The Wall Journal™

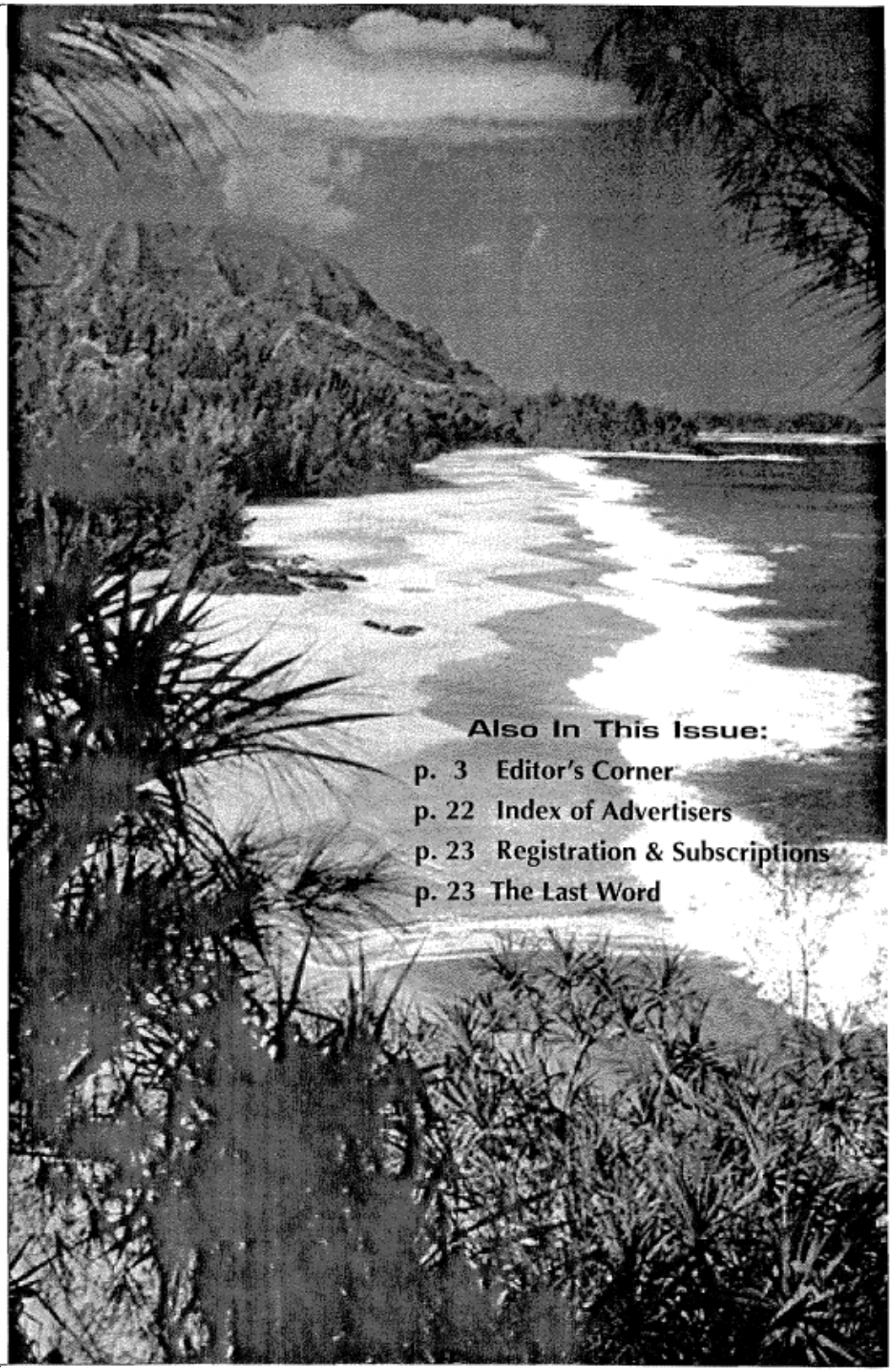
Issue No. 24

THE INTERNATIONAL JOURNAL OF TRANSPORTATION-RELATED ENVIRONMENTAL ISSUES

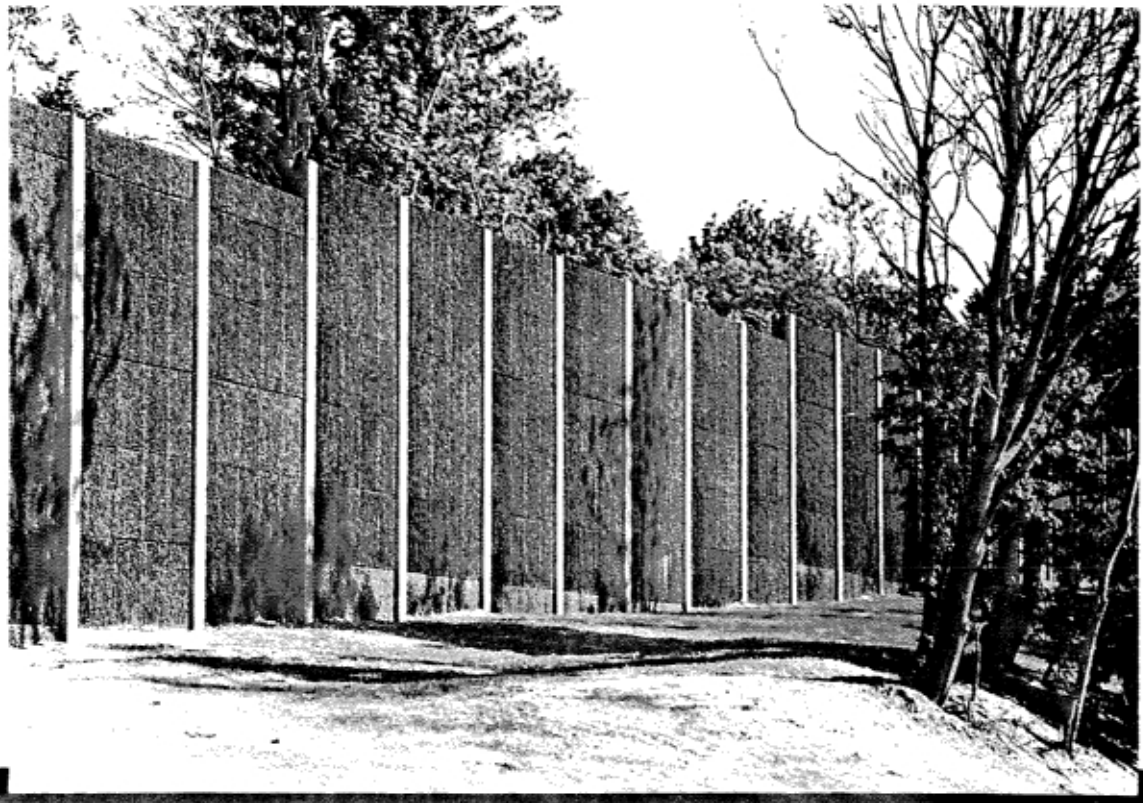
Jul/Aug 1996

Summertime 1996 — the best of times and the worst of times

In This Issue:



When beautifying and protecting soundwall...



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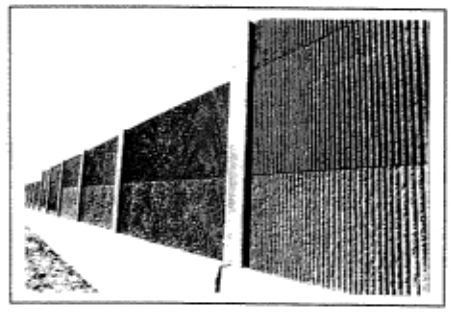
Sound absorptive highway noise barriers are becoming specified more and more. To significantly improve the appearance and durability of these structures, more specifiers are relying on **Fosroc** *for:*



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The Wall Journal

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Subscription and advertising information are shown on page 23.

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Editor's Corner

by El Angove

Changing Times

I know that title is not unique — I think it's the name of a song, or a newspaper or a magazine or a rock band — but it's the truth. The times are a-changin'. I can feel it. I can smell it.

I'm not as young as I used to be, but I still look pretty much like my picture. Except that I haven't worn a suit and tie in the last six years. So, I'm not complaining about getting old, nor getting left behind, nor being lonely, nor of not getting my share of the pie.

None of that. It's just that I sort of feel that there are *things* out there that are about to overtake me. I feel a sort of mounting presence of, well, evil. Not like Satan or ghosties, but just *things* over which I have no control.

Maybe it's all the violence and bad stuff that's going on in the world. Maybe it's just my imagination, but it surely makes me uneasy.

Like many of you, I watched the entire Olympic Games (which has delayed my publication of this issue – sorry about that). I was absolutely entranced by the thousands of athletes from all across the world, who were giving their gutmost efforts to win at competitive sports.

Those kids were all healthy, good-looking, bright, muscular, talented, well-coordinated, intelligent, well-trained and totally dedicated to what they were doing. What a great bunch of people to have on this planet!

Their enthusiasm and drive is infectious; it makes you happy just to be in their presence. I want to be around young people like that. Race, religion, color, country of origin — none of that matters when you deal with golden personalities in **real** people.

Conversely, I look at the lack of quality in a lot of the youth of America that I see in the streets and neighborhoods of the cities and towns in America. We seem to have spawned a breed of ill-educated, non-motivated, listless and hopeless youth. Their gods are rock stars and multi-millionaire sports figures who now look down on their own poor and underprivileged.

Of course, it is not entirely their own fault that they are in such dire circumstances. We can lay some blame on our government for this, but the militia is not an answer to the problem.

There is a simple answer to the whole problem in the universe. It is known as **discipline**. We need a lot more **discipline** in our lives. I don't mean black boot discipline. Possibly a year of (shudder) compulsory military service would put some backbone in our youth. More likely, in view of what sports competition has done for those great Olympic heroes, a **national sports program for amateur athletes** would probably produce a higher quality of citizen. I've had my fill of overpaid and egocentric **professional** sports figures.

I think that my hours watching the Olympic Games have allayed a lot of my unrest. Those kids have resurrected my faith in the human spirit. You know that it was their sheer discipline and strength of character that made them all champions.

There were really no losers in the more than 10,000 athletes who participated. **All of them** had already become champions for the *millions* of kids who didn't make it to the Olympics.

And their total humanism showed itself at the end of every hard-fought competition — winners and non-winners all congratulated and hugged each other in celebration of the struggle. They all showed us the way to real peace in the world. Discipline, hard work and love for each other.

And I think that the Atlantans showed everyone in the world a magnificent show and performance which will probably never be topped.

Sadly enough, Olympic athletes and terrorists coexist on the same planet. It is now time for a real change. ■

Newsmakers in Noise Abatement

Gary Figallo

GARY FIGALLO HEADS NEW HIGHWAY NOISE BARRIER DEPARTMENT FOR INDUSTRIAL ACOUSTICS COMPANY

Bronx, New York, June 19, 1996. The appointment of Gary Figallo to head Industrial Acoustic Company's (IAC) new Highway Noise Barrier Department, has been announced by IAC's President, Martin Hirschorn, effective immediately. IAC is an international noise control engineering and manufacturing company headquartered in New York and for many years has designed and constructed Sound Absorptive Noishield™ Barriers for highway and industrial applications.

Mr. Figallo, who joined IAC in 1994, brings more than 15 years of experience in the design and construction of highway walls. He has broad experience as product manager for sound absorbing concrete barriers and is well-known in the transportation noise control industry.

"I look forward to continuing IAC's long presence in the design and construction of highly Sound Absorptive Noishield Barriers for highways, at airports for jet aircraft, for transformers, pumping stations, cooling towers and many other applications," comments Figallo. "In addition," he states, "IAC will enhance its product line by offering low cost concrete, wooden and other innovative barrier structures. The necessary alliances for this type of work have already been established. It's exciting – we already have orders for several concrete barriers."

Figallo notes that there are many situations where state highway authorities, or communities specify concrete, wood or other barrier materials, but remarks, "We will continue to recommend sound absorptive barriers wherever appropriate because they provide more noise reduction than reflective ones, and allow for lower barrier heights. Sometimes the noise problem is truck related which would require a barrier designed for the lower frequency rumble while other problems may be the high pitched sound from grooved pavements." Moreover, IAC's NVLAP certified Aero Acoustic Laboratory can arrange for acoustical performance tests of barrier components or scale model barriers. The IAC Laboratory has an outstanding record in solving unusual acoustical and aerodynamical problems.

MORE ABOUT IAC

IAC, founded in 1949, a world leader in the manufacture of acoustical products and systems, is headquartered in New York City with offices and production plants in New York, South Carolina, and England and engineering sales offices in Germany and licensed representatives in the Far East. IAC serves the transportation, architectural, air conditioning (HVAC), industrial, medical life/sciences, power plant and military/commercial aviation markets. ■

LETTERS TO THE EDITOR

Dear Mr. Angove:

I am writing to request that you renew our free subscription to The Wall Journal as it is a very useful and informative tool used by our District Environmental Specialists. Please address the subscription to: Mr. William Barbel, Environmental Studies Manager, Illinois Department of Transportation, 201 West Center Court, Schaumburg, IL 60196-1096.

Thank you for the work you do to keep all interested parties current with the newest products and technologies. If you have any questions please contact William Barbel, Environmental Studies Unit Chief, at (847) 705-4122.

Very truly yours,

Duane P. Carlson, P.E.
District Engineer
Illinois Dept. of Transportation
District 1, Schaumburg, IL

By:
Patrick J. Pechnick, P.E.
Project and Environmental Studies Section Chief

(Ed. – Following is the kind of letter which does me the most good, because it adds to the size and accuracy of our database of readers, and makes me feel warm at the same time. I need all the help I can get.

The letter is from Wayne Kober, Director of the Bureau of Environmental Quality for PennDOT in Harrisburg. It is too full of details to print here, but I will highlight):

Dear El,

As we recently discussed, we looked over the PennDOT mailing list for The Wall Journal and request that you update your list as follows:

Make These Changes to Our Central Office Personnel:

(Wayne then lists four name and location changes).

Add the Following People:

(Wayne then gave me 11 new names, which also included District Engineers).

Keep Other PennDOT Personnel, Namely:

(He then verified the status of 9 names on our database. And then he wrote):

"Thank you".

(He had that last all wrong — it's me who should be thanking him, and I did. You can't believe how much moving around 1,800 readers can do. I really appreciate receiving letters with mailing list info and particularly **new names**. *Sock it to me).*

Larson•Davis Announces New Internet Home Page

Provo, Utah — Larson•Davis Incorporated (Nasdaq Symbol "LDII") today announced the release of their "Superior Sound and Vibration Instrumentation" home page at "http://www.lardav.com".

Larson•Davis' initial entry to the Internet includes full text and graphics for its product specification sheets; a calendar of upcoming shows featuring Larson•Davis booths; an overview to the Larson•Davis service and support policy; an e-mail link to the Larson•Davis Marketing Department for additional product and pricing information; and a comprehensive international directory of Larson•Davis sales representatives including phone and fax numbers, e-mail addresses and related links.

"While the current information establishes a strong presence on the Internet," stated the Larson•Davis Web designer Bruce Kolste, "in the near future we will be stretching the tremendous potential of the Internet to improve access to vital information, provide interactive product introductions, and give answers to frequently asked questions (FAQs) for enhanced customer support." In keeping with the Larson•Davis policy to remain at the industry forefront in terms of client satisfaction, Kolste continued, "We encourage all our clients - including both current and potential customers - to visit our Web site. Let us know the features you'd like to see to help you make more informed decisions."

For more information contact Ron Guymon at (801) 375-0177 ext. 168.

New Literature: Environmental Noise Monitoring System

Provo, Utah — Larson•Davis Laboratories has published it's newest full color 16 page brochure describing it's full line of hand-held, portable, and permanent environmental noise monitoring products.

The entire Larson•Davis range is discussed. The simplest products are the type 1 and type 2 basic sound level meters that provide time histories, interval data, and exceedance events that can be read in the field or in the office with or without the Windows™ based software. The four portable systems, ranging from 20 pounds to 60 pounds, provide increasing sophistication and capability. The systems are chosen based on moderate to severe weather conditions, lengths of measurement up to two weeks, ability for self calibration, and weather-data collection. All functions can be accessed and downloaded through cellular phones and modems as well as manually or by PC hookup at the site.

The permanent monitoring systems have abilities to share communications between units and the central station, alarms on tampering, remote calibration, and a host of other features. L_{dn}, CNEL, and virtually any other noise metric can be automatically and remotely retrieved by modems and telephones. Data can include wind velocity, humidity, barometric pressure, and rainfall.

For further information call or write: John Carey, Larson•Davis Laboratories, 1681 West 820 North, Provo, UT Tel: 801 375-0177 Fax: 801 375-0182 Internet: www.lardav.com

FHWA UPDATE

By Bob Armstrong, Office of Environment and Planning, Environmental Analysis Division, FHWA

The reports of my demise have become greatly exaggerated. As you can see, I am back in my accustomed column, where I intend to remain and continue to update you on what's happening at FHWA.

NHS Designation Act of l995 (NHS):

This act restricts Federal participation in the construction of Type II noise barriers (barriers built along an existing highway that are not part of a highway construction project). Federal funds may only be used to construct Type II barriers that (1) were approved before the date of enactment of the NHS bill or (2) are proposed along lands which were developed or were under substantial construction before approval of the acquisition of the rights-of-way for, or construction of, an existing highway.

FHWA intends to publish an Interim Final Rule in the Federal Register to make 23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise, consistent with the NHS legislation.

Section 772.13(b) of 23 CFR Part 772 will be revised to read as follows: "For Type II projects, noise abatement measures will only be approved for projects that were approved before November 28, 1995 or are proposed along lands where land development or substantial construction predated the existence of any highway. The granting of a building permit, filing of a plat plan, or a similar action must have occurred prior to right-of-way acquisition or construction approval for the original highway on new location. Noise abatement measures will not be approved at locations where such measures were previously determined not to be reasonable and feasible for a Type I project."

Traffic Noise Model (TNM):

FHWA is planning to release a new highway traffic noise prediction model, the Traffic Noise Model, Version 1.0 (FHWA TNM). Release has been delayed pending correction of program "bugs" and reduction of program run times.

The FHWA TNM will calculate traffic noise levels using totally new acoustical algorithms, as well as newly-measured emission levels for five standard vehicle types, i.e., automobiles, medium trucks, heavy trucks, buses, and motorcycles. The calculations will be based on one-third octave-band analysis and subsource heights for trucks. The FHWA TNM will output overall a-weighted sound levels for locations with and without noise barriers. It will allow for analyses of (1) both constant-flow and interrupted-flow traffic, (2) attenuation due to rows of buildings and dense vegetation, (3) effects of parallel noise barriers, (4) results of multiple diffractions, and (5) noise contours .

The FHWA TNM will have a Microsoft Windows interface and an internal Computer-Aided Design Drawing capability. It will be designed to run on the following hardware/software:

- Processor: IBM-PC compatible with 66 MHz 486 and integral math coprocessor
- Memory: 8 MBytes
- Hard Drive: 300 MBytes
- Monitor; Accelerated Super VGA (1024 x 768),16 colors, small font

TNM "Look-Up Tables":

FHWA plans to distribute TNM "look-up tables" for simple applications of highway traffic noise prediction. These tables can be used for screening analyses or uncomplicated traffic noise analyses.

New "Highway-Related Noise" Measurement Manual:

FHWA plans to distribute a new noise measurement manual this fall. The new manual will replace the existing "Sound Procedures for Measuring Highway Noise: Final Report."

Noise Barrier Videotape:

FHWA will release a 30-45-minute videotape this fall on noise barriers, intended for use in public forums where a general knowledge on traffic noise and noise barrier examples is desired. Copies will be distributed to all State highway agencies.

Noise Barrier Listing:

FHWA plans to distribute "A Summary of Noise Barriers Constructed by December 31, 1995," this fall. Data is still being supplied by State highway agencies. Barrier "trends" data will also be distributed and will also be published in The Wall Journal.

OECD Report on "Roadside Noise Abatement"

The Organization for Economic Cooperation and Development (OECD) published a report in October 1995 titled "Roadside Noise abatement." The report reviews the current state-of the-art and national experience with noise abatement techniques for new and existing roads. It presents the traffic noise regulations and limits prevailing in the different OECD countries and provides criteria that are used in measuring, predicting, and evaluating traffic noise. It discusses low-noise roadway pavements, noise barriers, and the economics of noise abatement in detail.

Copies of the report (# ISBN 92-64-14578-8) are available for $50 from the following:

OECD
Publications & Information Centre
2001 L Street, NW., Suite 700
Washington, DC 20036-4910
Tel: (202) 785-6323
Fax: (202) 785-0350

TRB Committee A1F04 on Transportation Related Noise and Vibration

Report on the Summer Meeting

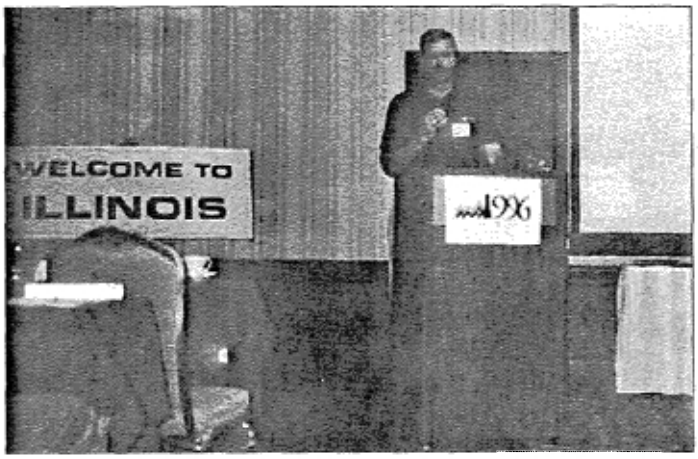
By Michael T. Bruns, Noise Specialist for Illinois DOT and A1F04 Committee Conference Coordinator

Committee A1F04 of the Transportation Research Board held its 1996 Summer Conference in Lisle, Illinois. Hosted by H. W. Lochner, Inc. and the Illinois State Toll Highway Authority and the Illinois Department of Transportation, the conference was held July 21 to 24. Over 80 participants attended the three days of exceptional presentations, afternoon field trips in the Chicago area and evening social events.

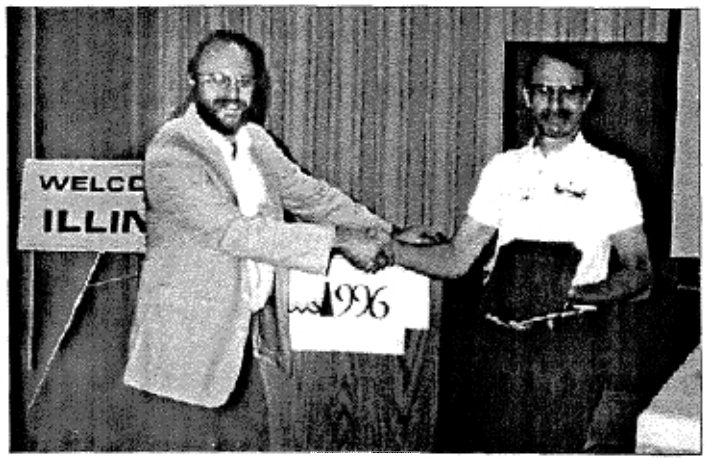
Highlighting the 1996 Conference were a special guest Chairman appearance by the inimitable Domenick Billera, a two hour interactive demonstration of FHWA's new Traffic Noise Model (TNM) by Grant Anderson, the latest on the Mayan ruins and how this might affect highway traffic noise barrier design by Roger Wayson and Michael Staiano, PennDOT's new noise video (a.k.a. the Osborne Tapes) by Roy Osborne and James Cowan, Testifying in Court (praised on every Conference Evaluation Form, including Jim's) by James Cowan, afternoon tours to O'Hare International Airport's Noise Abatement Department, Riverbank Acoustical Laboratories of IIT Research Institute and the Mainstream Pumping Station of Chicago's Tunnel and Reservoir Project, and three different evening events (we count it as four, because we are taking credit for the Tuesday night pool game, also).

The technical discussions, which you can read summaries of in this issue, were again of the highest quality and painstakingly prepared by many working professionals in the field of noise and vibration. These professionals deserve our sincere gratitude for the excellent work they contributed to sharing their expertise and experiences with the conference attendees. Year after year, the presenters of the discussions work the hardest and determine the level of success of the conference. Our gratitude is also expressed to the exhibitors and sponsors, who have become an integral part of these meetings, for their contribution to the wealth of information available to the attendees and to the excellent food available at this summer's event. ■

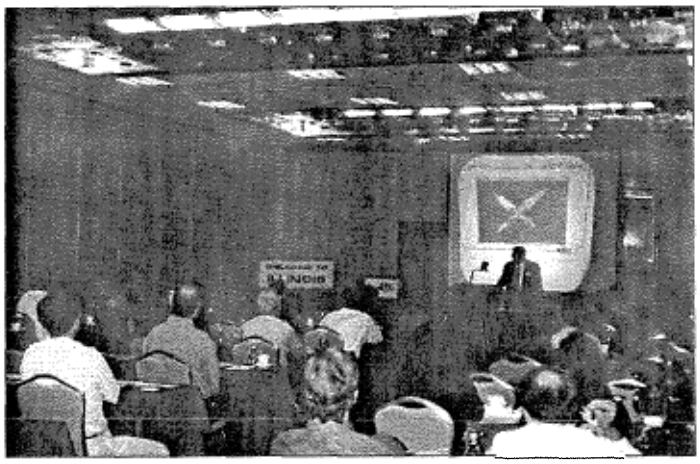
(For further information, you may contact Michael Bruns by phone at 217 782-7077 or by fax at 217 524-9356).



Michael Bruns, Noise Specialist for the Illinois Department of Transportation and Conference Coordinator, welcomes the attendees and delivers the opening address.



Ken Polcak, of Maryland State Highway Administration and Chairman of the A1F04 Highway Noise Subcommittee, presents Domenick Billera of New Jersey Department of Transportation with a plaque for outstanding service as the former Chairman of the A1F04 Committee on Transportation Related Noise and Vibration



Eric Stusnick of Wyle Laboratories and Chairman of the A1F04 Subcommittee on Aircraft Noise, presenting his paper.

A partial view of the Vendors' Exhibition Hall during a morning coffee break, where attendees visited with vendors at their booths.

SUMMARIES OF PROFESSIONAL PAPERS

Presented at the TRB A1F04 Committee 1996 Summer Meeting In Chicago, Illinois, July 21-24, 1996
Hosted by: H. W. Lochner, Inc., Illinois State Toll Highway Authority and Illinois Department of Transportation

Interactive Demonstration of the FHWA Traffic Noise Model

Author: Grant S. Anderson, Harris Miller Miller & Hanson Inc.

Mr. Anderson will demonstrate the capabilities of FHWA's new Traffic Noise Model (TNM) in action: setup, input, calculate, barrier analysis, parallel barriers, and contours. The demo will show TNM's input dialogs, graphical views, and output tables — how they work and how they interact. The demo will be loosely structured, so that it can adapt to questions and suggestions from conference attendees. ■

Public Opinion of I-71 Noise Barrier Effectiveness

Author: Lloyd A. Herman, Ph.D., Assistant Professor, Civil Engineering, Ohio University

The largest Ohio Department of Transportation (ODOT) Type I Traffic Noise Abatement Project to date was completed in Hamilton County in 1994. Concrete noise barriers totaling 5.4 miles in length were installed on both sides of the I-71 roadway at a cost of $9.4 million, The initial public response to the noise abatement project was mixed, with some residents believing that the noise barriers were effective, while other residents believed that the barriers made the noise problem worse.

As a result of the public response, which gained significant media attention, ODOT sponsored a research project, conducted by Ohio University, to determine the nature and extent of any problems that may have resulted from tbe construction of the noise barriers. A survey of public opinion was conducted to obtain the perceptions of noise barrier effectiveness for 1,200 residents living in the project area within 1/2 mile on either side of I-71. The results of this survey, as well as correlations with noise measurements, will be presented. ■

Aircraft Community Noise Impact Model (ACNIM)

Authors: Eric Stusnick and Xin Zhuang, Wyle Laboratories

Under contract to the National Aeronautics and Space Administration, Wyle Laboratories is developing the Aircraft Community Noise Impact Model (ACNIM) – a software package intended for use as an adjunct to the Federal Aviation Administration's Integrated Noise Model (INM). ACNIM will allow a rnore detailed analysis of the impact of aircraft noise on the people in the communities surrounding an airport than does INM. It accomplishes this by coupling INM to a powerful Geographic Information System called GRASS (Geographical Resource Analysis Support System), which was developed by the U.S. Army Corps of Engineers.

The current version of ACNIM, which runs on an Intel processor-based personal computer under the Microsoft® WindowsTM operating system, has the capability of providing a more precise estimate of the number of people within any given aircraft noise contour than does INM. It also has the capability of determining the number of homes within the contour and of determining the population and housing counts for subsets of the U.S. Census database.

ACNIM computes the number of people within a given noise contour by first calculating, from the total population and land area within each census block, the population densities of the blocks. It then applies this density to the area within the census block that is contained within the noise contour. A total count is obtained by summing over all census blocks, A similar process is followed in calculating the number of housing units within the noise contour.

ACNIM goes one step further in improving the accuracy of the population (and housing) count within a noise contour, by allowing the noise analyst to remove obvious non-residential areas, such as water bodies, industrial parks, and shopping centers, from the calculation. This is done by superimposing the noise contours onto remote imagery (aircraft or satellite photography) of the region around the airport and providing a drawing tool which allows the analyst to outline non-residential areas.

An additional feature has recently been added to ACNIM which allows individual elements of the Census's Summary Tape File 1 (STF1) and Summary Tape File 3 (STF3) to be analyzed. STF1's population categories include, for example, age, race, sex, and marital status, and number of units in the structure. STF3 expands these categories to include, for example, citizenship, ancestry, and income in the population categories and number of rooms per unit, type of heating fuel, and value in the housing categories. This additional information not only provides information useful for planning a residenial sound insulation program at the airport but also information for an "environmental justice" analysis, should one be required. ■

PennDOT's New Noise Video

Authors: Roy Osborne, Pennsylvania Department of Transportation James P. Cowan, INCE.Bd.Cert.. McCormick, Taylor & Associates, Inc.

This will be the first public presentation of an educational video developed by PennDOT's Bureau of Environmental Quality and McCormick, Taylor & Associates. The video will present the basics of noise analysis, control, and policy used by PennDOT for new highway projects. It will be used at public meetings and any other appropriate forums where noise issues will be discussed. The 14-minute video has practical, real-world examples (including sound perception demonstrations) to demonstrate the principles being discussed. This will hopefully provide a model for other states to develop such needed educational tools. ■

Offering Testimony in Court from the Noise Expert's Point of View

Author: James P. Cowan, INCE.Bd.Cert., McCormick, Taylor & Associates, Inc.

It has been said that the most dreaded of experiences for most people (even over death) is public speaking. With this in mind, testifying in court takes us exponentially beyond this fear because this experience has each word we utter destined to haunt us for the rest of our lives. As the law enforcement officers say, "Each word can (and will) be held against you in a court of law". Many attorneys have recently published articles and books on expert testimony; however, only the expert in each discipline can appropriately relate the experience to his peers. This presentation stems from the author's experience with attorneys and court appearances (for clients but not in his own defense). As each of us may someday be called to the witness stand (with or against our wishes), this presentation will give the audience an intimate perspective on dealing with lawyers, what to say (and how to say it) and what not to say in court. If no lawyers are in the audience, the honesty of the presentation will be brutal. ■

Good Fences Make Good Neighbors: Highway Noise Barriers and the Landscape

Authors: Domenick Billera, New Jersey Department of Transportation, and Richard Parsons and S. Hetrick, Gannett Fleming Engineers

This paper focuses on the importance of early consideration of aesthetics in the noise barrier design process and outlines a case study process followed to develop a barrier system which is an enhancement to the roadway and community. ■

Validation of Aircraft Noise Models at Lower Levels of Exposure

Authors: Juliet A. Page and Kenneth J. Plotkin (presented by Eric Stusnick), Wyle Laboratones

Noise levels around airports and airbases in the United States are computed via the FAA's Integrated Noise Model (INM) or the Air Force's NOISEMAP (NMAP) software. Many other countries use these or similar software. These models are generally used to compute day-night average sound level (DNL) in the vicinity of the airport, where "vicinity" usually means areas exposed to a DNL of 65 dB or greater. There is increasing interest in aircraft noise at larger distances from airports as community planning and environmental assessments sometimes consider DNLs as low as 60 or 55 dB. Wyle was retained by the National Aeronautics and Space Administration to conduct a measurement program to examine the accurcy of noise models at distances encompassing areas exposed to a DNL of 55 dB.

Measurements were conducted at 14 sites around a major air carrier airport over a two month period. ARTS radar tracking data, which provides actual flight paths and positive identification of aircraft, were obtained for the 25 days in that period. Three hundred and forty-two (342) specific aircraft operations were selected for detailed analysis. This selection was sampled by aircraft type, stage length, straight versus curved flight tracks, runway, and arrival versus departure. Single-event noise, quantified by sound exposure level (SEL), was computed via INM and compared with measured SEL. The INM modeling used flight paths derived from ARTS data.

Once the field data was collected and the corresponding INM calculations were performed, a statistical analysis was carried out of the difference between measured and predicted SELs. While the average results were very consistent, and therefore support DNL analysis, there was large variation in individual events. The individual overflight SEL data was characterized by spreads of 10 dB or more, that were independent of most of the independent variables considered, including distance.

The event-to-event variation is larger than can be explained by any single mechanism. Differences due to choices in modeling of tracks, nominal power settings, etc., account for differences of 2 to 3 dB. Aircraft position, type, weight (as predicted from stage or trip length and associated fuel load), and nominal meteorological conditions (analysis limited to good-weather days) were controlled in the analysis. There were unknowns of actual power settings and variations, actual engine types (rather than fleet nominal), turbulence, and surface micrometeorology, that are continuing to be examined in this ongoing project. ■

NASA Advanced Subsonic Technology Noise Reduction Program

Author: Frank Jones, NASA Langley Research Center, Noise Reduction Program Office

Aircraft noise is an international issue prompting airports to operate with strict noise budgets and/or curfews, thereby restricting airline operations. Internatonal treaty organizations are actively considering more stringent noise standards which will impact the world market growth of the air transportation system and the U.S. aincraft industry's marketability. Evidence of this increased stringency is the mandated phase out of Stage 2 airplanes by the year 2000. NASA's noise retuction program, in cooperation with U.S. industry and the Federal Aviation Administration (FAA), targets technologies to reduce the aircraft community noise impact by 10 decibel (dB) relative to the state of the art by the year 2000 for future subsonic transports. Technologies that meet these design goals will provide the design margins for successful U.S. engine and aircraft growth for the next generation of subsonic transports. The program approach is designed to develop noise reduction technology in cooperation with U.S. industry and the FAA; namely, engine noise reduction, nacelle aeroacoustics, engine/airframe integration, interior noise reduction, and flight procedures to reduce airport community noise impact, while maintaining high aircraft efficiency. This presentation is a discussion of the technical objectives and the accomplishment of the NASA, FAA and U.S. aircraft industry subsonic noise reduction program. ■

(continued on page 10)

(*Papers*, *continued from page 9*)

Stop the Whine! Narrow Band Noise Level Measurements of Three Highway Pavements

Authors: Domenick Billera, New Jersey Department of Transportation;
Bela Schmidt and W. Miller,
Louis Berger Associates

A series of measurements were conducted to identify and correlate roadway surface texture and frequency components of tire noise and their relationship to annoyance for roadside listeners. ■

A HITEC Evaluation of the USG Sight and Sound Screen

Authors: Louis F. Cohn and Roswell A. Harris, Department of Civil Engineering, University of Louisville;
Richard T. Kaczkowski,
US Gypsum Research Center

A program of laboratory and field testing designed to evaluate the capabilities and limitations of the US Gypsum Sight and Sound Screen (SSS) is discussed. The evaluation plan is a collaborative testing and evaluation effort conducted with volunteer state highway agencies, and includes a program of field demonstrations. Also discussed is a new product evaluation protocol that has been completed and applied to the SSS system. The current status of the project is also to be discussed. ■

Pensacola Weigh-in-Motion Site Noise Study: A Case History

Author: Win Lindeman, Florida Department of Transportation

Based on public concern expressed during the public hearing process, the Plorida Department of Transportation was asked to take a detailed look at the potential impact of increased noise levels on adjacent property owners. Using existing traffic noise models to accurately predict the noise impact proved to be questionable so an alternate methodology was employed. The results of this effort were used to identify abatement needs and options. ■

Noise Characteristics of Pavement Surface Texture in Wisconsin

Authors: David A. Kuemmel, P.E., Center for Highway and Traffic Engineering, Marquette University;
John R. Jaeckel, P.E. and Alexander Satanovsky, P.E., HNTB Corp.;
Stephen F. Shober, P.E. and Mitzi M. Dobersek, P.E., Wisconsin Department of Transportation

Twelve Portland Cement Concrete Pavement (PCCP) test sections were constructed to compare with the standard PCCP and asphaltic concrete pavements (ACP) to quantify the impacts of the pavement surface texture on noise, safety, and winter maintenance. Asphalt pavements studied included a Strategic Highway Research Program (SHRP) asphalt, stone matrix asphalt (SMA) and Wisconsin standard asphalt.

A dependency between the pavement textures and their noise characteristics was observed. Noise measurements indicated that uniformly transverse tined PCCP created dominant noise frequencies. These dominant frequencies were audible adjacent to the road and inside the test vehicles. Careful design and construction of transversely tined PCCP can reduce tire/road noise. No significant acoustical advantages of open graded asphalts over the standard dense asphalt were found. ■

Interrupted Flow Reference Energy Mean Emission Levels for the FHWA Traffic Noise Model

Authors: William Bowlby and Srvinivas Chiguluri, Civil and Environmental Engineering Department, Vanderbilt University; Roger I. Wayson and M. Martin, Civil and Environmental Engineering Department, University of Central Florida; Lloyd A. Herman, Ph.D., Center for Geotechnical and Environmental Research, Ohio University

During the period, November 1994 through January 1996, the U.S. Dep~ of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center (Volpe Center), Acoustics Facility, in support of the Federal Highway Administration (FHWA) and 25 sponsoring state transportation agencies, conducted the National Pooled-Fund Study (NPFS), SP&R 0002-136, titled "Highway Noise Model Data Base Development".

This presentation discusses the results of one portion of that study – the measurement, data reduction and analysis of individual vehicle sound level and speed data for interrupted flow traffic (accelerating from stop signs, toll booths and on highway ramps). Also described is the development of regression equations for the resulting Reference Energy Mean Emission Levels (REMELs) as a function of vehicle speed and vehicle type. These REMELs are part of the data base that is the foundation around which the acoustical algorithms in the FHWA's Traffic Noise Model, Version 1.0 (FHWA-TNM®) are being structured. ■

Use of Contours for Reporting Highway Traffic Sound Levels

Author: Michael A. Staiano, Staiano Engineering, Inc.

This paper examines practical considerations for presenting highway traffic noise prediction results. Predicted traffic noise can be reported in the form of point-specific sound levels or more graphically in the form of sound level contours. Contourrs have the advantage of being more concise and readily understandable – especially to lay audiences. However, the accuracy of the contour lines, that is, their "width", is often ignored. Consequently, decision-making based upon finely drawn contour lines rnay be needlessly arbitrary. Since contour locations are interpolated from a matrix of location-specific predictions, the required density of the prediction points depends upon the variability of the sound propagation conditions. The presence of propagation "discontinuities" along a roadway – such as finite-length barriers, rapid grade changes, or ground surface variations– necessitate more prediction points for the computed contour to realistically represent the actual sound field. ■

Sound Phenomenon from the Mayan Ruins

Authors: Roger L. Wayson, University of Central Florida; Michael A. Staiano, Staiano Engineering, Inc.

This presentation deals with acoustic phenomenon occurring at the Mayan ruins of Chichen Itza. Details of a recent trip to the site that included sound measurements will be discussed and results shown. It is apparent from the results of this study that not only were these the first Indians to develop writing and an accurate astronomical calendar, but that their understanding of acoustics was also quite advanced. The results of this study will address the claimed parametric amplification as discussed in The Wall Journal, the reasons for the frequency shift of the echo from the temple, and how this might affect highway traffic noise barrier design. Also discussed will be other acoustic phenomena that was experienced in other parts of the ruins such as the ball court. ■

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PennDOT Study of Retrofit (Type II) Noise Barrier Program

By Roy J. Osborne, Environmental Analysis Division, Pennsylvania Department of Transportation

A growing complaint throughout Pennsylvania is noise related to highways. Unfortunately, due to population growth and increased single occupancy vehicle use, roads once less traveled have become main thoroughfares. The primary source of noise for many residences is traffic along these existing roadways in Pennsylvania.

The reduction of traffic noise along existing highways is termed "Retrofit Noise Abatement or Type II Abatement". From a noise standpoint there are two (2) types of noise abatement projects:

Type I highway improvement projects include those projects which involve 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 travel lanes. For these types of projects, federal regulations and our policy require that we evaluate potential noise impacts and incorporate noise abatement measures as part of the project if such measures are determined to be warranted, feasible, and reasonable.

Type II (Retrofit) projects include projects for providing noise relief along an existing highway. The latest federal regulations (The National Highway System Designation Act of 1995) allow (but do not require) us to spend federal funds for this type of abatement only if the property to be protected was substantially developed prior to the acquisition of right-of-way for or construction of the original highway. Because of other more critical needs for our available funds (roadway reconstruction, bridge deck replacement, safety improvements, etc.) our policy has been (and remains) that we will not undertake retrofit noise abatement pro

The Pennsylvania Department of Transportation recognizes the lack of an active Type II program as a concern not only to the Department, but the public as well. As a result, the Department's Bureau of Environmental Quality undertook a comprehensive Retrofit Noise Barrier study in November of 1993. The Department devised a three (3) phase process to provide an informational base and study a Type II program.

Phase I of the study was a nationwide survey of Type II programs. This phase of the study was completed in April 1994. Utilizing survey questionnaires and telephone interviews, it was determined that twelve (12) states have had a Retrofit Noise Policy implemented at one time. It was determined that approximately 200 miles of Retrofit Noise Barriers have been constructed nationally. Of the states evaluated, funding for the Type II barriers varied, however it was suggested not to implement a Type II program without identifying a funding source first. The twelve states all had very explicit eligibility requirements and prioritization methods. Also it was suggested that once a policy is established do not deviate from the standard.

Phase II of the study was a statewide assessment of need. This phase was completed in December 1994. This

phase incorporated information from the Department's Roadway Management System (RMS) Data and the Geographic Information System (GIS). Information from these two data systems, in conjunction with 1990 Census data were used to produce mapping exhibiting isolines of noise impacts throughout Pennsylvania.

This enabled the Department to provide an analysis of potential statewide need/impact for retrofit noise barriers. The analysis showed an overwhelming need for Type II abatement along National Highway System roadways in Pennsylvania. The conclusion of this phase was the illustration of statewide applicability and need for Retrofit Noise Barriers.

Phase III of the study was the development of a draft retrofit noise barrier program. This phase was completed in November of 1995 and presented to the State Transportation Commission I he objective was the development of program alternatives which could be considered for adoption. Throughout this phase input from the MPO's in Harrisburg, Philadelphia, and Pittsburgh as well as from a Subcommittee of the Transportation Advisory Committee was continually solicited, and used to guide the study. A proposed decision support process consisting of eight (8) steps were identified during this phase, such as; identify programmed projects, eligibility, detailed noise analysis, prioritization, noise abatement public involvement, visual screening evaluation, visual screening public involvement, and construction. Utilizing this information variables were identified and alternative concepts developed. The Department analyzed the potential use of "Visual Screening" for those areas that may be eliminated during the prioritization process.

The Department is currently completing the administrative record of the study which will provide more detailed information. Presently no funding source has been identified, therefore no Type II program will be implemented. The identification of a funding source is extremely important when you consider the financial impact of providing such abatement. The average cost of providing Type II abatement will range from $2 to $ 3 Million per mile, and potentially more if the barrier is constructed on structure rather than simply ground mounted. Due to the financial impact of Type II Barriers the Department has analyzed the potential use of "Visual Screening" which would cost approximately half as much. Although the insertion loss (noise reduction) wouldn't be as great, it would still provide a screen between the noise source and the receptor

Due to the lack of a revenue enhancement, no program will be implemented. Until such time as a funding source is identified, the Department will not consider the possibility of adopting a Retrofit Noise Abatement Program. However, if additional state transportation revenue is identified as a funding source, the pro gram will go forward. If implemented, a four year pilot program with a target of $2 Million per year may be proposed in order to evaluate the program's effectiveness. ■

(For further information, you may contact the author by phone at 717 772-0832. The above article has been reprinted here with the permission of ***Environmental Express****, a publication of the Bureau of Environmental Quality, Pennsylvania DOT).*

MEET THE STAFF — PennDOT's "Air Quality, Noise and Vibration Group"

By Roy J. Osborne

The Bureau of Environmental Quality is comprised of three Divisions, the Environmental Analysis Division, the Waste Management Division, and the Policy/Project Development Division. Within the Environmental Analysis Division three "Groups" of varying technical expertise exist. One of these groups is the "Air Quality, Noise and Vibration Group".

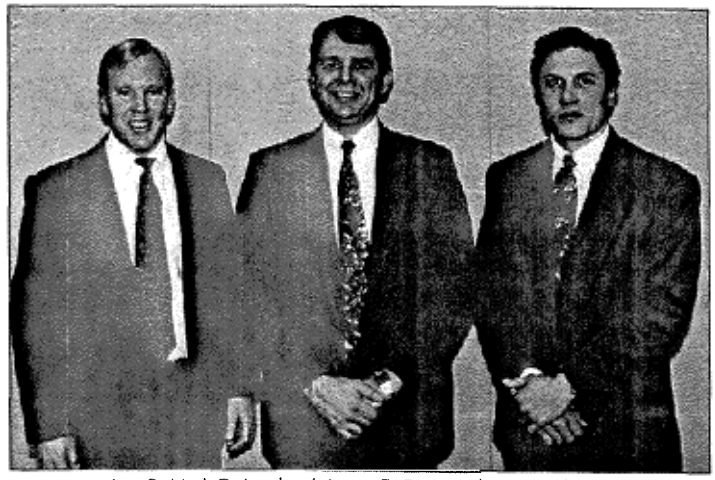
A primary focus of the Air and Noise Group is to continually improve the technical services provided to our customers. The group recognizes that customer service is a top priority, and we will continually strive to improve in all facets of our technical areas to serve you better.

The Air andNoise Group has a compliment of three staff members, James Byers, Roy Osborne, and Mark Lombard.

James Byers is the Air, Noise and Vibration Group Leader. Jim brings twelve years experience to the Department and holds a Bachelors of Science Degree from Indiana University, as well as a Masters Degree in Regional Planning from the Pennsylvania State University. Mr. Byers is an Armed Forces Veteran having served Honorably in the United States Navy.

Roy Osborne is an Environmental Planner II and has held the position of Noise and Vibration Specialist for three years. Roy holds a Bachelors of Science Degree in Environmental Biology/Biology from Lock Haven University. Mr. Osborne has served nine years Honorably in the U.S. Armed Forces, and is currently active in the U.S. Army Reserve.

Mark Lombard is also an Environmental Planner II with three years as the Air Quality Specialist for the Group. Mark holds a Bachelors of Science Degree in Environmental Land Planning from Shippensburg University. Mr. Lombard has also served in the U.S. Armed Forces, having served Honorably in the United States Navy.



L to R: Mark D. Lombard, James B. Byers and Roy J. Osborne

The Air, Noise and Vibration Group provides technical assistance to the Engineering Districts as well as Central Office on a wide range of Air and Noise Issues. Assistance may be provided on a project specific basis as well as through policy development and training. In addi tion, the group administers six Statewide Open End Contracts for Environmental and Engineering services. The Group also participates on several State and National committees, such as the Air Quality Executive Committee, the Transportation Research Board, Product Evaluation Panels and several research foundations. ■

(If you wish further information, Roy Osborne may be reached by phone at 717 772-0832 and fax at 717 772-0834).

New Products

Whisper-Grip

Whisper-Grip is a thin coating of 2-5 mm, which can be applied to both asphalt and concrete. Whisper-Grip consists of a two-component epoxid based binding agent in conjunction with fine aggregate of a high PSV-value. The binding agent is applied in metered quantities to the dry, brushed road surface, by means of an electronically controlled transverse application system. The advance of the applicator vehicle depends on the amount of resin applied per m^2 of road sur face.

The aggregate is spread onto the resin immediately. The grain size is 1-2, 2-3 or 3-4 mm. depending on the amount of resin used. Any material that has not adhered after the binder has hardened, is removed by sweepers. The Whisper-Grip can then be driven on immediately.

The excellent adhesive properties of the binding agent both on the road surface and in respect of the aggregate ensure a long maintenance free service life.

Improved skid-resistance with Whisper-Grip

Whisper-Grip provides existing road surfaces with both micro and macro texture. The micro texture gives the road surface its sharpness and thus increases the friction between tyre and road surface. A macro texture of between 0,2 and 3 mm. provides the road surface with excellent drainage properties which are comparable to porous asphalt. Any water that is present on the surface is rapidly dispersed from the contact area between tyre and road.

Whisper-Grip has an optimum micro and macro texture with extremely high SRT or SFC value. It has been established that accident figures are clearly reduced, particularly in the wet (see sketch).

Whisper-Grip reduces tyre noise

Unfavourable mega textures of the road surface generate a droning/booming noise when in contact with tyres.

On the other hand excessively smooth surfaces generate a whistling noise, i.e. the so-called air pumping effect. Whisper-Grip works in two ways:

Mega textures which have an unfavourable effect and generate noise are evened out by the Whisper-Grip. The oscillation of the tyre profile is thus dampened and the droning reduced (see sketch).

The surface is, in addition, provided with numerous small chippings distributed randomly. The air between the tyre contact area/road surface can thus escape at all times without pressure, reducing the air pumping effect.

Measurements carried out in accordance with method DIN-ISO 362 and also using the tyre noise measuring vehicle, demonstrate a significant reduction in tyre noise of 2-5 dB(A) with the DIN-ISO method, and 3-8 dB(A) for the tyre noise measuring device. ■

(Whisper-Grip was developed in Germany. For further information, contact:
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PennDOT's Task Force on Dirt and Gravel Roads

Serving Pennsylvania's industries and citizens with environmental guidance for managers of unpaved roads

By Wayne B. Kober, Chair, PennDOT Task Force on Dirt and Gravel Roads

Twenty eight thousand miles of unpaved roads provide local service to Pennsylvania's rural residents and the major enterprises of agriculture, tourism, mining/mineral industries and forest products. Although they are inexpensive to maintain, loss of fine materials from the roads and their drainage areas creates dust and sediment.

Dust is both a nuisance and a pollutant. Sediment is one of the greatest sources of pollution to waters of the Commonwealth. Excessive amounts of sediment can adversely affect aquatic life in many ways. Sediment can smother species of plants, insects and fish eggs and destroy the habitat they require.

History of Task Force

1990 - Anglers in Potter County, reported streams were being hurt by sedimentation conveyed in dirt road drainage. Turbidity was so high, people had to travel elsewhere to fish for trout.

1991 - James H. Byron of Pennsylvania Trout, a Council of Trout Unlimited, arranged a "Northcentral Erosion Conference." It was attended by government agencies and concerned environmental groups. Effects of sediments on streams were brought to the forefront of environmental concern at that meeting.

1991 - The Rural Technology Assistance Program conducted a meeting on drainage and maintenance of unpaved roads. The meeting was sponsored by the Potter County Conservation District and Trout Unlimited.

1991 - A demonstration to stabilize banks by hydro-seeding was funded by Trout Unlimited and Butterkrust Bakeries of Sunbury, PA. Specialized equipment for that work was provided by Penn Lines Utilities and The PA National Guard.

1993 - A series of meetings were held to discuss how to control runoff from unpaved road drainage areas. PennDOT, as administraters of the Municipal Services funding program, was selected to head the statewide effort.

1993 - The Task Force On Dirt and Gravel Roads was formed and the following work groups were appointed: **"Scope of Problem", "Training", "Monitoring"** and **"Road Maintenance Standards, Techniques, Demonstrations".**

Task Force Participants:

Department of Environmental Protection, DCNR - Bureau of Forestry, Fish and Boat Commission, Game Commission, PA Association of Township Supervisors, PA Council - Trout Unlimited, PA County Conservation Districts, PA Environmental Defense Foundation, PA House and Senate Staffs, PA Federation of Sportsmen, Penelec Power Company, Pennzoil Products, PennDOT, US Fish and Wildlife Service, US Forest Service.

(continued next page)

Goals

Conduct statewide evaluations to determine the extent of unpaved roads' adverse affects on streams protected as "Exceptional Value" and "High Quality" Waters.

Develop an interim reference manual for road managers.

Address the circumstance of environmentally harmful products being included in state purchasing contracts without adequate safe guards and warnings.

Develop a multi-media training program on environmentally sensitive maintenance of unpaved roads and make this training easily available to road managers.

Document or develop new examples of dirt and gravel road management practices that establish the value of considering environmental ramifications.

Develop maintenance standards for dirt and gravel roads that include consideration of environmental values and consequences of their loss.

Achievements

Using maps prepared by a PennDOT funded contract, Trout Unlimited volunteers are field verifying the extent of and locations where drainage from dirt and gravel roads adversely affects streams classified as special protection waters.

"Controlling Sediment Pollution From Light Duty Gravel/Dirt Roads" was produced by the Indiana County Conservation District using an Environmental Protection Agency 319 grant.

A PennDOT product evaluation board now requires vendors offering new products to include data on the affects of their ingredients on the natural environment; future work of the board will include consideration of products already on the purchasing lists.

The Transportation Institute at Penn State is working with Task Force members to prepare manuals of "Best Management Practices." Correlations between the functions of natural systems and road maintenance are being prepared by the Fish and Wildlife Unit. The Local Technology Assistance Program will present this material to road managers.

Staff of the Mid-Atlantic University Transportation Center at Penn State is soliciting conservation and transportation agencies for colored slide photographs and cost figures of unpaved road projects that demonstrate these values.

The Task Force offered guidance to PennDOT District 2-0 during planning of road upgrades for Card Creek Road in Potter County. Card Creek Road was part of a group of roads which were improved and then turned back to Roulette Township.

In conjunction with preparation of the training program, individuals at the Pennsylvania Transportation Institute are identifying specifications within PennDOT manuals that are inconsistent with best practices. ■

To obtain further information, contact:
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Green Sound, Green Noise and Analytic Standards

By Frank Hodgson

This document is an appeal for the use of proven scientific methods for the evaluation and design of commercially relevant sound structures. These include sound barriers, baffles, grates, frequency shifting surfaces and other useful structures. This document also suggests nomenclature that may be useful and outlines areas of study that should be productive and helpful to those concerned with the design of such physical structures for the modification of ambient sound.

The current and popular practice of measuring energy amplitudes in narrow frequency bands should be abandoned in favor of obtaining accurate frequency profiles, plotted on paper, in the field when possible, from commercially available modern oscilloscopes and/or from software packages such as HiQ available from National Instruments (800 433-3488). The HiQ mathematical package runs on most PC and Mac personal computers. For measurements in the field a good reliable AC power source such as Statpower equipment (604 420-1585), which is a battery powered source, can be used. Such power sources have the advantage of being silent. The current measuring methods obscure much of the critical detail, conceal the creation of new frequencies and generally are not optimum approaches to data acquisition.

The work done by Herb Chaudiere and others in documenting the so-called "picket fence" effect is most noteworthy. These publications can generally be summarized by stating that regardless of impinging frequency spectra, much of the reflected energy has been converted to a frequency roughly twice that of the gap width, that is, the distance between individual picket slats. These notable publications are of particular interest when considering the use of narrow slots, as has been reported by this author in The Wall Journal, as the phenomena certainly also occurs in higher, inaudible, frequencies. Restated, the use of narrow slots that resonate at inaudible frequencies can convert audible frequencies upward to inaudible frequency ranges.

Thus, the transformation of audible frequencies into higher inaudible frequencies, with the concurrent reduction in audible sound levels, would seem to be a common event given the diversity of structures in many urban areas. The amount of energy converted would normally seem to be quite small, however, as in most cases the effect is incidental, the structure not having been designed to optimize this result. The design of suitable structures which will enhance this effect would seem to be a most attractive objective for engineers concerned with the design of sound walls.

Pursuant to the examination of this critical area of study, it is suggested that

three general terms be adopted for the description of sound frequencies that include those which extend below and above audible frequencies. These terms are defined as follows:

Natural Green Sound. In the broadest sense, natural green sound is defined as sound frequencies which are, or which can be created, without human action or intervention and which extend below and beyond the range of frequencies to which humans are perceptive. Natural green sound also includes those sounds which result from human action or intervention which effectively duplicate or which closely mimic such sounds.

Green Noise. Green noise is defined as any natural green sound which is generally recognized as being unpleasant because of its amplitude and/or content. Obviously in many cases what constitutes green noise is very subjective. In general, as amplitude diminishes normally as the distance from the sound source is increased, it becomes less and less likely that the sound can still be characterized as green noise. Another way to view the situation is to envision a set of concentric envelopes of sound, the characteristics of which are essentially constant on the surface of each imaginary envelope. For a given observer, one single envelope would represent a theoretical boundary at which the natural green sound changes from green noise to green sound.

Green Sound. Green sound is defined as the difference between natural green sound and green noise. It is sound which is generally recognized as not being unpleasant. Again, in many cases, what constitutes green sound is very subjective. In general, green sound does not normally include music.

It would seem most desirable to begin to measure and to document in detail the broad range of natural green sounds which are most common. Of equal importance is the determination of the frequency response characteristics of common structures, particularly those which can be routinely integrated into the design of large man-made structures. Slotted structures whose gap widths are half wave lengths which are well above audible frequencies, say 1/8 inch gap widths and narrower, are of particular interest. These measurements should extend well into the inaudible range, say to 50 kHz, to insure that the final designs fully utilize the needed frequency transformations.

These transformations have the potential of substantially reducing the amount of energy in the impinging audible frequency ranges. Again it must be stressed that to be of real value, frequency profiles for the specific sound sources and the true frequency spectra derived from specific structures should be determined. These can be plotted in graphical form on paper, preferably as the sound is recorded in the field if required.

The result of such an analytical approach to the design of sound walls and related structures is that the characteristics of given structures can be systematically compared with specific types of green sound with the objective of suitably modifying the frequency profile of the structure so that the net result is the creation of a form of green

(continued on page 20)

(**Green Sound**, *continued from page 19*)

sound. To some degree this presumes that a given environment with objectionable levels of noise has fairly predictable frequency profiles. Many situations involving highway noise abatement would seem to qualify for this approach.

The equipment that is needed to record on a dynamic basis is more expensive than that required to make "snap-shot" frequency profiles. Both approaches however are of comparable merit. Most of the commercially available oscilloscopes which are of interest, are very portable and rugged, lending themselves to use in the field under difficult conditions. For those that require AC current, the use of suitable battery sources is a reasonable approach.

Analytic Measurements

The generation of the needed frequency profiles is not an unreasonable effort and given their utility and that fact that such information is generally not available, there is a measure of urgency in acquiring and publishing them. It is hoped that a measure of standardization in the cataloging of the various types of profiles can be achieved. For the serious investigator the following equipment is recommended, although a great variety of commercially available equipment will also serve equally well. The Gould 1600 series oscilloscopes with built-in hard copy capabilities (216 328-7400) have a sample rate of 100 mHz. These units currently cost less than $5,000 and permit the taking of a "snapshot" of the frequency profile being recorded. The more sophisticated units allow a continuous recording of the events.

When such equipment is used with a good microphone which is suitable for recording ultrasonic frequencies such as the Bruel & Kjaer 4135 (having a range of 2 Hz to 100 kHz with a dynamic range of 96 dB), excellent results should be routinely obtainable. The Gould 1602 scope has a sample size (not to be confused with sample rate) of 1024 for FFT (Fast Fourier Transforms). In simple terms, the sample selected (usually 1/1000 of a second or 1/100 of a second – called the sweep time), is sampled at intervals of 1/1024 across the screen. Some scopes have larger sample rates but the lower rate is fine. What this means is that a 400 Hz signal with a sweep time of 1/100 second puts 4 full sine waves on the face of the scope. This means that the calculation for the frequency by FFT has 256 data points on each sine wave to analyze. The result is that the frequency should be known to an accuracy of better than .01%. Given the great sensitivity of this type of equipment, the vertical scale, the amplitude of the various frequencies calculated by FFT, can also usually be displayed on a vertical scale on the scope for clarity and convenience.

Fast Fourier Transforms

Typically the FFT calculation plots a series of vertical lines to indicate the amplitudes of the various frequencies measured. The actual calculation is based upon the fact that a sine wave can be characterized by a mathematical series. ■

(Frank Hodgson will welcome inquiry and discussion on the subjects of this article. He may be reached at 415 493-5511).

Surfing the Web

Subject: More Mayan Acoustics
Date: 14 May 1996 15:39:50 GMT
From: LQYM67A@prodigy.com (Wayne Van Kirk)
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Newsgroups: sci.archaeology.mesoamerican

NEWS ALERT!!!

The Journal of the Acoustical Society of America, Feb 1996 issue, has published an article "Acoustical Resonances of Assorted Ancient Structures"

Abstract

"Rudimentary acoustical measurements preformed inside six diverse Neolithic and Iron Age structures, revealed that each sustained a strong resonance at a frequency between 95 and 120 Hz (wavelength - 3m).

Despite major differences in chamber shapes and sizes, the resonant modal patterns all featured strong antinodes at the outer walls, with appropriately configured nodes and antinodes interspersed toward the central source. In some cases, interior and exterior rock drawing resembled these acoustical patterns. Since the resonant frequencies are well within the adult male voice range, one may speculate that some forms of human chanting, enhanced by the cavity resonance, were invoked for ritual purposes." ■

The Walrus says: *"I'm off on my summer vacation, soaking up some rays before I have to get back into that cold, icy water up north. My good friend Bob Bullmoose is watching over this space for me while he also lays on a load of fat for the winter".*

Some of the good stuff you might want to read again, now and then:

- Noise Barrier Construction Forecast
- Summaries of Professional Papers
- Noise Barrier Project Reports
- Fundamentals of Sound
- New Product Press Releases
- TRB A1F04 Committee Meetings
- State DOT Noise Barrier Programs
- FHWA Noise Model Updates
- Noise Abatement in Other Countries
- Airport Noise Control
- Construction Trends in Noise Barriers
- Product Approval Process
- FHWA History of Barrier Construction
- Materials Test Standards
- Rail Transit Noise Control
- And a Bunch More

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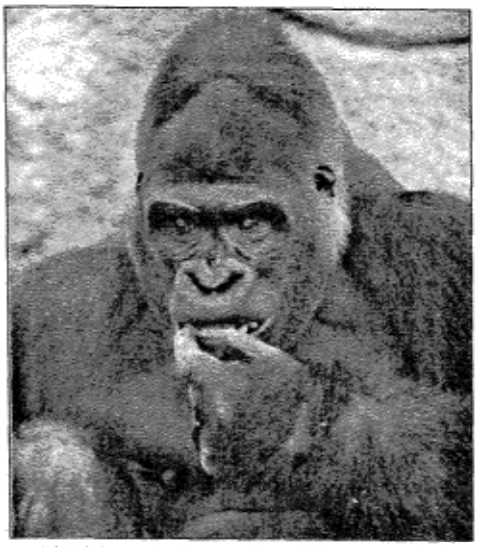

Hi. My name's Gus. I'm one of the staff around here, along with Bob Bullmoose, Walrus and Bashful. El calls us the Animal House.

My job is to make sure that everyone who gets The Wall Journal is a paid-up subscriber if they're from the private sector, and if they are registered if they are government people. I hate it when people don't follow the rules. See page 23.

I don't want to have to tell you again.

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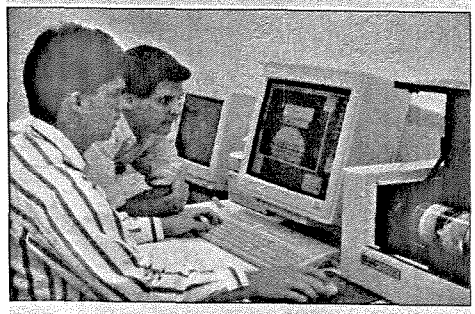
O.K. I know that there are hundreds, maybe thousands, of readers out there who are right now working on projects, theories, new products and technical data which the rest of our readers would really, really liketo learn about. Please share it with us.



The nice thing about being a registered reader of The Wall Journal is that you can also be a writer. We won't charge you a dime for publishing your articles. Look at all those people who got into this issue. And, we have international readership. You will be famous.

Ladies are most welcome. In fact, I harbor a personal preference for them. Come on in. —Ed.

Don't Be Bashful!

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The Last Word

As your fearless but benevolent leader, I believe I have rights to the first and last words in The Journal. Therefore, I have dedicated this space to my parting messages for each issue. The Editor's Corner simply does not allot me sufficient space to exercise my vast writing talent, nor to adequately vent my spleen when the occasion demands, as oft occurs.

In this introductory column, there will be no splenetic comments. Rather I have some complimentary salutations to you, my favorite readers.

You are probably well aware that all of you are part of a select fraternity and sorority of dedicated professionals, who are engaged in the worthy endeavor of protecting the environment from the impact of air, noise and water pollution which is ascribed to the transportation industry. May you live long and prosper.

However, you are all probably **un**aware that you belong to a **more select** segment of that group. The readership of The Wall Journal has been culled from an initial mailing of 3,000 copies of the July/August 1992 issue, to 1,700 copies of this issue. That would seem to be an indication that we are in trouble.

Fearless Himself

Not to worry. We started The Journal with whatever databases we could get our hands on. We soon discovered that there were lots of 'dearly departeds', 'no longer heres', 'addressee unknowns' and other vaporous names on our lists.

Over the past four years, thanks to our "You ***MUST*** Register" policy and the "Address Correction Requested" notice on the label portion of The Journal, and your own cooperation in keeping our database current, we have the most accurately targeted mailing list in the business.

I'm proud to say that our readers are the **real** shakers and movers in the world of transportation related environmental issues. Thank you. ■

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