrenn. I think it is a great publication. Especially from a "hunt and peck typwriter artist".

I would like, not only to begin my subscription, but to get all of your back copies as well. Thanks for putting out such an informative periodical.

Mike Milhous
Teichert Precast
Sacramento, California

Dear Sir:

It was a pleasure talking with you on the phone today. Please send me a complete set of Journals #1-16 and sign me up for a subscription beginning with #17. Enclosed you will find a check for $65.95.

I look forward to receiving my Wall Journals, past and future. To all those involved, keep up the excellent work; it is appreciated.

Bob Cooper
San Rafael, California

Regional Municipality in Canada Sets Noise Control Guidelines for New Developments Adjacent to Existing and Proposed New Roads and Transitways

One of the goals upon which the Official Plan of the Regional Municipality of Ottawa-Carleton is based is to "protect inhabitants from exposure to adverse environmental influences". One of the four identified constraints to development is noise and the Regional interest has been summarized in the following statement: "The protection of people and property from the risks posed by inappropriate development in environmental constraint areas".

The Council of the Regional Municipality of Ottawa-Carleton is concerned with noise from aircraft, roads, railways and transitways as expressed in the Official Plan of the Region adopted in 1988 and approved by the Minister in 1989. The Council's stated objective in this regard is that development not receive an unacceptable level of noise. In June 1988, the Ministry of the Environment advised the Region that sources such as Provincial Highways, railways and airports are matters of Provincial interest and that the Ministry will discontinue their land use plan review activities adjacent to Regional and Local roads.

Section 7.2.3 of the adopted Regional Official Plan contains specific policies for noise including quantitative sound level criteria requiring that specific outdoor areas of residential development meet energy equivalent sound levels (Leq) not exceeding 55 dBA during the daytime and 50 dBA during the night time periods.

The Regional Official Plan also directs other local Official Plans to contain policies dealing with the establishment and implementation of acceptable noise levels through the approval of Site Plans.

Although the Regional Official Plan policies for noise are largely based on the technical guidelines prepared by the Ontario Ministry of the Environment, the policies do not provide the necessary detailed technical guidelines to enable the RMOC and the Local Municipalities to undertake the necessary implementation of the policies. Accordingly, staff of the RMOC, in consultation with representatives from the Local Municipalities, prepared Terms of Reference for the Development of Noise Control Guidelines and hired the services of a Consulting Engineering firm specialized in the field of environmental noise to assist the Region in the development of such guidelines.

The proposed noise control guidelines specifically deal with the establishrnent of new noise sensitive developments adjacent to existing and future Regional roads and Transitways or Busways in the Regional Municipality of Ottawa-Carleton.

It is not the intent of these guidelines to apply to existing developments adjacent to existing and new Regional surface transportation facilities or to the transfer of area Municipality road right-of-way into the Regional roads systems. The Region will, in the near future, develop other noise control guidelines to deal with these areas of concern.

One of the key issues addressed in the guideline document is the feasibility of implementing noise control measures in the land use planning process. Four basic noise control measures are recommended which include site planning techniques, the use of acoustical barriers, the application of architectural design and construction techniques to buildings and structures.

Some of the recommended concepts may appeal more to some Local Municipalities, while others may not be directly compatible with the planning objectives in specific areas. Therefore, it is expected that the most appropriate choice of noise control measures will be implemented by the Local Municipalities in cooperation with other concerned parties.

Application guidelines and procedures have been developed and the areas of responsibility for noise have been defined to include the role of the Region, the share of the Local Municipality and the responsibility of the proponent. For example, in the area of noise control studies, the guideline document provides information on the components required to complete both the Noise Control Feasibility Study and the Detailed Noise Control Study depending on the planning stage. Specific quantitative guidelines are incorporated in the guidelines to enable all concerned parties to determine whether such noise studies will be required or not.

The guideline document provides an outline of several technical issues of importance to the implementation including the noise prediction model and the relevant input parameters to meet the RMOC objectives.

The proposed noise control guidelines provide detailed sound level criteria, design criteria, submission guidelines and a systematic approach for implementation at all levels of responsibility to deal with new development adjacent to existing and future Regional Roads and Transitways or Busways.

While the scope of this guideline document applies to Regional surface transportation facilities only in accordance with the Terms of Reference for the development of the Noise Control Guidelines, it is hoped that the presented guidelines will be of benefit to the 11 constituent Local Municipalities when dealing with local municipal surface transportation facilities in keeping with the spirit and intent of the adopted and approved Regional Official Plan.

The Region, based on screening criteria, will require the applicants of all residential or other noise-sensitive developments subject to approvals under the planning legislation to engage the services of a Professional Engineer, having demonstrated experience in the areas of acoustics and noise control (referred to as the Acoustical Consultant), to prepare an acoustical report which will recommend noise control measures, where warranted, to meet the sound level objectives of the Region.

The Region will be using outdoor and indoor sound level criteria to ensure that the adverse environmental influences on the outdoor living areas and the indoor spaces are minimized. For example, the sound level criterion for outdoor living areas during the daytime is Leq 55 dBA, the sound level criterion for outside of bedrooms and sleeping quarters during the night-time is Leq 50 dBA, and the sound level criteria for indoor spaces are Leq 40 to 50 dBA depending on the type of space.

In order to arrive at the sound levels produced by a Regional surface transportation facility, the Region will require the use of noise prediction models and/or actual field measurements of the noise source(s) of concern. The data used for sound level projections will correspond to the future conditions projected to the lifetime of the Regional Official Plan in order to protect the future interests of the Region.

Should the projected sound levels and project specifics indicate the need for a noise barrier, the Region will limit the maximum height above the road/corridor centre line or the outdoor living area to 4.5m. The barrier wall component will be limited to a maximum height of 2.4m unless otherwise approved by the Region. Other requirements associated with the use of noise barriers include the provision of a minimum of 6.0 m depth of rear yard space and specific land and berm slopes to ensure the viability of the development.

It is the Region's intention to require close co-ordination of the various design activities of the development including site planning design, grading, landscaping and noise control to ensure that the final finished product will meet the Regional and Local Municipal objectives.

Due to the importance of appropriate implementation of the designed and approved noise control measures, the Region will require the proponent to enter into a Development Agreement with the Region and/or the Local Municipality whereby financial guarantees will be sought towards the successful completion of the required works under the supervision of the Acoustical Consultant. ■

(For further information on the complete "Noise Control Guidelines", contact:
Max Börk
Transportation Planning Division
Regional Municipality of Ottawa-Carleton
111 Lisgar Street
Ottawa, Ontario K2P 2L7
Fon 613.560.2064 Fax 613.560.6068)

Noise Testing of Wheel Vibration Absorbers on Mass Transit Vehicles – the Engineering Report

By Richard B. Weiss

WMATA transit cars enter West Falls Church, VA inspection and service yard for installation and testing of wheel vibration absorbers.

ABSTRACT

Two transit cars belonging to the Washington Metropolitan Area Transit Authority (WMATA) were outfitted with newly rebuilt trucks whose wheels had the AEG wheel vibration absorbers. Testing was conducted to determine the effectiveness of the wheel absorbers at two WMATA yard locations and on the main line during the week of September 11, 1994. Subsequent tests were performed at the West Falls Church Yard during the week of January 22, 1995.

This report presents data that was gathered at West Falls Church Yard where very tight radius curves exist. Tests made with the absorbers in place had practically no characteristic wheel screech or squeal, while test runs without AEG wheel vibration absorbers had definite screeching. Analysis of the data shows that the wheel absorbers reduced the overall A-weighted broadband noise level during traversal of the 290 foot radius level curve on the east end of the yard by 7.6 to 14.7 dBA, depending on speed and direction of travel.

The average reduction was 11 dBA on the trains with modified wheels, which is a significant reduction. When comparing cars with unmodified wheels with the test pair with absorbers, the range of reductions was 12.1 to 14.7 dBA with an average of 13.7 dBA including data at both 5 and 10 miles per hour!

INTRODUCTION

AEG Transportation Systems, Inc. and Daimler-Benz Aerospace (DASA) have been working together to introduce DASA's wheel vibration absorber technology to the North American rail transit industry. WMATA graciously consented to be the first transit authority in the USA to test the wheel vibration absorbers.

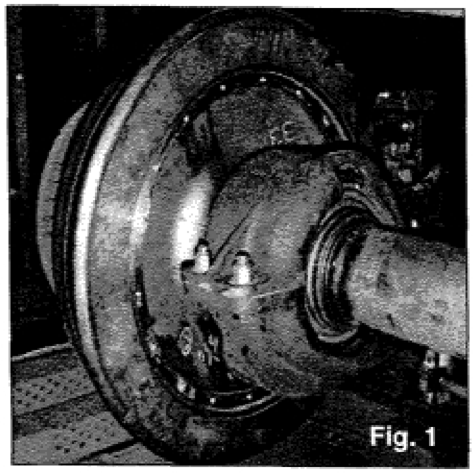
Two car sets of new WMATA wheels were specially machined in order to install the AEG wheel vibration absorber assemblies. The machining consisted of a groove on the inside of each wheel at the top of the web. The purpose of the groove was to accept a steel ring, as shown in Figure I, that was shrink fitted into the wheel by cooling the ring and heating the wheel. After installation of the ring, six absorber plates were bolted to the shrink ring (shown in Figure 2).

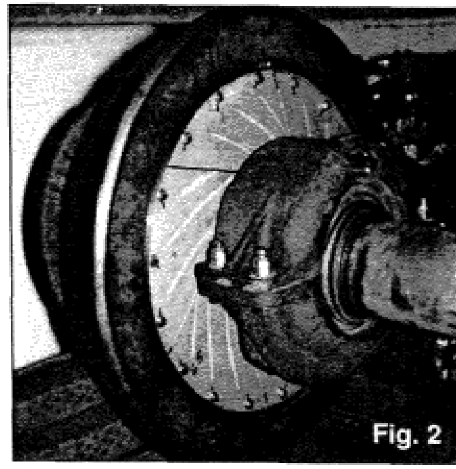
During the design phase a finite element analysis was done on the modified wheel configuration to quantify the stresses that would be encountered during service. The analysis showed that the stresses would be within acceptable limits and that the machined groove would not create any high stresses.

As another part of the vibration absorber design process, a WMATA wheel was subjected to an impulse (instrumented hammer blow) test in order to characterize its natural resonances. Then the vibration absorber plates were designed to attenuate vibrations throughout the frequency range where the natural resonances occurred. These tests of the prototype vibration absorber on the specific type of wheel used in the fleet provided a high level of assurance that the production hardware would perform properly.

Two carsets of wheels were modified with vibration absorber attachment rings. Then they were shipped to WMATA's Brentwood shop where they were pressed onto axles and assembled into newly rebuilt tlucks as part of WMATA's Rohr truck rehabilitation program. The trucks were then installed on WMATA Cars # 1218 and # 1219 for testing with and without the vibration absorber plates installed.

A second set of tests were conducted in January 1995 to supplement the previous data. During these tests the trucks with the modified wheels were on Cars # 1048 and # 1049. Cars 1050 and 1051, which also had recently rehabilitated tlucks with new standard (unmodified) wheels, were included in the second tests to provide a benchmark for noise performance comparisons.





TESTING

The testing at West Falls Church Yard (WFC) was conducted during the week of September 11, 1994, and again during the week of January 22, 1995. The September tests consisted of running the two car test train on the tight 290 foot radius inside curve at the east end of the WFC yard. A map showing the yard layout and test site location is shown in Figure 3. The test train was run on the inside track.

Trackside locations were picked in order to achieve a 50 foot distance from the track centerline and to avoid obstacles such as parked cars, as best as possible. The two trackside microphones were set up on a platform in the back of the Yard Operations Building. The height of the platform was about 4.5 feet above the ground. The microphone height was four feet above the platform which roughly corresponded to a four foot height above the track roadbed. This also located the microphones above parked cars.

The microphones were about six feet in front of the brick wall of the Yard building. The locations of the microphones were not ideal, however the goal was to obtain relatively comparable measurements and not absolute free field levels. Therefore AEG considered the locations to be acceptable. One trackside microphone was 50 feet from the track centerline and the other was 52 feet from the track centerline. The microphones were 25 feet apart from each other. Interior noise levels were measured by two microphones, one was over one of the trucks and the other was in the center of the car. Both microphones were in car #1218. The microphones were four feet above the floor and located on the longitudinal centerline of the car. A microphone was also mounted on one of the gear units so that it was within three inches of the wheel flange. A description of the test instrumentation is included.

The original plan for the September tests called for data to be collected on the test train with absorbers and for data to be collected on a second test train that had unmodified wheels. However, in an effort to conserve resources, the test plan was changed so that all of the data was taken on the test train with absorbers. Two test runs were made with the complete absorber assembly in place, and then the absorber plates were removed leaving only the shrink ring in place. These first two runs were made at 8:50 AM Sept. 15. A light rain had fallen during the early morning hours but had stopped several hours before the testing began.

After removal of the absorber plates, two test runs were then made. These test runs were made at 11:55 AM of the same day. The weather conditions at 10:00 AM on Sept. 15 were 73 F, 90% relative humidity, winds NNW S MPH, and barometric pressure 30.09 inches and rising. All of the September test runs were made at 5 mph - the normal maximum allowable yard speed due to noise ordinances. In addition to these data, two sets of test data were recorded as a revenue (unmodified) service train passed by on the same track.

Guard rails were employed in the curved section of track to prevent wheel flange and rail wear. Automatic grease lubricators had been employed on the guard rails to reduce wear of the guard rails and the inner side of the wheel flange, and presumably to reduce the amount of wheel squeal. The running rails were Riflex rails.

The January tests consisted of running the two car test train (Cars #1048 and 1049) and another two car train (Cars #1050 and #1051) with standard (unmodified) wheels around the 290 foot radius curve at the east end of the yard and also around the 300 foot radius inner curve at the west (entrance) end of the yard (See Figure 3). The January tests included 3 passes in each direction at 5 mph and then at 10 mph. Sound measurements in January were taken only from the wayside.

The primary instrument was moved from the September location to the end of the platform of the yard service building at the east end of the yard. It was set up on a dumpster to get the desired height of 4 feet above track grade. Ihis change in location was necessary to allow acceleration to 10 mph and then decelerating to a stop without entering the grade crossing at the end of the curve.

The preferred location for the other instrument was at 100 feet but a train with auxiliary equipment running was parked near the proposed microphone location. As a result the instrument was set up on the platform 60 feet from track center. The sound instruments were about 40 feet apart.

The terrain at the west end of the yard necessitated that the sound-monitoring instruments be placed higher than normal. The primary instrument was about 10 feet above grade while the other instrument was about 15 feet above grade. The primary instrument was 50 feet from track center line while the other was located at a distance of 100 feet.

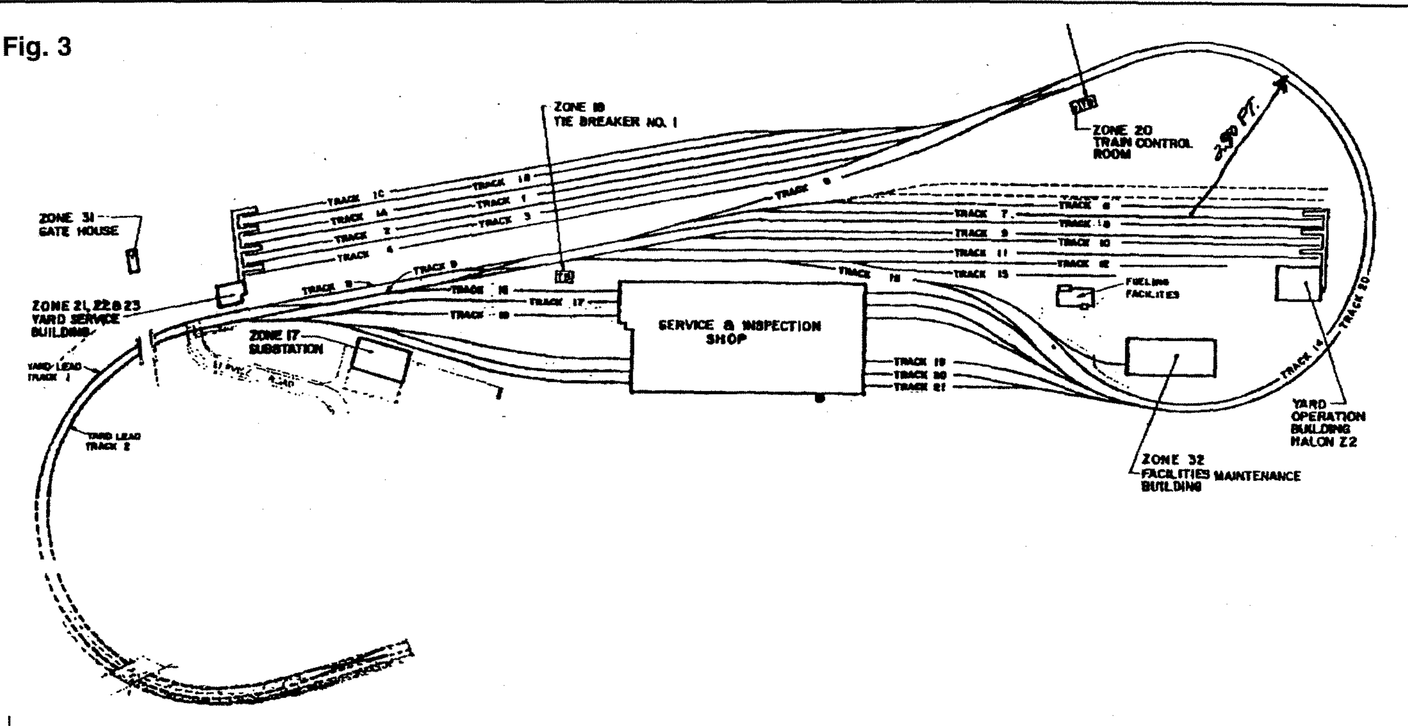
Tests on both trains without absorbers were run on Tuesday, January 24 at the west end of the yard in the morning and at the east end of the yard in the afternoon. The AEG vibration absorber plates were installed on Cars 1048 and 1049 by WMATA on Tuesday evening. Then tests on these cars (only) were conducted on Wednesday morning, commencing at the west end of the yard. Weather both days was sunny and breezy with temperatures in the upper 30's to low 40's.

TEST INSTRUMENTATION

All of the microphones for the September tests were Bruel & Kjaer (B&K) Type 4165 1/2 inch free field condenser microphones. The microphones were used with B&K Type 2639 microphone preamplifiers. The microphone and preamps were powered by B&K Type 2807 microphone power supplies. Each Type 2807 can power two microphones. The trackside equipment consisted of two microphone/preamp combinations powered by one 2807 supply. THE 2807 was powered by a HP 85901 portable AC

(continued next page)

Fig. 3



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supply. The microphones were supported by tripods.

The signal output from the 2807 was recorded on a TEAC RD-130 T DAT recorder, which was powered by a car battery. One of the signal channels was paralleled into a B&K Type 2144 FFT analyzer. This allowed an "on the spot" preview of the data. The two car interior microphones and truck microphone were powered by two Type 2807 microphone power supplies. The signal output from the 2807s were recorded on a TEAC RD-200T DAT recorder. One of the signal channels was paralleled into a B&K 2144 FFT analyzer for on-site analysis. All of the interior equipment was powered by means of an inverter that converted the car's DC voltage into 120 VAC.

The microphone equipment used in September was unavailable in January. Two Type 2230 sound level meters provided the equivalent functions. One was set up at 50 feet from track center and was used as the primary instlument with output to a TEAC RD-200T Data Recorder. The 2230 was set to LINEAR (No weighting) and 110 dB Full Scale. Since the recorded output was not affected, the meter display was set to MAX and the display reading was recorded for each pass. The other 2230 was set to "A" weighting and output was recorded on the 2317 Level Recorder which provided paper tape charts of each pass. This instrument was also set to MAX and the display readings were recorded were recorded.

DATA ANALYSIS

During each test run the data from each microphone was recorded on a TEAC DAT recorder. After return to AEG, the data was replayed on the DAT recorder and the signals were fed into a Bruel & Kjaer Type 2032 Dual Channel Analyzer. The runs without absorbers had intermittent screeching that obviously raised the overall noise levels. Because of this, exponential averaging was used to analyze the data. Exponential averaging is a time weighted running average. The 2032 allows the number of spectrums that are continually updated and averaged to be specified.

For these data analyses 16 spectrums were used primarily. In this mode, the Type 2032 will begin averaging and will continually update similar to a handheld sound level meter, except that the Type 2032 can analyze the entire frequency spectrum. The overall A-weighted noise levels for runs without absorbers therefore represent the noise level during screeching. The wheel screech is the most annoying and loud sound to bystanders, therefore this a realistic approach to analyzing the data.

The test runs with absorbers did not have the characteristic screech and the noise levels were relatively uniform compared to the data without absorbers. Exponential averaging was also used to evaluate the data with absorbers. Linear averaging of this data gave essentially the same results as exponential averaging.

As a result of lessons learned during the reduction of the September data, some refinements of measurement techniques were made for the January tests. The most useful was recording the train passes on the memo channel. This was done by keying the microphone when the leading edge of the train was aligned with the instrument and letting off when the trailing edge passed. When the data tapes were analyzed, the proper spots on them were easily found and extraneous noises, such as contactors opening and closing, could be avoided. ■

(Interested parties may obtain a copy of the complete 22-page report by writing to:
Components and Services Department
AEG Transportation Systems, Inc.
1501 Lebanon Church Road
Pittsburgh, PA 15236-1491,
or telephone 800.245.0696 or 412.655.6666.
Request Engineering Report No. 1470)

AEG Transportation Systems, Inc.

AEG Transportation Systems (ATS), located in Pittsburgh, Pennsylvania, is a world leader in developing and applying innovative technologies for transit systems and services. As a supplier to most major mass transit systems in the United States, approximately half of all self-propelled rail transit cars in the nation use ATS equipment. In addition, AEG Transportation Systems enjoys a leadership role in supplying automated guideway transit technology, with more operating systems worldwide than any other company.

AEG Transportation Systems, which employs nearly 1,000 in the U.S. and field offices around the world, currently is supplying propulsion equipment to transit systems in Taipei, Dallas, Toronto and Los Angeles; a monorail system to the Newark International Airport; signaling equipment to New York City Transit; and an automated transit system for the new Kuala Lumpur International Airport. Current programs also include the expansion of existing automated transit systems in the Atlanta and Las Vegas airports. Earlier this year, the company received an award to rehabilitate 200 20-year-old cars for the San Francisco Bay Area Rapid Transit District (BART).

The company is a member of AEG Daimler-Benz Industrie. However, on March 16, 1995, it was announced that AEG Daimler-Benz Industrie and ABB Asea Brown Boveri intend to merge their rail transportation activities and form a 50-50 joint venture. The new company, with the working title ABB Daimler-Benz Transportation, to be headquartered in Europe, will benefit from ABB's leading technology position in electrical engineering and the Daimler-Benz group's leading position in transportation systems.

If approved by the respective parties' supervisory boards and appropriate authorities in Europe and the United States, the resulting company would be the largest international provider of rail systems, with estimated sales this year of $4.5 billion. The venture will have operations in about 40 countries. The company will employ over 20,000 people.

Transportation Research Board, Committee A1F04, Transportation Related Noise and Vibration
Chairman's Corner

Domenick Billera

Boston was the site of A1F04's 1995 Summer Meeting. Hosted by USDOT and Acentech and held from July 16-19, over 120 participants experienced three days of exceptional presentations, excellent adventures on field trips and evening social events which provided extra time for in-depth exchanges on many noise issues. A summary of the papers presented are included in pages 12-17 in this issue. My thanks to organizers and participants alike for making the meeting a success.

Looking ahead, August is the deadline for submission of papers to TRB for our Annual Meeting to be held in Washington, D.C., January 7-11, 1996. See the call for papers announcement on page 24 of this issue for more information.

A basic mission of TRB Committees has always been information exchange. Recently we have been approached by other organizations in an attempt to improve information exchange between all noise experts. The Institute of Noise Control Engineering is attempting to organize an informal coordinating group on Noise Control Engineering. A1F04 representatives have attended two organizational meetings. Ideas being discussed are a CD ROM project, Internet home pages and more. As things develop, you'll read it first here in the Wall Journal. ■

Ed. Note: In this issue, we have printed summaries of the professional papers which were presented at the TRB A1F04 Summer Meeting in Boston.

In the next issue, we expect to have a further report on the conference and social activities which took place at the meeting, as well as some good photography, we have been told.

It is not too late for you to get involved in the professional workings of A1F04. Phone, fax or write the Chairman Domenick Billera at:

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SUMMARIES OF PROFESSIONAL PAPERS

Presented at the Transportation Research Board Committee A1F04 Summer Meeting in Boston, MA July 16-19, 1995
Hosted by: US DOT Volpe Acoustics Facility Center and Acentech Incorporated

WAYSIDE HORN TESTS IN LOS ANGELES

Since initial operation of the Blue Line, the first new light rail transit line in Los Angeles, the system has had continuing problems with accidents at grade crossings and community complaints about the horn noise. The use of wayside horns located at the grade crossings has been proposed to improve the warning to pedestrians and motorists of approaching trains while simultaneously minimizing the community noise exposure by localizing the warning noise to the immediate vicinity of the intersection. The wayside horn concept was recently demonstrated at one of the Blue Line grade crossings in Compton. This presentation will summarize the acoustic results of those tests, both the impact on community noise exposure and the warning effectiveness, and present the results of a focus group evaluation of the wayside horn effectiveness.

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NOISE REDUCTION RETROFIT ON HISTORIC STRUCTURES

The legacy of our country is written in the historic buildings in each of our communities. Very often historic buildings are located adjacent to major highways, rail lines and airports. Nothing can be more logical. What has been an excellent site 300 years ago for proximity and ease of commerce, becomes amplified over time as an excellent site now saddled with modern transport.

This presentation focuses on historic buildings in everyday use where noise reduction retrofit would be an enhancement to the building occupants. There must be a strong feeling that the historic nature of the building should be preserved. Very often, sounds annoying to the occupants of a building come not only from direct vehicle source but also from vibration that rattles the building structures. The process of designing a creative solution to noise reduction takes all sources of generated noise into consideration.

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ESTIMATION OF THE VIBRATION ATTENUATION EFFECT OF CONCRETE SLABS UNDER BALLAST MATS

Ballast mats are planned to be installed at a number of locations in the Tri-Met Westside Light Rail Transit Project (Hillsboro Extension) in Portland, Oregon, for the purpose of reducing the vibrations that reach buildings near the right of way. Although ballast mats generally have been placed on concrete slabs, the desire to save costs has prompted consideration of locating concrete mats directly on the soil. This paper extends an earlier, validated analysis to show that omission of the concrete slabs may be expected to reduce the vibration attenuation effectiveness of ballast mats relatively little in the important frequency bands.

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CANTON VIADUCT STUDY

As part of a MBTA sponsored renovation design project to facilitate faster train speeds, the Canton Viaduct and surrounding sensitive receptors were examined with respect to potential noise and vibration impact severity. The Canton Viaduct is a multiple arch, 700 ft long, 55 ft tall, granite rail viaduct spanning the Neponset River. Built in 1834 and on the National Register of Historic Places, the viaduct currently supports two tracks between the Canton and Sharon Stations. It services MBTA Commuter Rail, Conrail and Amtrak rail activities. For safety reasons, the present structure has a severe speed restriction on some trains that use this viaduct.

KM Chng performed extensive noise and vibration monitoring on and surrounding the active rail viaduct. Future noise impacts, including impacts during construction, were predicted using FTA proposed rail noise models adjusted for site specific conditions and speeds. Vibration impact models were developed empirically from the measured data and were extrapolated to estimate impacts from higher design speeds. Potential impacts on the adjacent properties and neighboring residences were identified, and candidate noise and vibration mitigation measures were proposed.

Significant points of interest for a TRB paper would include a description of the extensive and challenging vibration measurements performed at 3 mutually orthogonal directions on the top and bottom of the viaduct, respectively. In addition, vertical ground-borne measurements were made in a traverse pattern at 6 locations. In total, over 100 train passby events of differing consists, speeds, and types were measured. Data was reduced to yield wideband RMS velocity levels (in dB re 1 u-ipS) and curve fitted to find the best empirical model fit for both structural and ground-borne vibration levels as a function of speed and distance. Interesting characteristics regarding the viaduct's dynamic behavior were revealed through spectrum averaged transfer functions developed through the viaduct in longitudinal (X), lateral (Y), and vertical (Z) directions. Namely, the viaduct responded predictably in the X and Z directions, but exhibited a more efficient transferal of vibration in the Y direction manifesting in two discernible resonance frequency regions.

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A VIEW OF SOUND INSULATION FENESTRATION

In over 10 years of residential sound insulation around Logan Airport, some things have stayed the same and some things have changed the same. The generic approach to treating windows for sound insulation has remained constant: use the dead airspace between two layers of glass to provide improved noise reduction performance against the infiltration of aircraft noise. However, as the program has treated different noise exposure conditions with different housing stock and neighborhood character, the actual type of window treatment has evolved. This presentation discusses the acoustical implications of these changes and compares data from manufacturers with a wide range of field results.

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APPLICATIONS OF BOSTON-LOGAN'S NOISE MONITORING SYSTEM

Boston's Logan International Airport has an advanced noise monitoring system consisting of noise, aircraft track, weather, and land use information. The system has been used to support INM 5.0 validation efforts, to improve INM track definitions, to assist in assessing aircraft departure procedures, and to isolate the types of aircraft affecting various communities. Examples of the newer applications pursued will be presented.

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NOISE IMPACT STUDY FOR LEAST BELL'S VIREO HABITAT ALONG CALIFORNIA STATE ROUTE 33

A noise study was conducted to determine the impact that a proposed temporary detour during a highway reconstruction project would have upon a habitat area for the least Bell's vireo, a federally-protected species. FHWA and California Department of Transportation policy do not address noise impacts on wildlife species; the study was conducted in response to a requirement of the U.S. Fish and Wildlife Service. Several mitigation measures, including approximately 4,000 feet of temporary noise barriers, were considered. The project is notable because it was among the first instances of highway noise mitigation in California considered specifically for the protection of a wildlife species. The study contributes to a precedent for future studies and raises questions regarding several policy issues.

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SITING THE NIST ADVANCED TECHNOLOGY LABORATORIES: CONSIDERATION OF TRANSPORTATION-INDUCED VIBRATIONS

Vibrations from transportation sources can have a significant impact on facilities in which research is conducted. This is particularly true when the objective of the facility is to define and advance the state of the art in measurement standards. Historically, the National Institute of Standards and Technology (NIST) has been a major resource to industry in that it maintains national standards and undertakes basic research. NIST has been assigned the mission of supporting America's technological competitiveness worldwide, and the obsolescence of its existing laboratory space has made necessary the design of new Advanced Technology Laboratories and the renovation of existing laboratories. One of several primary mandates to the design team is to provide extreme vibration stability, with criteria even more stringent than typically encountered in a high-technology facility. As the first step in the vibration consultant's involvement throughout the design process, vibration surveys were carried out at a pair of sites on the Gaithersburg, MD campus. Vibrations due to highway and rail traffic became the primary reason for rejecting one site in favor of the other. This paper reviews the statistical-based analytical procedures used in that site selection process, as well as considerations that carried over into site planning and design.

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* Work performed while employed at Acentech Incorporated ■

CONTROLLING HELIPORT NOISE IN SUBURBAN ENVIRONMENT

The location of a heliport and helicopter maintenance facility in the middle of a suburban residential community can set up an adversarial relationship between the helicopter facility and its neighbors, mainly because of the noise generated by the facility. In the community studied, this adversarial relationship had been going on for more than 20 years before the study commenced. Through a monitoring, modeling, and negotiating process, a strategy was developed to ensure that such a facility and its neighbors could peacefully coexist. The results of this study will be discussed. Key to the success of this study was dealing effectively with both the neighbors and heliport management to come up with effective solutions that each party would be satisfied with.

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ARCHITECTURAL FINISHES FOR PRECAST CONCRETE SOUNDWALLS

The subject matter involves the Architectural Finishes for Precast Concrete Soundwalls. Discussions will include Colored Concrete (both Integral Pigment and Stain), Exposed Aggregate, Form Liners, and Smooth as Cast.

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PENNSYLVANIA DEPARTMENT OF TRANSPORTATION RETROFIT NOISE BARRIER POLICY STUDY

Federal Highway Administration (FHWA) noise regulations (CFR 23 Part 772) allow States to use Federal-aid highway funds to provide noise abatement along existing highways. These projects, known as Type II noise abatement projects, are implemented strictly at the option of the State. There is considerable flexibility in the FHWA noise regulations for States to design their own programs, manage these projects, and prioritize projects. The Pennsylvania Department of Transportation is in the process of designing, and plans to implement a methodology for inventorying and prioritizing areas eligible for Type II noise abatement. Since FHWA does not provide full funding for these projects, state funding options will also be analyzed.

Greenhorne & O'Mara (G&O) and Paul Heishman, P.E. (PH/PE) were retained by PennDOT to investigate these issues. A three phase process was devised for the development of a policy and a program to address Type II abatement needs. The first phase of the process involved a survey of various state Departments of Transportation (DOT), review of secondary source information regarding various Type II programs, and the examination of noise complaint files. This information will be used to develop a methodology for prioritizing Type II noise abatement programs. The activities of this first phase, literature review, survey of State DOTs, and review of complaint files, will be presented at the TRB summer session.

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NOISE IMPACT OF A LAYOVER FACILITY

This paper describes a noise impact analysis that addresses the low frequency noise impact from commuter rail layover facilities. This analysis included measuring noise levels of existing layover facilities, and establishing layover facility operations to develop a noise model to assess impacts of proposed layover facility at sensitive receptor sites. In addition, measurements were taken at a train maintenance facility to assess the noise attenuation from different enclosures. Since there was only a dBA criteria for the facility, a low frequency noise criteria was developed. Noise mitigation recommendations to meet both state noise code requirements and the established low frequency criteria were developed.

Some of the significant points of interest for this paper are that most noise criteria for train facilities use dBA, which does not address the impact of low frequency noise. If low frequency noise from the operation of a layover facility intrudes into a residential community, it can cause considerable annoyance. A high noise level in the 31 Hz octave band can cause windows, doors and china to vibrate and even set off car alarms! This paper presents a low frequency noise criteria that addresses these issues.

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USE OF BACKGROUND NOISE CORRECTION

A correction scheme has been proposed which consists of repetitive measurements of the source-signal-with-background and background noise alone when the computation of a signal estimate and prediction interval. The procedure assumes that both the source of interest and background noise are: un-correlated, normally distributed, random processes which are stationary over the duration of the measurements. 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 measured parameters. For relatively low background noise situations, the technique is useful primarily for quantifying expected measurement confidence bounds. Application of the procedure to a field measurement situation with mean source band sound levels ranging approximately 2-15 dBA re mean background band sound levels gave a 99.5% confidence upperbound margin of 0.3-1.3 dB with 17-19 measurements per band.

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NOISE ABATEMENT PRIORITY PROCEDURE FOR MBTA 'S RAPID TRANSIT SYSTEM

A fair priority ranking procedure for noise abatement has been developed for MBTA as part of the Authorityls comprehensive noise abatement program. With the authorization of $18 million in funding for the program, it was necessary to devise a fair method for determining the most effective use of the resources. This paper presents the details of the method and discusses how it has been applied to the Blue Line and the Red Line. Noise barrier construction and soundproofing programs are being implemented. Vibration control is also being implemented on a priority system, slightly different from that of noise. An optional tour of the initial noise barrier and ballast mat installations will be a part of the TRB Summer program.

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FHWA TNM/TNS EMISSION LEVEL DATA BASE

The U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center, Acoustics Facility (Volpe Center), in support of the Federal Highway Administration (FHWA) and twenty-six sponsoring state transportation agencies, conducted a highway noise measurement study to develop a Reference Energy Mean Emission Level (REMEL) Data Base. The Data Base is the primary building block for the FHWA Traffic Noise Model/Software (TNM/TNS) around which the acoustic algorithms are being structured. The components of the REMEL Data Base are as follows: constant-flow REMEL data; interrupted-flow REMEL data; and subsource-height data.

Measurement site selection was based on geometry, traffic speed and volume, vehicle type, pavement type, and roadway grade. Acoustical data, including the A-weighted maximum sound levels (LAFmx), the one-third octave-band spectrum at the time of LAFmx, and the spectral time-history data, were obtained. The REMEL data and related subsource-height data are being used to develop the regression equations of sound level versus speed, frequency, and subsource-height required for TNM/TNS.

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HOW RESULTS FROM FHWA'S NEW TRAFFIC NOISE MODEL COMPARE WITH STAMINA: REAL CROUND EFFECTS, DIFFRACTION AND REFLECTIONS

The new FHWA Traffic Noise Model (TNM) incorporates much more sophisticated sound propagation algorithms than STAMINA does. The results of implementing these algorithms are in some cases very similar to the results from STAMINA, and in other cases quite different. This paper discusses situations that give similar and different results, and explains the reasons. The magnitudes of the differences in results are presented and discussed.

The following are some elements of the TNM that contribute to differences in results compared with STAMINA: selectable ground types (impedance), multiple diffraction, proper representation of berms, and incorporation of reflections from barriers. The significance of each of these elements is discussed.

•The TNM user can select various ground types, and this affects the rate at which sound levels drop with distance. Since the user has many choices, and the ground type can be varied within a study area, the possibilities are much more varied than with STAMINA.

•TNM will compute diffraction over (up to) two objects that interrupt the source receiver path, while STAMINA can handle diffraction over only one barrier. Therefore, greater total barrier insertion loss can be computed. In addition, TNM accounts for the effects of various surface impedances for the two diffracting objects, which also affects the results.

•Since TNM accounts for the impedance of diffracting surfaces, berms (which are soft) provide different results from STA-

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MINA. TNM computes greater insertion loss for berms, which matches measured data better than STAMINA results do.

- STAMINA does not compute reflections from barriers correctly. TNM computes reflections and incorporates the proper reflected energy by accounting for the user specified Noise Reduction Coefficient (NRC), thereby increasing sound levels at receivers opposite such barriers.

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THE EFFECTS ON HUMAN ANNOYANCE OF MILITARY FLIGHT TRAINING OPERATIONS

The United States Air Force routinely conducts training missions which are characterized by low-altitude, high-speed overflights of military jet aircraft. The noise from these missions can be characterized as sporadic, with short duration and rapid onset. Over the past several years a sequence of psycho/socio-acoustic studies has been conducted to better understand the environmental impacts of such noise exposure. The sequence ranged from laboratory studies, in which the physical and social parameters were well controlled but highly artificial, to field studies in subjects' own homes, in which these parameters were less well controlled but the setting was natural.

This paper summarizes the results of this sequence of studies. A statistically significant dependence of annoyance on the onset rates of individual noise events was found and has been codified in the Air Force's onset rate corrected, busiest month, day-night average sound level metric, L_{dnmr}. Measurements of the daily annoyance to various sequences of individual noise events confirmed the equal-energy principle, which generally states that annoyance is a function of the total acoustic energy received and not of the manner in which it is received. No statistically significant dependence of daily annoyance on the sporadicity of the noise events was observed.

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INTERSTATE 95 NOISE BARRIER DESIGN PROJECT

Acentech Incorporated, in conjunction with LZA, was retained by the New York State Thruway Authority to design five Type II (retro-fit) noise barriers along I-95 in New Rochelle, New York. The approximate barrier limits are as follows:

MP 3.5NB to M P4.3NB
MP 9.SNB to M P9.8NB
MP 8.38NB to M P8.80NB
MP 14.46NB to MP 14.76 NB
MP 6.1SB to MP 6.76SB

This paper presents several interesting acoustic design issues with regard to the barrier at MP 3.5 NB to MP 4.3 NB (Barrier A). On the side of the Thruway opposite Barrier A, a reflective (concrete) barrier is currently in place to shield adjacent neighbors from highway noise. The parallel barrier configuration that will arise after installation of Barrier A could degrade the acoustic performance of both barriers. Acoustic analysis and subsequent sound absorption treatments to reduce such acoustic performance degradation are discussed.

In addition, the Northeast Corridor runs parallel and is immediately adjacent to the east of I 95. It was deemed necessary to place the barrier within the right-of-way, that is, between the Thruway and the Northeast Corridor. This barrier position could reduce the acoustic performance of Barrier A due to rail noise and/or reflected rail noise. A discussion of acoustic analysis and subsequent sound absorption treatments to reduce such acoustic performance degradation are discussed.

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FREQUENCY DEPENDENCE OF BARRIER INSERTION LOSS

The performance of road noise barriers is typically estimated making use of approximate geometrical, energy-based methods. While these techniques provide some insight to the shielding effect of a particular geometry, they are only crude approximations to the frequency dependent, wave-based phenomena. In this paper, roadside barrier and berm insertion loss characteristics are determined for a variety of geometries making use of two and three dimensional boundary element methods to model the true wave-based nature of the scattering problem. Using this modeling basis, it is possible to properly consider phase, wavelength and destructive cancellation effects that most energy-based strategies cannot model. Several parameters are considered in the study, including barrier cross-section, source and receiver positions, single and parallel barriers as well as hard and absorbent surfaces. Results from the tests are presented in a variety of ways including insertion loss characteristics as a function of frequency, distance behind the barrier and height of the barrier. Many of the results differ greatly from the widely accepted, presently used modeling standards.

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IN-SITU NOISE AND VIBRATION MEASUREMENTS AND DESIGN RECOMMENDATIONS FOR WELDED ALUMINUM JET BOATS

The difference in operating noise levels between welded aluminum jet boats and similar sized boats of more conventional design (wooden or fiberglass hull, external propeller) are not well documented. Welded Aluminum Jet Boats are typically used in shallow rocky waterways (such as the Idaho Snake River) where conventional boats are not well suited for such extreme conditions. A small association of Aluminum Jet Boat builders, in an effort to avoid potential pressure from environmental groups, sought to document the operating noise levels of their products, and also receive some practical assistance in improving their product design to achieve a reduction in noise levels. Acentech was retained by the manufacturers' association to conduct in-situ noise and vibration measurements of their current models, and to provide some guidance to the manufacturers on how they could produce a quieter product in the future. For example, there was concern, but no hard evidence, that noise radiating from the aluminum hull was a major contributor to overall noise levels. A series of tests, including comparative vehicle pass-by events, in-situ hull vibration measurements, and in-situ engine noise acoustic intensity measurements were conducted. These tests helped to identify the greatest contributors to overall noise level at on shore positions and have aided the manufacturers in determining a plan for quieting their boats.

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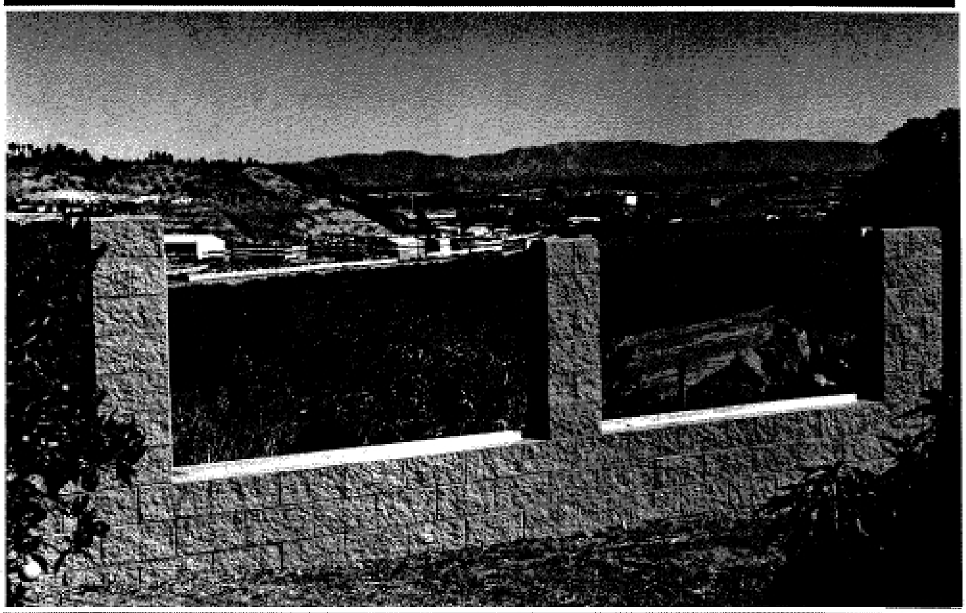

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STANDARDIZATION OF AIRCRAFT NOISE INSULATION MEASURES WITHOUT COMPROMISING RESULTS

By Dana Hougland and Michael B. Barnhardt, David L. Adams Associates, Inc.

INTRODUCTION

A program to bring noise relief to all owner-occupied homes within the 70 Ldn contour surrounding a major metropolitan airport allowed investigation of many innovative methods. Among the innovations included were: criteria based on improvement in noise reduction rather than total noise reduction, using a systematic construction survey method rather than acoustical testing of each home, a maximum monetary cap on construction costs of each home, and cooling and ventilation techniques utilizing evaporative cooling.

The Stapleton Noise Insulation Program (SNIP) is a project fully funded by the City and County of Denver. Of the original 3600 homes potentially eligible, a total of 2296 eventually participated in the program. Most homes which dropped out of the program did so due to sale or repossession of the home. The program also included churches and schools located within the 65 Ldn contour.

The results presented herein show that the acoustical performance improvements were substantial, consistently exceeding a 10 dB improvement in A-weighted noise reduction. Public response has also been extremely positive. Construction costs were capped at $7500.00 per home and average administrative costs were held to approximately 10% of construction costs.

INNOVATIVE TECHNIQUES

As a result of the initial research and testing by the design team lead by David L. Adams Associates, Inc. a program based on systematic surveying and prioritization was developed. Surveys were designed to be conducted by personnel experienced in construction but not specifically specialized in noise insulation programs. Preliminary research was completed on a carefully selected sample of 2% of the program homes. Pre- and post-construction testing was conducted on just over 1% of the program homes. Tested homes were done as part of the overall program and received no special treatment.

The initial testing and research established the prioritized remedial measures. The prioritized recommendations were coded with a series of standardized construction details. Bid packages for groups of 10 to 20 homes were created by providing a list of prioritized remedial measures for each home with the appropriate details. Custom detailing was produced for less than 1% of homes in the entire program. This system is unusual primarily for its use of construction rather than acoustical surveys on the individual homes. The basic priorities for remedial treatment followed were as follows:

- Air leaks into living areas.
- Fresh air ventilation.
- Large air leaks into adjacent upper plenum space (attic).
- Window upgrade or replacement.
- Exterior door upgrade or door replacement
- Large air leaks into adjacent lower plenum spaces (crawl space or basement).
- Upgrades to exterior walls or roof structures.

It was found that homeowners were very receptive to the use of standardized products if products of very high quality were selected. Quality was made affordable by bulk purchasing. Bulk purchasing was utilized for replacement windows, exterior doors and storm doors.

Windows all meeting the same stringent performance standards were utilized throughout the program. After investigation of shielding effects, it was decided that differentiation of window performance by consideration of noise exposure was detrimental to the program. Tests showed that due to the altitude of the aircraft during fly-over and the effect of nearby reflecting surfaces, variations in wise exposure were less than 5 dB for different exposures. Not surprisingly, homeowners were much more receptive to complete window replacement with identical windows wherever monetarily possible. Window replacement in most homes accounted for approximately 50% of the total construction cost. The performance requirements along with the tested performance of the various window styles are shown in Figure 1.

Improved ventilation was a high priority. Ventilation measures included the addition and noise control of make-up air and combustion air, noise control of existing venting, addition of fresh air ventilation systems either by the addition of a fan-only option to existing forced air furnaces or the addition of an attic mounted fresh air ventilation system. Ventilation rates were based on a minimum of 1-1/2 cubic feet per

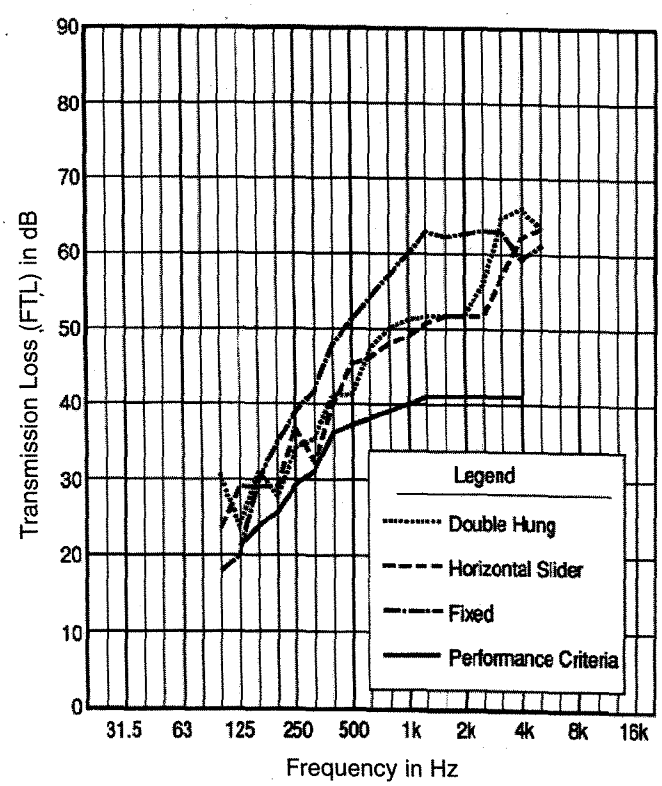

Figure 1: Transmission Loss Test Data for Windows with Equivalent STC Ratings

(*Aircraft Noise Insulation*, continued from page 19)

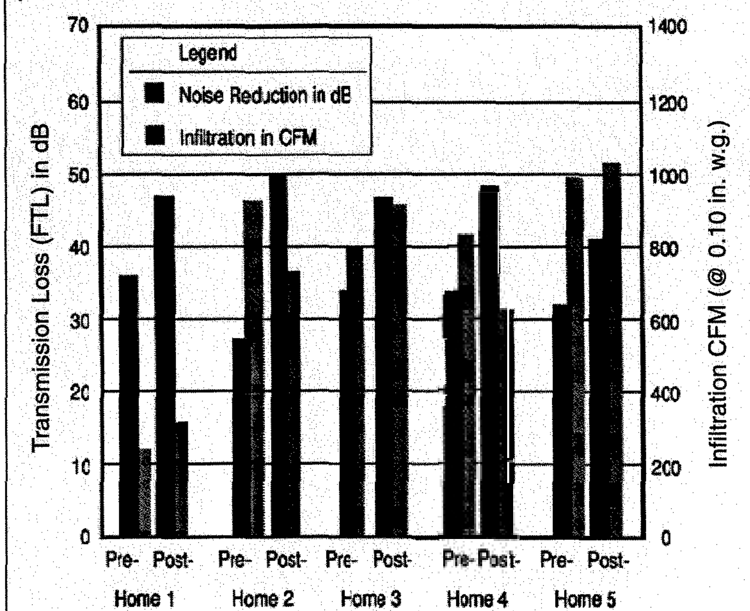

Figure 2: Comparison Between Pre- and Post-Construction Noise Reduction and Air Infiltration Tests for Five Homes

minute per square foot of floor area. Cooling was added either in the form of mechanical or evaporative cooling.

The evaporative cooling option, though cost effective for operation, has inherent noise insulation liabilities. Traditional installations utilize a direct discharge into the central portion of the house through the roof with circulation provided by slightly opening windows about the perimeter of the house. A ducted evaporative cooling system design was incorporated for noise control with barometric relief vents in perimeter rooms into the attic with noise baffled exterior venting.

Due to concerns about indoor air pollution, and radon daughter contamination in particularity, a special study was conducted correlating air infiltration to noise reduction. Air infiltration tests were conducted along with noise reduction tests. Results, such as those illustrated in Figure 2, indicate no significant correlation.

Two sample homes were tested before construction, after the standard noise insulation package was implemented, and then after a special infiltration retrofit was completed. Results showed no improvement or at most1dB of improvement in A-weighted noise reduction. These results support a previous study conducted for the Naval Facilities Engineering Command.

Original designs incorporated traditional, fiberglass lined sheet metal ductwork. Due to very low profile attics in certain groups of homes a technique using longer

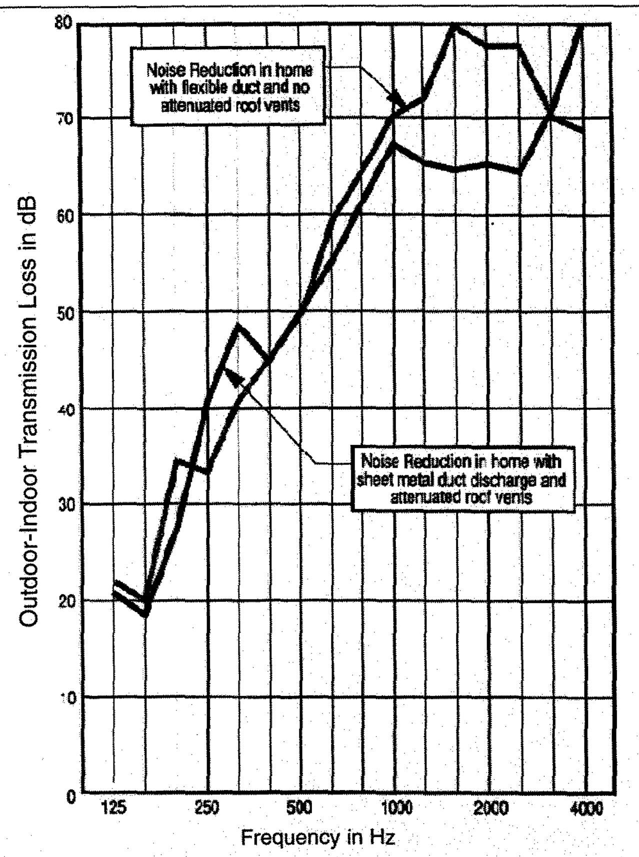

Figure 3: Comparison Between Noise Reduction Data for 2 Similar Houses that have Different Evaporative Cooler Installations

lengths of flexible ductwork was investigated. Noise reduction tests were conducted with both styles of ductwork systems to evaluate the feasibility of the flexible ductwork design. Test results are summarized in Figure 3. Results were found to be acceptable and the revised supply system was utilized where appropriate throughout the program with satisfactory results.

A variety of contracting methods were sampled during the course of the project. Traditional contracting methods using general contractors with groups of 5 to 10 homes were employed. One of the Installing Agencies experimented with negotiating line item pricing with groups of subcontractors and the use of separate crews of municipal employees to do window installations. All variations from a standard general contracting procedure resulted in problems with quality control and scheduling. Although the intent was to streamline the entire process by working directly with subcontractors, both Installing Agencies eventually used the standard general contractor system in combination with unit pricing for best results to complete the project in a timely manner.

(***Aircraft Noise Insulation***, *continued on page 22*)

(**Aircraft Noise Insulation**, *continued from page 21*)

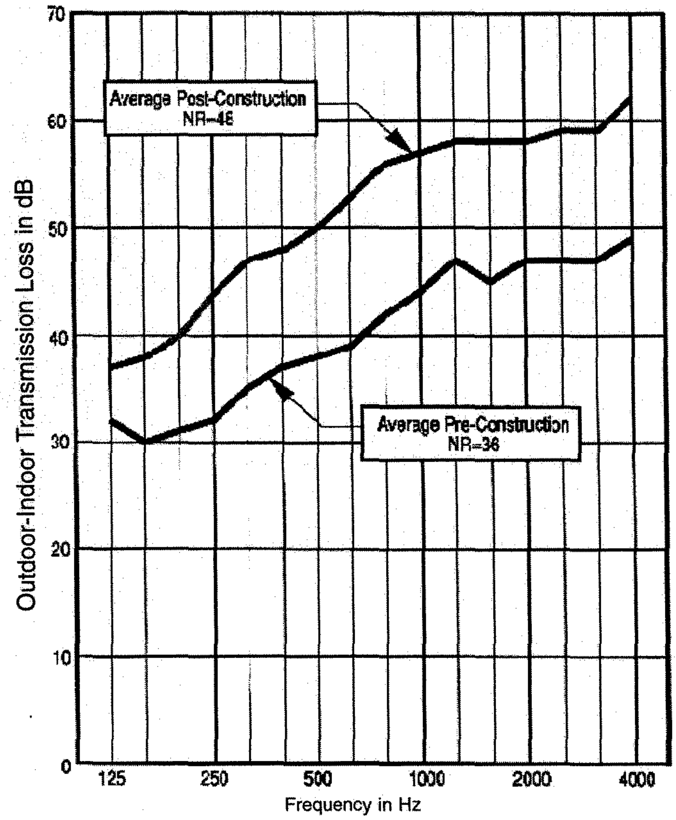

Figure 4: Average Noise Reduction Data for Pre- and Post-Construction Periods

RESULTS

The results of the pre- and post-construction testing are testament to the success of the techniques applied. Even with the extremely stringent monetary cap, the average A-weighted noise reduction improvement was 12 dB. Figure 4 illustrates the results of the pre- and post-construction testing.

Through the use of innovative techniques, the program was made very economically efficient. Including the cost for construction, administration, as well as engineering design costs, the resultant improvements cost less than $800.00 per dB of noise reduction improvement.

Public response has been extremely positive. Throughout the program 93% of the participants gave the SNIP program a favorable evaluation in independently conducted public surveys. An average of 93.5% of the participants experienced improvement in the noise levels and 80% experienced less irritation after the improvements. ■

REFERENCES

1. J.D. Verschoor and J.D. Haines, Acoustical Benefits Resulting From Insulation and Air Leakage Control in Family Housing Units. (Denver: Manville Services Corporation, [1983]), p80-81.

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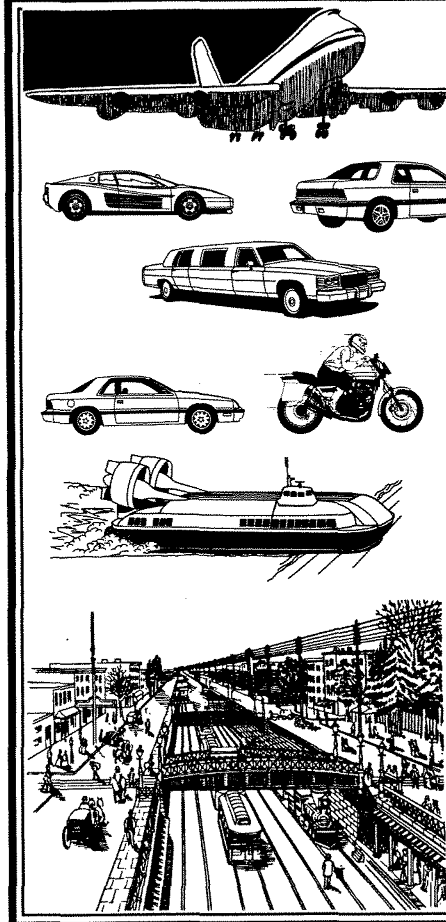

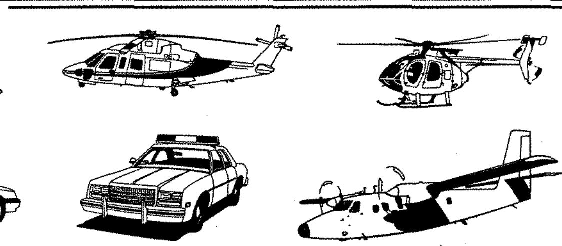

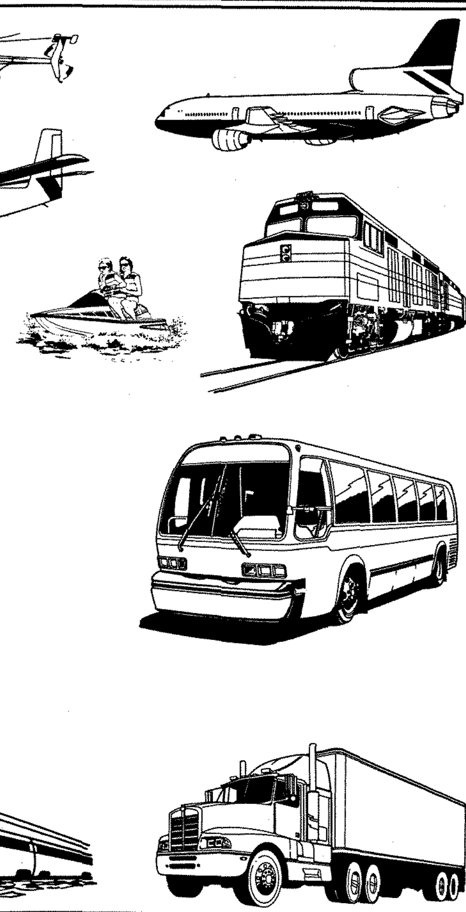

HELP!!!!

I'm surrounded by transportation related noise and vibration. It's driving me crazy. I can't fight it alone. I need professional help. Please send your personal remedies for this plague. I will publish for the enlightenment of the masses.

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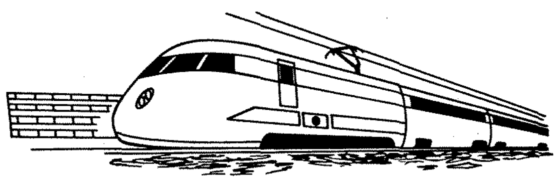

CALL for PAPERS for the TRANSPORTATION RESEARCH BOARD ANNUAL MEETING, JANUARY 7-11, 1996, WASHINGTON, D.C.

Call for papers on Transportation Noise (Aircraft, Highway, Rail) and Land Use Planning related to Transportation Noise, to be presented in sessions held by Committee A1F04, at the 75th Annual Meeting of the Transportation Research Board.

NOTE: If you have interest in submitting a paper, it is recommended that you contact one of the following persons immediately; papers were first required for submission in mid-August.

Submit Annual Meeting Papers to:

Peter Shaw
TRB Staff Liaison
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Maryland State Highway Admin.
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One Consultant's Checklist for Conducting a Public Meeting on Highway Noise

James P. Cowan of McCormick, Taylor & Associates, Inc. of Philadelphia made a spirited and interesting presentation on the above subject at the 1994 Summer Meeting of the TRB A1F04 Committee. Here are some excerpts.

Top 10 Questions/Comments Posed by the Public on Noise Issues

(Treat all responses to the public as court testimony because someday they may be).

- Your report is too technical.
- Our wall doesn't work; now we want a berm (and vice versa).
- You don't know what you are talking about/I know more than you do about noise.
- How can you know anything about my neighborhood when you don't live here'? (let me do the report).
- You promised us a wall and now you are breaking that promise.
- Why wasn't my house monitored?
- You said you monitored my house but you marked another location on your map.
- My brother's gardener monitored 82 decibels near my house; how can you say you monitored less than 67 and that that is acceptable?
- How would you like this in your back yard?
- The noise is ruining my life/driving me/my family crazy (pending lawsuit).

Explain the Fundamentals in Understandable Terms

- Use common analogies (e.g., sound/light, decibel/Richter scales).
- Give meaning to the decibel scale, descriptors.
- Provide annoyance/hazardous limitations.
- List the effects of noise on people.
- Explain common noise control options in realistic terms.
- Use demonstrations.
- Use only terminology that has been fully explained.
- Always leave room for questions.

Make People Feel That They Are Part of the Process

- Listen for concerns, encourage discussion after fundamentals are explained, determine real agenda and deal with that.
- Make realistic promises that you know you can keep, document all relevant promises and conversations, get comments in writing, provide answers in writing, and provide no surprises.
- Admit mistakes by praising the people who point them out.
- Be prepared to answer questions like "how would you like to live in this environment?" with sensitivity.
- Provide the option of people being involved in the monitoring process.
- Ensure accuracy of maps and monitoring locations, label streets.
- Have the consultant meet with people separately from DOT personnel.
- Have the consultant prepare a concerns document that is approved by the majorityof affected residents.
- Following analysis, show areas that warrant abatement consideration by color coded shading inside noise contours.
- Show people their real options for abatement, including those for people who live in areas not warranted for abatement consideration; let the people hear the effectiveness of different methods; obtain choices in writing.
- Provide phone numbers of responsible project personnel that will make themselves available, answer phone calls within 24 hours.
- Publish the abatement choice that is requested by the most residents; if no significant complaint after a specified comment period, provide that choice. ■

(If you would like further information, contact:
James P. Cowan
McCormick, Taylor & Associates, Inc.
701 Market Street, Suite 6000
Philadelphia, PA 19106
Fon 215 592-4200 Fax 215 592-0682)

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